LIVING DESERT ZOO & GARDENS STATE PARK

DOCENT TRAINING MANUAL

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SECTION 1

DOCENTS

Section 1: Docents

Welcome: Thank you for your interest in serving as a volunteer docent here at the Living Desert Zoo & Gardens State Park. Welcome to the opportunities and challenges this important position offers, for you personally, as well as for our many thousands of visitors. For you, it is our intention to provide all the information, support, and fellowship you need and deserve in order to feel an effective part of our larger team of state park personnel and volunteers. For our visitors, our goal is to acquaint each person with the plants, animals, and people of the Chihuahuan Desert, and to help them appreciate the inspiring intricacies of what some initially see only as a "desert wasteland." This Docent Manual has been designed to help you with that whole process.

Introduction to "Docent-ing":

A dictionary definition of "docent" is: "a teacher or lecturer," with the implication that the docent is officially recognized by the institution as qualified, whether paid or volunteer.

Our experience with the docent program has been consistent. The people who volunteer are eager to learn and are enthusiastic about sharing all that the Living Desert Zoo & Gardens State Park offers. This is truly a unique place in a beautiful and ever-changing setting.

Interpretation is a service for visitors who may have come for recreation and relaxation, but who may also want to learn about the natural and cultural resources of this area. For school groups, interpretation can be a very useful and stimulating supplement to the classroom experience.

By being visible, accessible, informed, open and friendly, docents offer visitors a remarkable and memorable opportunity to explore the life of the Chihuahuan Desert region. Techniques using touch, smell (sensory learning), questioning, comparison, humor, and anecdotes will appeal to the interest of the visitor and enhance his or her experience with us. Interpretation has been called "entertaining education," but you are not expected to be primarily a performer or an entertainer; not even an "expert."

You will meet people of all ages, races, cultures, and economic backgrounds. There will be individuals, families, and large groups, some quite young and some more elderly, school groups. This contact with such a variety of people and their perspectives is only one of the rewards you can expect from your service as a docent. We encourage you to be concerned with their physical comfort and safety, and sensitive to any limitations they may have. Quickly learn where drinking fountains and restrooms are and be alert for signs of heat exhaustion or other indications of distress.

Your efforts as a docent are very much a partnership with all other park personnel, as demonstrated in the following "Bill of Rights for Volunteers."

A Bill of Rights for Volunteers

1. The Right to be treated with respect as a co-worker

- **not as "just free help"**
- **not as a "prima donna"**

2. The Right to a suitable assignment

- **With consideration for personal preference, temperament, life experience, education, and employment background.**

3. The Right to know as much about the organization as possible

- **its policies, its people, its programs, its plans for future development.**

4. The Right to training for the job

- **thoughtfully planned and effectively presented training**

5. The Right to continuing education

- **as a follow-up to the initial training**
- **information about new developments**

• training for broader responsibility

6. The Right to sound guidance and direction from someone who is experienced, well-informed, patient and thoughtful, and who has time to invest in giving guidance

7. The Right to more responsibility and a variety of experiences

• through transfer from one activity to another, if desired

• through special project assignments and new opportunities

8. The Right to be heard

• to have a part in planning

• to make suggestions

• to have respect shown for an honest opinion

9. The Right to recognition

• in the form of genuine appreciation and occasional benefits

10. The Right to a place to work in safety

• an orderly, designated place, conducive to work and worthy of the job to be done.

Interpretation

The Living Desert Zoo and Gardens State Park is an ideal setting for the interpretation of the Chihuahuan Desert and all it contains. By understanding and appreciating the qualities of this unique area, people can gain insight into how we can live in the most ecologically responsible way.

The subjects interpreted include plants, animals, people, and geological processes of the Chihuahuan Desert region. The interpreter goes beyond identifying the specific plant, animal or landform, and presents the "why" and the "how." The interpreter weaves an entire story of the ecosystem, involving the visitor in the process. The guiding principle for interpretation at the Living Desert is to reveal through the use of living or real native specimens and objects, the interrelationships of the life and land of the Chihuahuan Desert ecosystems. The trained docent adds a dimension to the Living Desert's ability to communicate and interpret this message to the public. By being visible, accessible, open and friendly, as well as informed, the docent offers the visitor a one-to-one encounter and an opportunity to explore the life of the Chihuahuan Desert region. Techniques such as sensory learning (employing smell, touch, etc.), questioning, comparison, humor and anecdotes are used to interest and appeal to the visitor. Interpretation is "entertaining education." Its ultimate aim, in the case of the Living Desert, is conservation.

Docents will be trained as generalists -- well informed and ready to perform a wide range of interpretive services for visitors. They will be equally at ease with large numbers of visitors, adults, and family groups at special events, and classes of students at all age levels.

Helpful Hints for Docents

1. Every docent is different. Find YOUR style.

2. Every audience is different. Find THEIR style.

3. Children like to be INVOLVED

- **Ask questions; encourage thinking**
- **Discussions: everything they know is important**
- **Biofacts (realia): simple, immediate hands-on gratification to reinforce the theme.**

4. Flattery will get you everywhere! Encourage, don't discourage.

5. Have fun and show it!

6. Know your stuff and stay on task.

7. Evaluate. Students should leave with good feelings and a message they will remember.
(From the John Ball Zoo in Grand Rapids, MI)

Emergencies

- **Put the Park's phone number (575-887-5516) on your cell phone so you can call the office if there is an emergency.**
- **For minor injuries that do not need professional help- first aid kits are in the staff office.**
- **Severely injured of ill persons should NOT be moved or treated by nonprofessionals. Call 911 first if there is a serious situation and then called the office.**

About Our Animals

Visitors often wonder where our animals come from. Each of our animals have a special story. Our animals come to us for different reasons:

- **They were orphaned when they were too young to survive on their own.**
- **They were confiscated from people who had illegally been keeping them as pets.**
- **They were born in captivity and didn't have the opportunity to learn how to survive in the wild.**
- **They were injured, and after rehabilitation, still had a disability that would not allow them to survive in the wild.**

We think of our animals as ambassadors of their species. They provide the opportunity for our visitors to see and learn about them in an up-close environment where they are safe and lovingly cared for.

Key Things to Remember

- **Interpretation is not just information.**
- **Interpretation depends on making emotional and intellectual connections. The more passionate the interpreter is about the plants and animals, the more connection and appreciation the visitor will have with nature.**
- **Let the visitor discover rather than just hear a lecture. Remember that visitors retain:**
    1. **10% of what they hear.**
    2. **30% of what they read.**
    3. **50% of what they see.**
    4. **90% of what they do.**
- **Know the audience and respect their viewpoint.**
- **Be flexible.**
- **Have fun!**

Tour Techniques

- **Be on time.**
- **Wear your name badge and docent t-shirt, or vest.**
- **Be friendly – greet the visitors with a "Welcome," or "We are glad you here!" Make eye contact.**
- **Tell the group your first name.**
- **Be enthusiastic.**

- **Keep things positive.**
- **The tour leader always stays in the front of the group.**
- **If there is more than one docent, have one at the front and one at the back of the tour.**
- **With a large group tour, make fewer stops, but make the duration of each stop a bit longer. With small groups, it is easier to stop more frequently.**
- **When stopping the group, walk to the farthest edge of the exhibit and have the group make an arc so that everyone can see the animal or plant. If possible, position the group so they are not looking into the sun. Wait for everyone to arrive before beginning the talk.**
- **Docents will find that standing on a rock or elevation to be heard and seen by the entire group can give an added advantage when guiding a large group.**
- **If a question is asked, repeat the question so everyone knows what has been asked before the answer is given.**

Beginning a School Tour

- **If leading a school group, ask the teacher if he or she has anything in particular (something the class has studied) that she or he wants you to present. Also find out how much time you have. This information can help the docent determine the presentation. Example: Try having the students look for the coverings of different animals-feathers, fur, scales or look at the eyes and feet of animals to determine if they are predators or prey.**
- **Be sure the children know the rules of the park and the consequences of misbehavior.**

  (1) Keep on the path. There are many plants that have sharp spines and thorns that you don't want to come in contact with.

  (2) Always stay behind the leader.

  (3) Stay with your group.

  (4) Don't run in the park.

  (5) Walk quietly. They will see more of the animals if they don't frighten them with noise.

Discipline

- **Discipline should be the teacher's responsibility, but often the class is split up and parents are the chaperones, or sometimes a teacher just can't control his or her class.**
- **Use gentle reminders: avoid scolding, humiliating, using sarcasm, or embarrassing the children.**
- **Stand in front or next to a talking child and make eye contact.**
- **Snap finger and point to the misbehaving child.**
- **Put finger to mouth and say "shhh."**
- **Say the child's name.**
- **Stop talking and stare at the talking student.**
- **Say to the group, "I will wait until everyone is ready." Or say "It is difficult to show you something when you're not looking."**

Outdoor Tours

It is strongly recommended to carry a cell phone that is programed with the Park's phone number (887-5516) in case of an emergency.

- **Keep in mind the age and experience level of the group.**
- **Keep things moving, especially with younger children.**
- **Set a reasonable pace. It takes visitors about 1 ½ hours to tour the Park on their own. With a group it will take longer.**
- **Ask questions. This will help determine the groups knowledge and keep them listening. Example: At the wolves ask how many of them have dogs. Ask them what is different about their teeth. Ask them what wolves eat. Ask them if their dog's fur is different in the summer and the winter. Ask them how the story "Little Red Riding Hood" makes people feel about wolves. But be sure to tell them that all wild animals should be left alone and not disturbed.**

  Example: At a sotol or yucca ask the visitors where they get their shoes from. Ask them what they think the Native Americans did for shoes over 100 years ago. Then show them a yucca and explain how the Indians used the plant's fiber to make their shoes.
- **Give children time to think of an answer. Don't allow one or two children to dominate and give all the answers.**
- **Let a child know if they gave a good answer, but never ridicule a wrong answer. Avoid saying "no" or "that's wrong." Say that was good thinking, but that is not quite right, or can try guiding him or her find the correct answer.**
- **Ask open-ended questions that don't have a definite right or wrong answer. Example: say, "Look at these two deer. What is different about their appearance?" "Yes, one has antlers." Ask them why they think one has antlers and the other doesn't?**
- **Encourage the visitors to observe what they are looking at. By asking questions, help them to observe more and share knowledge in way that will help them remember their experiences.**
- **Repeat back answers received. This helps people who may not have heard the response.**
- **Use humor- an animal or plant joke.**
- **Use visual aids. The Docent Program has a lot of realia (objects used to teach- pelts, skulls, feathers, plant skeletons, etc.) Let us know if you want fur pelts because they are kept locked up.**
- **Use a short personal story, but keep it short. Be prepared- children will want to share their stories also. The Docent can ask, "Is this a question or a story? Tell the children they can share their stories later with the class, but there is not time for all their stories now.**
- **Always use a teachable moment. If talking about a hawk and a lizard runs by, the children will direct their attention to the lizard, so use that moment to talk about it.**
- **Avoid using anthropomorphism. Don't talk about the animals as if they are little people with the same feelings and emotions that humans have.**
- **Don't be afraid to say, "That's a good question. I don't know. I will have to find out."**

Chats

Some Docents feel more comfortable having a prepared presentation. This especially works when they are "stationed" at one exhibit because there are several classes visiting on the same day. Docents often feel

comfortable using this format because they can memorize it. (Note: Be prepare to answer any other questions that might be asked after the presentation)

These chats should be short and cover five or less quick bits of information.

Select a theme: Great horned owls hearing helps them to be great hunters.

Prop: Skull of a great horned owl.

- **Great horned owls have many special hearing adaptations that allow them to be great hunters.**
- **They have incredible sense of hearing that allows them to hear a mouse moving under a foot of snow.**
- **Their ears are located on the sides of their heads, but the openings of the ears are slightly tilted in different directions. So, the squeak or rustles from the mouse will reach one of the owl's ear a fraction of a second before the other one. The owl then moves its head to judge the sounds and pinpoint its prey.**
- **The facial disc is indented feathers that surround the bird's eyes and act like a satellite dish for catching sound waves and sending them to their ears. The bird can change the position of these feathers so they can change their focus at different distances to allow them to locate prey by sound alone under snow, grass, and plant cover.**
- **The great horned owls has special hearing adaptations that help them find their prey.**

Indoor Activities

- **Know as much as possible about the presentation, but remember that no one wants to sit and listen to facts for the whole program.**
- **Do a Power Point presentation.**
- **Use visual aids- pictures, models, realia (teaching objects), puppets, etc.**
- **Use the "think-pair-share" method to make sure all students are participating. Everyone considers the question, pairs with someone near them and tells them what they think. Then ask people to share with the group a few of the answers.**
- **Use smell, taste, and touch whenever possible. Don't send samples around while doing the presentation because this will lose the children's attention. Walk among the class while talking and let them touch things.**
- **Summarize the points at the end. Do a wrap up to make sure they understood the presentation.**
- **Use a child to help demonstrate something, but choose the child wisely. If a child tends to be a show-off, don't use him or her.**
- **Involve the children physically. Example: Have them keep their eyes open for as long as they can because snakes don't close their eyes.**
- **Play a game or do hands-on activities. There are several that work well when discussing various subjects.**
- **If possible, walk around the room to keep the children actively involved.**
- **When seeing a lot of blank expressions, find a different way to explain what is being said. Try an example.**
- **When doing an inside presentation, the class may need to have a "stand and stretch time" so they can get the wiggles out.**

Evaluation

- **After a tour or presentation, evaluate what went well and what didn't.**

- **Don't be afraid to ask other more experienced docents for help and suggestions.**
- **Often, new docents like to shadow an experienced docent on one or more tours, so they have an example to follow.**
- **Many docents like being stationed at one place during tours, so they only have to learn a small amount of information. It would be helpful to take different stations, so you can learn more.**

Realia

.**Realia are real objects such as specimens of plants or animals that can be useful in presenting a fascinating learning experience while improving the retention of concepts learned. The Living Desert has a wide variety of realia, which can be used during tours and doing outreach programs. Items such as pelts and skeletons are kept locked up, but can be checked out through the Docent Coordinator or the Animal Curator. Items from the Touch Table and from the realia bookcase can also be used with no check out needed.**

Please follow the same visiting hours that our guest follow. The staff must conduct a sweep of the Park before the Park opens and at the closing of the day.

SECTION 2

ZOOS

Section 2: Zoos

History of Zoos

Zoos, or collections of animals, existed as long ago as the 8th century (AD) in Europe. These were often kept by the wealthy, who could afford to feed large numbers of animals, for their own amusement or to impress guests. Sadly, there was little or no thought for the study or protection of the animals.

The possession of exotic animals was seen as a way to show off these oddities large or small, docile or dangerous. The animals were not much more than living "curios" in cramped displays meant only to be ogled at. They were seen mostly as wild animals and not related to the habitats from which they were taken.

These first zoos displayed many species often in small, barren cages. The cages were made to be cleaned easily, like shower stalls. The result was much disease and death, and many neurotic, confused animals. Animal comfort was not a priority as collectors could simply go back to the wild to get more specimens. These facilities were referred to as "postage stamp" collections, because only one or two of each species were kept. Information on animal care was not shared between collectors/exhibitors. Unfortunately, the early zoos were not designed with the comfort, health, or natural habitat of the animal in mind. Those concerns did not become factors until early in the 20th Century, especially in England and Germany, when animals were provided with more access to outdoor environments.

Only as recently as the 1950's did the trend for roomier and bar-free exhibits arise, where animals were contained using moats, wet or dry. Now, for the benefit of animals and viewers alike, wild animals are displayed as part of their native habitats where possible. Mixed species exhibits are more common than single species exhibits. Enclosures offer soil, water, plants, hiding places (visual barriers) and room to really move around. Many zoos develop master plans that will benefit animals and humans alike. Species displayed are chosen by several criteria:

- **endangered status**
- **educational importance**
- **looks**
- **space needed**
- **ability to withstand the climate where they would be displayed**

Zoos now share much information on housing, diet, and care of their animals. Zoos cooperate to exchange animals for the benefit of the animals, not solely for the enjoyment and pleasure of the people.

Purpose of Zoos

The purposes of zoos have changed from the entertainment or status displays in early times to four basic purposes:

- **Conservation- helping animals to return to their own habitat or providing a place for them to live if they cannot be returned to the wild.**
- **Education – helping visitors know about and care for the animals, and understand their place in the ecosystem as well as our own.**
- **Scientific Studies – studying animal behavior, their dietary needs, habitat needs, and ways to enrich their lives through activities.**
- **Recreation- a place to visit**

Interestingly, on an annual basis more people visit North American Zoological facilities than the combined attendance at football, baseball, basketball, and hockey games!

AZA Accreditation

The AZA, formerly American Association of Zoological Parks and Aquariums (AAZPA), was founded in 1924 to provide a professional forum for information exchange among zoo and aquarium professionals. All institution members must be accredited by AZA. Accreditation teams look at budgets, security, record keeping, education programs, Zoological Society and municipal involvement, animal collection, parking, staff and their qualifications and more. The process is repeated every five years after accreditation is granted. There are only about 237 accredited zoos, aquariums, and wildlife parks in North America.

Species Survival Plan (SSP) and Saving Animals from Extinction (SAFE)

The Species Survival Plan ((SSP) is a program manage by the Association of Zoos and Aquariums (AZA) that aims to manage an ex situ species population with the interest and cooperation of AZA- accredited zoon and aquariums, Certified Relate Facilities (CRFs) and Sustainability Partners. The SSP program is responsible for managing captive populations of threatened and endangered species and ensuring their genetic diversity and long-term sustainability.

The Saving Animals From Extinction (SAFE) program is a collaborative conservation effort by AZA-accredited zoos and aquariums and other partners to save animals from extinction by leveraging their collective resources, expertise, and public engagement. The SAFE program focuses on the conservation of threatened and endangered species in the wild.

In summary, while the SSP program focuses on managing captive populations of endangered species, the SAFE program aims to conserve threatened and endangered species in the wild by leveraging the collective resources of AZA-accredited zoos and aquariums

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ZIMS

Species 360 ZIMS (Zoological Information Management Software) is a data base that is used internationally by zoos, aquariums, and wildlife institutions to help them achieve best practices in animal management and conservation goals. ZIMS is one global, accurate, comprehensive, and reliable source of information on animals and their environments. Families, teachers, and students can utilize

Zoological facilities are living museums and the exhibits change as the animals in them move around and interact with each other. Families, teachers, and students can utilize zoological facilities as outdoor classrooms. With graphics, staff, or volunteers present, many questions can be answered. The visitor has a more enjoyable time and will be more likely to return again and again.

The Role of the Living Desert in Conservation

Zoos today play the role of a Noah's Ark to many endangered species, providing refuge for them to survive in a world where they would soon disappear otherwise. The hope is always to preserve the species until and if they can be returned to native areas that have been reclaimed or saved for them. Living Desert Zoo and Gardens is involved in recovery efforts for two Chihuahuan Desert endangered species, the Mexican Grey Wolves and the Bolson tortoise. The Mexican Grey Wolves are carefully managed through SAFE. Some of the wolves have since been returned to areas of public land along the borders of New Mexico and Arizona, not without controversy. The Living Desert is the first zoo to be involved with the Turner Endangered Species Fund in a cooperative breeding program for the Bolson tortoises.

Where do the Living Desert's Animals Come From?

Each of our animals have a special story. Our animals come to us for different reasons:

- **They were orphaned when they were too young to survive on their own.**
- **They were confiscated from people who had illegally been keeping them as pets.**
- **They were born in captivity and didn't have the opportunity to learn how to survive in the wild.**
- **They were injured, and after rehabilitation, still had a disability that would not allow them to survive in the wild.**

We think of our animals as ambassadors of their species. They provide the opportunity for our visitors to see and learn about them in an up-close environment where they are safe and lovingly cared for.

Volunteers and Support Groups

Living Desert State Park is fortunate to have two support groups:

The Carlsbad Horticulture Society runs the gift shop, with its profit providing Park support money. The Friends of the Living Desert supports the park's educational programs and supplies funds for many needs that are not met by the budget allocated by the state.

The Zoo relies heavily on dedicated volunteers, some of whom help with the greenhouse, some with special events, some as front desk volunteers, and some as Docents (volunteer teachers and tour guides who help with all our interpretive and educational programs.) The Living Desert serves between 3,000 and 4,000 school children each year for field trips and is developing exciting curriculum-based programming. Docents and park staff also take outreach programs to schools and community groups.

Special Events

Each year the Living Desert hosts several events. Please refer to the Annual Events Calendar Brochure located at the Front Desk. Many volunteers are needed to make these events "special."

Interpreting the Chihuahuan Desert

The Living Desert Zoo & Gardens State Park is an ideal setting for the interpretation of the Chihuahuan Desert and all it contains. By understanding and appreciating the qualities of this unique area, people can gain important insights into how people may live here in the most ecologically responsible way. The subjects interpreted include plants, animals, geological processes, and native people of the Chihuahuan Desert region. The most effective interpreter will go beyond identifying a specific plant, animal, or landform, and present some of the causes and effects, the "whys" and the "hows." He or she will attempt to weave isolated and individual factors into a broader fabric representative of the broader ecosystem, involving the visitor in the process. The kiosks and displays in the main visitors' center are especially helpful for this. The guiding principle for interpretation here at the Living Desert Zoo & Gardens State Park is to reveal the inter-relationships of the life and land of the Chihuahuan Desert ecosystems. This is done using living or real native specimens or objects, supplemented by fossilized or carefully crafted reproductions where necessary. Informed docents add an important dimension to the Park's efforts to interpret this message for the public.

Mescal Apaches

Since this area was occupied by the Mescalero Apaches, information about them has been included. One of our kiosk presents information about the Mescal Apaches.

Apaches, Mescal Roasting, and Ring Middens in the Guadalupe Mountains

By Jacqueline Beidl, USFS Archaeologist

The Apache are the descendants of Athapaskans who migrated south from Canada and Alaska beginning about 1,000 years ago. Researchers today are uncertain what route these migrating Athapaskans followed, or how fast they traveled, or even why they began moving south. We can only guess that these early Athapaskans were nomadic and highly mobile. They probably lived in temporary settlements and subsisted on wild game and fruits. Their "migration," therefore, probably progressed very slowly, and resulted from following the movement and harvest cycles of the wild animals and plants they depended on.

In any event, Athapaskans began arriving in the Southwest sometime between A.D. 1000 and A.D. 1600. Most of them remained nomadic and claimed homeland territories around the mountainous regions of what are now Arizona, New Mexico, West Texas, and Mexico. According to the regions they inhabited, the Athapaskans became variously known as Mimbrenos, Gilenos, Lipanes, Faraones, Navajos, Mescaleros, Chiricahuas, Jicarillas and Western Apache.

Until they were confined to a reservation on the eastern slopes of the Sierra Blanca and Sacramento Mountains in 1873, the Mescalero Apache inhabited the region in and around the Rio Grande and Pecos Rivers, wandering as far north as the Chupadero Region in New Mexico, and as far south as Coahuila, Mexico. The Sierra Blanca, Davis, Sacramento, and Guadalupe Mountains were an integral part of this homeland. Here, the Mescalero lived in small bands of 45 to 300 people. They built temporary, dome-shaped shelters (wickiups) made of branch frames covered with grass or hides.

The Mescalero hunted bison, antelope, mountain sheep, lion, and mule deer. There was virtually no wild plant the Mescalero could not, and did not, make use of: agave, sotol, bear grass, mesquite, datil, wild pea pods, pinon nuts, acorns, walnuts, mint, sage, wild onion, and celery, horsemint, strawberries, and raspberries to name only a few. This subsistence was supplemented with food and material goods acquired through raiding or trading with Native, Anglo, and Spanish villages along the Rio Grande and in Mexico.

The subsistence practice which the Mescalero are most famous for, and after which they have been named, is the roasting of mescal or agave. This plant food was an important staple for the Mescalero because it was an abundant and dependable food source that could be preserved and stored. When game and other plant foods became scarce, the Mescalero could

depend on reserves of roasted and dried mescal to keep them alive. The southern Sacramento Mountains, foothills of the San Andres Mountains, and Guadalupe Mountains were favorite mescal collecting spots. It could be gathered at any time of the year, but spring and fall were the most popular seasons.

A "mescal roasting party" was usually initiated by an experienced and respected woman of middle age. This woman would casually mention that she planned to collect mescal to some of her female friends and relatives, and in this way recruited volunteers to accompany her. The "typical" mescal collecting group included between four and ten women, and often a couple of men for protection. The women removed the mescal plants from their roots at ground level with wedge shaped digging sticks. The leaves of uprooted mescal crowns would then be tied so that they could be hung over a stick and easily carried to the roasting pit.

The size and construction of roasting pits varied, but in general, a shallow pit ranging from two to eight meters in diameter would be dug. Once this was completed, a flat rock marked with a charcoal cross would be placed in the center as prayers for a successful mescal roast and for the general well-being of the band were made. The dirt pit was then lined with limestone rocks. Wood was placed over these rocks, and a second layer of rocks would be added.

Dried gramma grass, which had ritualistic value, was used for tinder and the mescal pit was fired before sunrise. After the wood had burned down, and the rocks were heated, the women brought the collected mescal heads to the pit. More prayers were offered, and a select mescal head was marked with a charcoal cross and placed in the center of the pit. Once this had been completed, each woman would place the mescal she gathered in that part of the pit assigned to her. Finally, all the mescal was covered with damp grass, and the pit was filled with earth to make it airtight. During the several days required for the mescal to cook, the women were not allowed to fight or be disruptive.

Once the cooking was complete, the women made "cakes" from the bases of the mescal leaves, and the hearts were sliced. The mescal was then sun-dried on brush racks. Some of the agave would be eaten by the collecting party at the roasting site, but most of it was saved for distribution to friends and relatives at the base camp, who would then cache it for lean times (Basehart 1973:157-158).

The Mescalero Apache roamed freely in the Sacramento and Guadalupe Mountain region for over 500 years, but little archaeological evidence of their existence has been identified. This is primarily because, as nomadic people, they owned few material goods to transport or leave behind. The ring midden (or mescal pit), the most common archaeological feature found in the Guadalupe Mountains, may be associated with Apache use of the area. These ring middens are usually round or crescent-shaped piles of fire-cracked limestone that range from two to eight meters in diameter, and stand from one-half meter to over one meter high above the ground surface. Some of the largest ring middens have central depressions and look almost like donuts.

Unfortunately, most sites containing ring middens often lack artifacts diagnostic of the Apache, and traditional radiocarbon dating methods have failed to date a significant number of ring middens to the Protohistoric (or Apache) Period. Although mescal roasting was a part of human subsistence patterns throughout the known prehistory of the region (e.g., Archaic groups and the Jornada Mogollon), some of the ring middens we find in the Guadalupe Mountains today are undoubtedly remnants of the pre-reservation Apache lifestyle. Until archaeological methods are improved, however, these markers of the Apache culture will continue to evade scientific scrutiny.

References Cited and Recommended Reading

Basehart, Harry 1973 Mescalero Apache Subsistence Patterns. In Technical Manual: 1973 Survey of the Tularosa Basin. Human Systems Research, Tularosa, New Mexico.

Haley, James 1981 Apaches: A History and Culture Portrait. Doubleday and Company, Garden City, New York.

Mails, Thomas E. 1974 The People Called Apache. Prentice-Hall, Inc. Englewood Cliffs, New Jersey.

Opler, Morris E. 1983 Mescalero Apache. In Handbook of North American Indians, Volume 9. The Smithsonian Institute, Washington, D.C.

Jacqueline Beidl is an archaeologist with the U.S. Forest Service and has extensive experience in the Lincoln National Forest of New Mexico. The Lincoln NF includes the Guadalupe, Sierra Blanca and Sacramento Mountains. We would like to thank both Jacqueline and the U.S. Forest Service, Lincoln National Forest, for this article

The Legend of the Mountain Spirits

As has been told to Apache youth for centuries, there were two young men, one was crippled and the other blind. Their band had been attacked and was fleeing from an enemy. So that they would not slow the flight of their tribesmen and jeopardize the safety of themselves and their families, they were hidden. The two handicapped men were placed in a secret mountain cave, the entrance of which was covered by a large boulder.

Many days and nights they waited for their tribesmen return. Their food and water ran out, their bodies grew gaunt. They came to fear that they had been abandoned. They knew that death would claim them soon.

Then, one night as they huddled in the quiet darkness of the cave, they heard strange and frightening sounds outside. The sounds got louder and louder. Suddenly the boulder was flung aside and five strange figures marched menacingly into the cave. Four were painted black with cryptic white symbols and wore mystical headgear. A fifth was painted white. These were the spirit guardians of the mountain or the mountain gods.

A mysterious light illuminated the cave silhouetting the figures of the strange intruders. These luminous rays were amazingly transformed into a huge bonfire. Around the fire the spirits danced and chanted. As the figures brandished their wands against unseen enemies and called upon the forces of nature for power and healing, the dance of the Mountain Spirits was revealed.

At first, the blind man and the crippled man cowered against the side of the cave, then grew more relaxed as the dancing continued until dawn. They sensed that these were, indeed, powerful spirits.

As the dance was ended, the white-painted god struck the massive wall of the cave with his wand and suddenly the rock divided to form the passageway to a new entrance. The spirits began to lead the blind man and the crippled man from the cave. As they stepped through the new entrance, the blind man and the crippled man were instantly healed. The blind man could see again and the crippled man was no longer lame. Moreover, each was clothed in the choicest buckskin clothing and carried the finest bows and arrows imaginable.

The mountain spirits were gone but the healed men were no longer alone for in the distance an Indian village became visible. As they drew near the village, they realized the band was their own. They rejoined their families and joyously told them of the miracle that had been performed by the mountain spirits. They taught their people the spirit dance, just as the mountain spirits had done. For many generations hence, the Apaches have performed this Dance of the Mountain Spirits to drive away sickness and evil and bring good health and good fortune.

Agave neomexicana

Mescal is the plant baked by the Mescalero Apache in their familiar rock-lined pits that are frequently found in the Guadalupe Mountains. The Latin name for the plant is Agave neomexicana. It is so named because it is very common in our state. Usually, we call it the century plant or agave. The Apache call it mescal.

Here in the Chihuahuan Desert agaves grow plentifully. They store water and nutrients in thick succulent leaves. At the tip of their leaves are sharp thorns, strong enough to pierce a leather boot. After 10-15 years these agaves produce bright yellow-to-orange bell shaped flowers atop a 10 to 20-foot stalk. After this burst of colorful energy, they die, flowering just once. Besides their value as food, several strong alcoholic beverages including mescal and tequila are made from other varieties of agave.

Agaves, sotols, and yuccas are often confused. Here is how to identify them. Agaves have sharp pointed leaves, do not have a trunk, and die after flowering once with bell shaped flowers. Yuccas have a trunk, usually have thinner leaves than agaves, bell shaped flowers, and do not die after flowering. Sotols are closer to yuccas, but like the agave, they do not have a trunk. Their narrow ribbon-like leaves have barbed leaf margins, often split at the tips. Tiny cream blooms borne on a tall flower stalk are much smaller than the bell-shaped yucca or agave.

SECTION 3

DESERTS

Section 3: Deserts

What is a Desert?

A desert is a region that receives less than 10 inches of rain a year. Deserts can be cold, such as the Gobi Desert in Asia or Antarctica.

The hottest places on the earth are the deserts. The Sahara Desert, in Africa, can have an air temperature of 136° F.

A desert can have extreme temperatures. In the heat of the afternoon, the temperature can soar to over 100°, but because there is little moisture and cloud cover in the atmosphere, the desert quickly loses the heat at night and the temperatures can plummet.

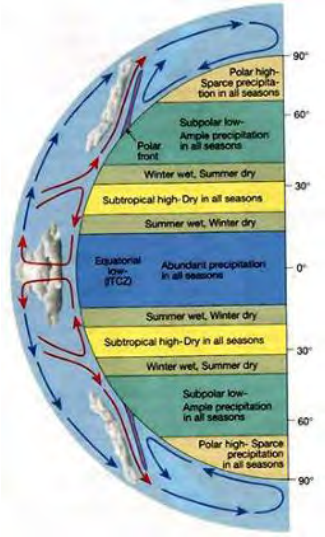
The one thing that is common to all deserts is the severe lack of moisture. The rain pattern can be unpredictable; a torrential downpour that causes flash floods can follow a yearlong drought.

A desert occurs when an area has a higher potential rate of water loss through evapotranspiration than what is supplied by rain.

Causes of Deserts

There are four main causes of deserts.

1. Perhaps the most significant cause of deserts is the movement of large air masses over the surface of the earth. Global winds influence climate because they distribute heat and moisture around the Earth. At the equator hot air rises and creates a low atmospheric pressure. The rising hot air flows away on both sides of the equator to descend to the two subtropical zones (Tropic of Cancer 30°N and Tropic of Capricorn 30°S). There, the air temperature is greatly increased and arrives at the surface of the Earth as very hot, dry, and totally incapable of producing precipitation.

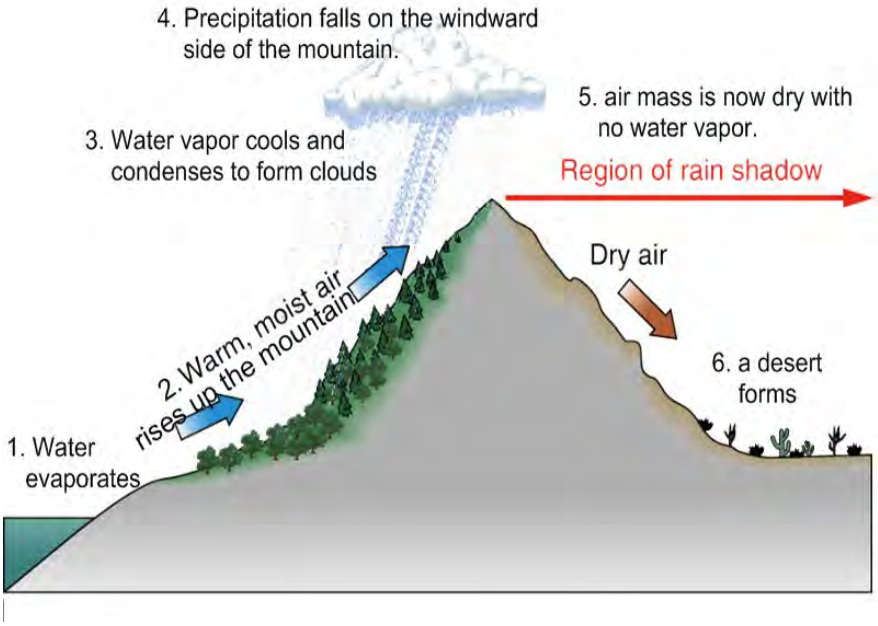


Farther to the north and south are two more broad belts of ascending air with low pressure. The Polar Regions have descending air and high pressure where the cold deserts are located.

2. Some deserts are in the center of continents. By the time winds reach the center of the continent, they have often lost most of their moisture.

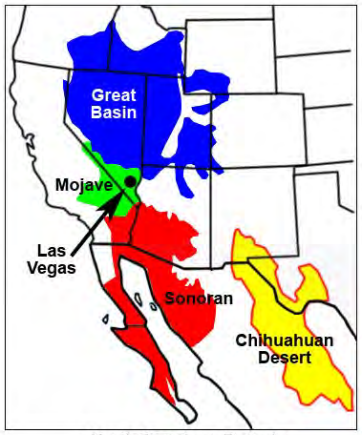
3. Some deserts lie near the edge of a continent where there are cold ocean currents. The cold ocean currents cause the moisture to drop out of the air and back into the ocean before it reaches the continent.

4. Some deserts are located behind mountains. As the winds carrying moisture travel over the mountains, the air rises and cools. This causes most of the moisture to fall as rain on the windward side of the mountain range. This is called the "rain shadow" effect because one side gets most of the rain, and the other side is mostly dry, causing a desert. Deserts caused by rain shadows are usually located on the east side of mountains.



The North American Deserts

The boundaries of the North American Deserts are not sharp. In particular, the lower portions of the Mojave are very similar to the lower parts of the Sonoran Desert. They are loosely determined by the plants, animals, and topography of the region. But because of their immobility, plants are more likely to be unique to a given habitat; few animal species are endemic to a single community habitat.



North American Deserts

North American Desert Comparisons

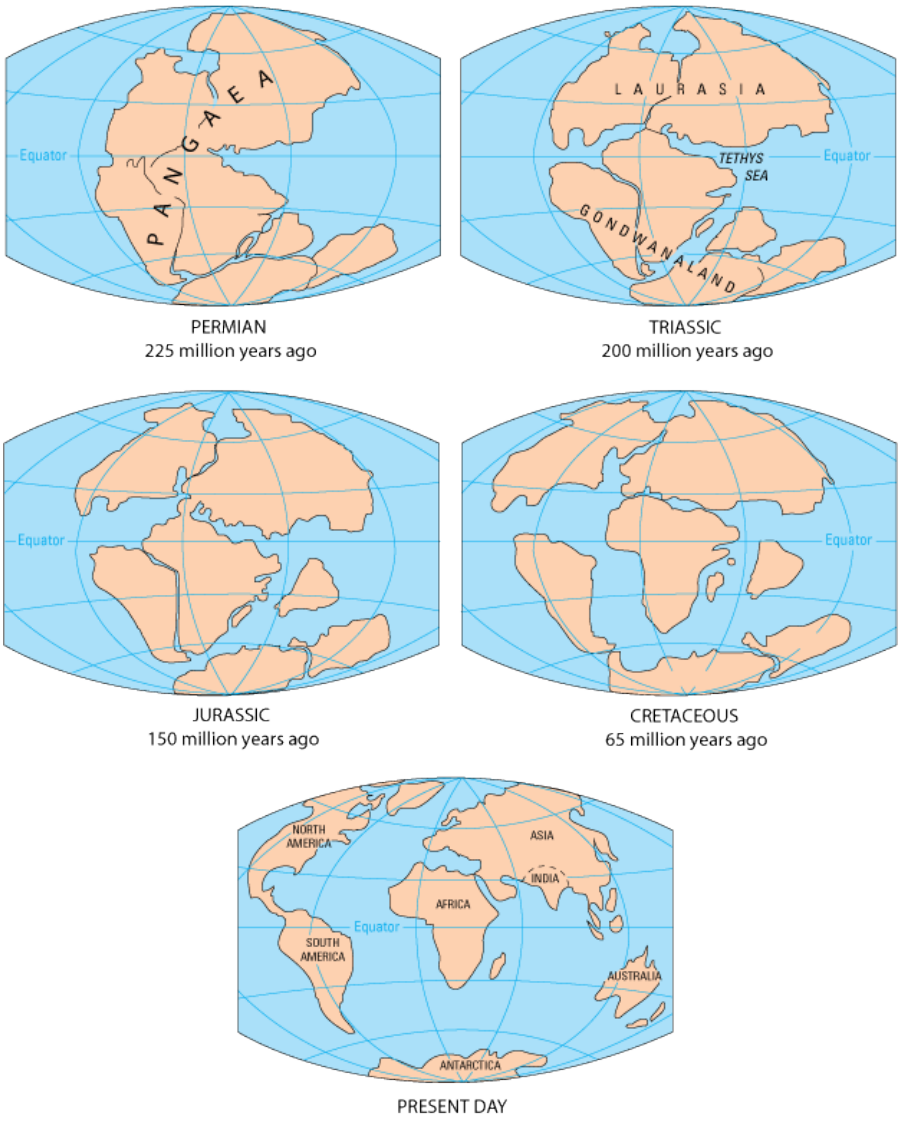
Desert	Elevation / Latitude	Winter Summer	Rainy Season	Characteristic Vegetation Type
Great Basin	**Mostly above 4,000 feet/ Northern latitude**	**Very cold warm**	**Year round, but effectively summer (winter too cold for plant growth)**	**Poor in life forms and species (low shrubs, few species) Almost no annuals, trees, or succulents.**
Mojave	**Intermediate distinctive part 2,000-4,000 / Intermediate latitude**	**Cold hot**	**Winter (eastern part also gets significant summer rain)**	**Few life forms; rich in species; (low shrubs, many species) Many annuals, few trees, some succulents**
Sonoran	**Low-mostly below 2.000 feet. / Southern latitude**	**Mild hot Most is frost free**	**Summer (NW part gets most rain in winter. NE part is bi-seasonal)**	**Very rich in both life forms and species: columnar cacti and other succulents. Trees especially legumes, shrubs, and annuals.**
Chihuahuan	**High, mostly above 3.500 feet. Southern latitude**	**Cold hot**	**Spring and late summer. (NW gets significant winter rain).**	**Rich in life forms and very rich in species: shrubs, succulents, semi-succulents (especially small species), annuals, few trees**

SECTION 4

GEOLOGY

Section 4: Geology

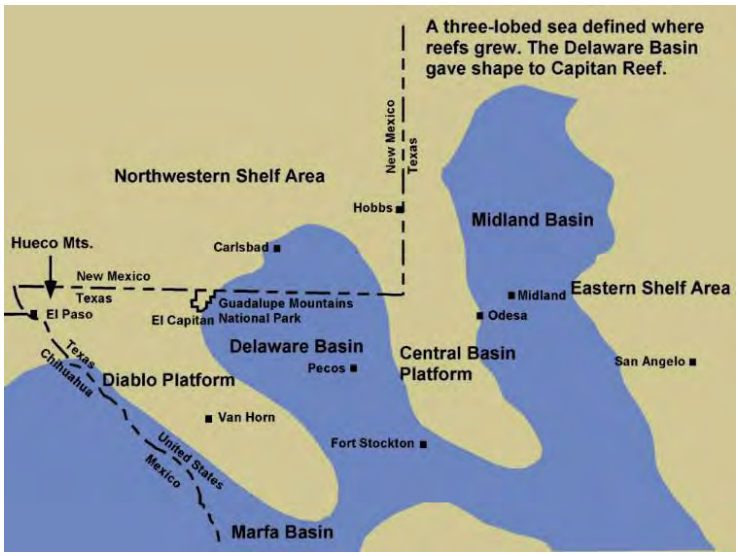
About 300 million years ago, the Earth did not look like it does today. The land masses are located on plates that are constantly moving, which resulted in the continents changing their position.



Geology of Southeast New Mexico and West Texas

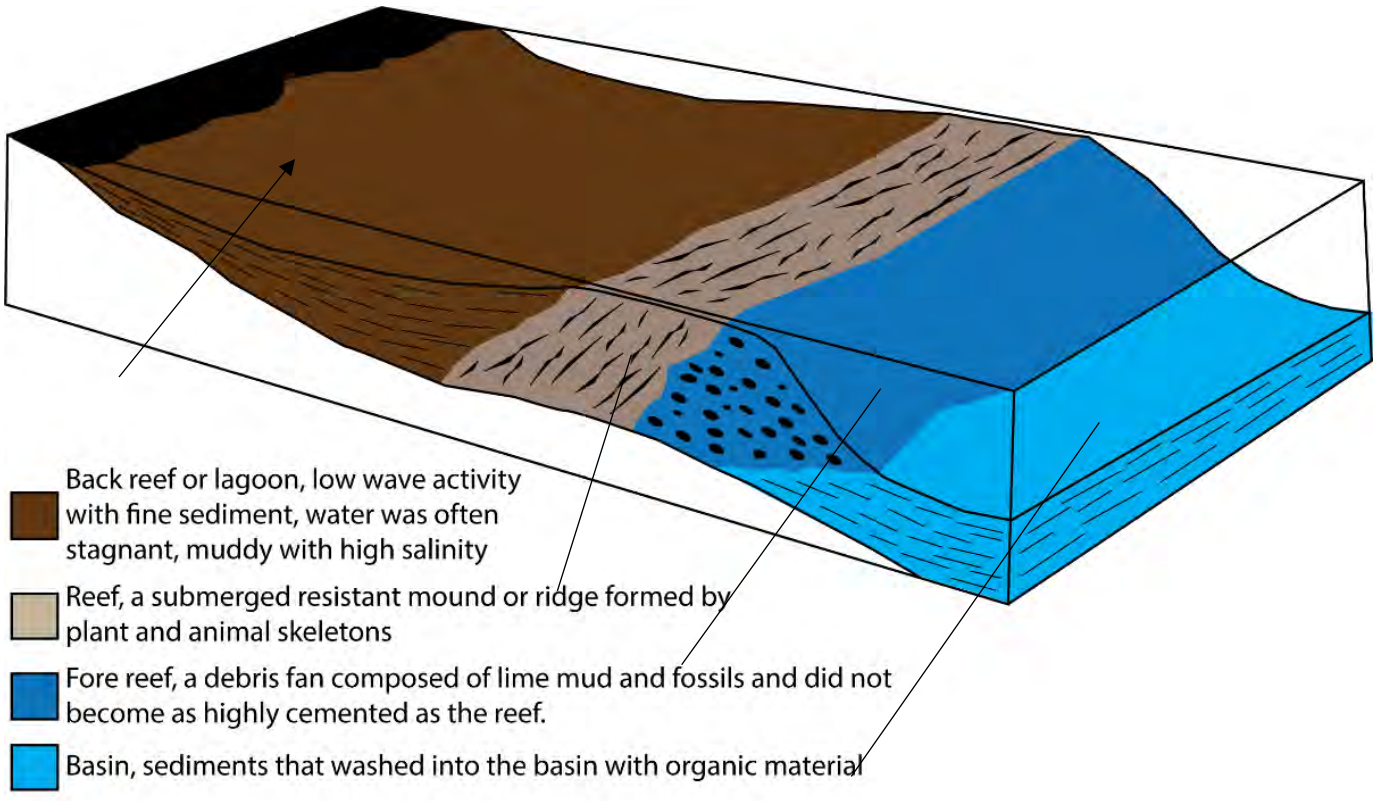
Between 275 to 195 million years ago, all the land masses on Earth were merged into one super continent called Pangaea. The earth was emerging from an ice age and was becoming hot and arid. Today's present-day Permian Basin was at that time located on the western edge of Pangaea near the tropics. The Panthalassa Ocean surrounded Pangea and a narrow inlet, the Hovey Channel, connected the Permian Basin to that ocean. The Permian Basin was composed of 3 lobes: Marta, Delaware, and Midland Basins. The city of Carlsbad now occupies a spot at the northwestern edge of the Delaware Basin (sea).

The Delaware Basin (Sea)



260 million years ago, the Hovey Channel got cut off by plate tectonic movement, and the Delaware Sea dried up slowly due to the Permian Sea leaking through the barrier at the same rate as the Delaware Sea was evaporating. Alternating salts (calcite, gypsum, and halite) precipitated out of the dying sea until the Delaware Basin was completely filled in, and the Capitan Reef was buried.

A reef developed along the margin of the Delaware Basin (sea) at the shelf edge, and a shallow lagoon was between the reef and the shore (back reef). A steep talus slope extended from the reef down to the basin floor.



Layers of organic rich shale and sandstone formed from partially decomposed dead plants and animals that became buried under thousands of feet of sediment. The organic matter became oxygen deprived and slowly over millions of years of heat and pressure changed into oil and gas.

Reef Building (265-260 million of years ago)

For millions of years the Hovey Channel provided ocean water to the Delaware Sea (Basin.) Fossils show that the "Capitan Reef" was built mostly of sponges and algae. Other marine fossils found here include ammonites, crinoids, snails, naticoids, bivalves, brachiopods, and the occasional trilobite. These organisms formed a shallow reef that grew just below the surface of the water along the edge of the shelf's ledge. As these organisms died, they provided a rocky base (mostly limestone) for new sponges and algae to grow.

Once the reef reached sea level, it began to grow horizontally, since it could not grow vertically anymore. For millions of years as the sea level rose or fell, the reef would grow vertically or horizontally depending on depth of the sea.

Eventually, the reef formed a horseshoe-shaped layer of limestone that grew 1,800 feet thick, 2 to 3 miles wide, and over 400 miles long.

265-260 million of years ago, reefs were abundant globally, and grew in places such as the Zechstein Basin in Eastern Europe, along the Tethys Ocean, and in cool water shelves in the Panthalassa Ocean. But the Capitan reef is now recognized as one of the most well-preserved fossil reefs in the world.

Forereef

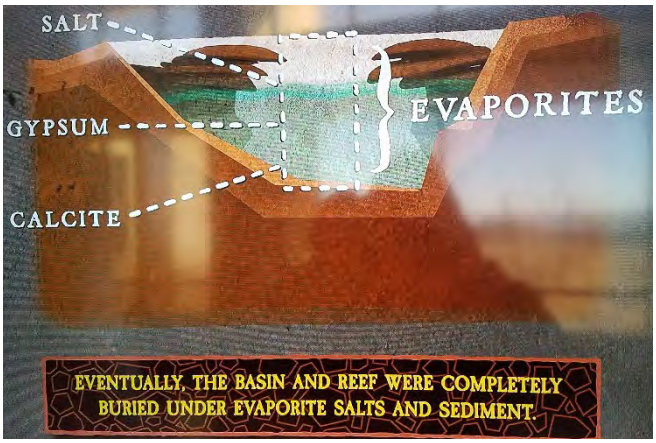
Waves against the reef (mostly limestone) and gravity caused large fragments of the reef to break off, slide down the talus slope, and pile up for nearly a half a mile at the base of the sea below. In addition to debris, the forereef was also composed of lime mud and fossils, such as trilobites, brachiopods, sea urchins, algae, and bryozoans. However, the forereef did not become as highly cemented as the reef.

Backreef

Behind the reef were shallow, quiet, salty lagoons that were fed by streams carrying fine sediments when the sea level rose. These lagoons were often stagnant, muddy, and had a high salinity. Layers of limestone and siltstone (sedimentary rocks) made up the backreef. A portion of the Tansill and Yates formations can be seen where some of the hill was cut away along the road leading up to the Living Desert Zoo and Gardens State Park. (A good viewing spot to see these layers of sandstone is from the Reptile Exhibit's patio.)

Reptiles of many kinds were common on land northwest of the reef (near today's city of Las Cruces, New Mexico). At the base of the Organ Mountains in the Mesilla Valley, a trackway of Dimetrodon and other primitive reptiles has become quite well known. Many kinds of spore bearing trees colonized broad swamps where they later formed coal deposits. Numerous insects of remarkably modern appearance were present during this time.

End of the Permian Era



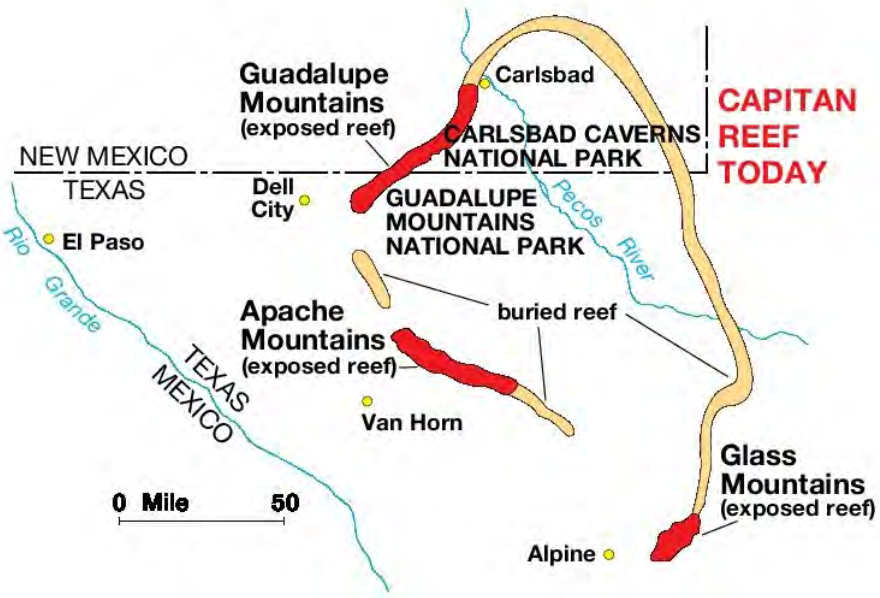
For five million years the Capitan Reef had expanded along the rim of the Delaware Basin, but by the late Permian time (about 269 million years ago) the Delaware Sea no longer existed, and the reef was buried. At the end of the Permian (250 million years ago), the greatest mass extinction (often called the Great Dying) killed 9 out of 10 species on the Earth.

Uplift

About 20 to 2 million years ago, plate tectonics caused steep faults to develop along the western side of the Delaware Basin (called the Basin and Range). Movement on these faults caused a long-buried portion of the Capitan Reef to rise two thousand feet above its original position. This uplifted block was then exposed to wind and rain, causing the softer overlying sediments to erode, uncovering the more resistant fossil reef, and forming the modern Guadalupe Mountains.

El Capitan Peak is the most iconic image of the exposed Capitan Reef

NPS Photo Cookie Ballou



As the fractured reef was raised, the salt water that had filled the reef for millions of years was slowly displaced by a layer of fresh water floating on top and a huge aquifer was created. The upper surface is the water table. Currently there are wells supplying fresh aquifer water to the Carlsbad area.

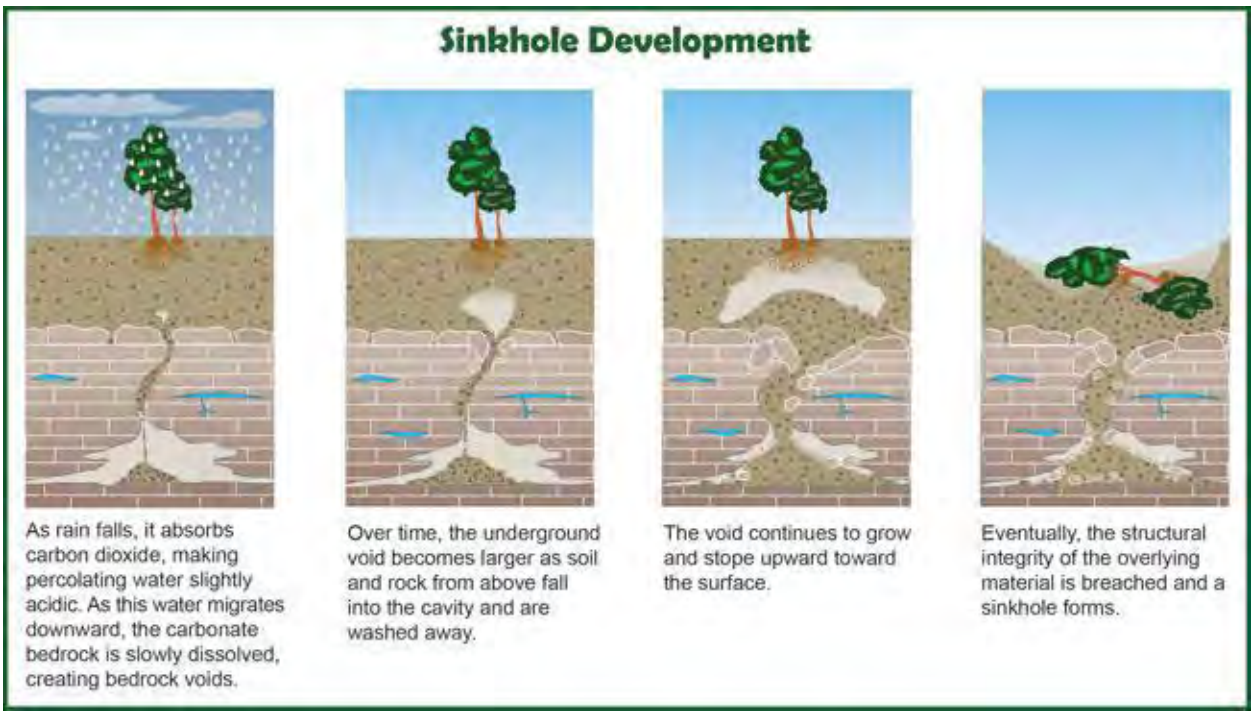
Today, as we look out from the Living Desert, we see the remains of the Delaware Basin below us. We are located on the edge of the Capitan backreef. Millions of years of alluvial deposits formed the salt, potash, oil, and gas for which our area is famous.

Underground Formations

Currently, southern New Mexico contains two kinds of underground formations- caves and sinkholes, which are a direct result of geologic changes during Permian times to the present. Hundreds of limestone caves and sinkholes have formed throughout the karst terrain. These are regions where the types of rock below the land surface can naturally be dissolved by groundwater circulating through them. Soluble rocks include salt beds and domes, gypsum, and limestone and other carbonate rock. When water from rainfall moves down through the soil, these types of rock begin to dissolve. This creates underground spaces and caverns.

Sinkholes

Sinkholes are usually circular surface depressions that were caused by the collapse of caverns that formed by slightly acidic groundwater in limestone. When the underground void spaces get too big, the land above it is not supported, and a sudden collapse of the land occurs.



Sinkholes also occur in the evaporite deposits east of the Pecos River. At Bottomless Lakes State Park, east of Roswell, the solution of gypsum in the Permian Basin has caused collapse of seven sinks, now water-filled lakes.

Cave Formation

Most of the world's caves are formed by carbonic acid in limestone rock. A weak carbonic acid is a combination of rain or snow melt and carbon dioxide gas from decaying plant material in the topsoil. As the weak carbonic acid makes its way down through the cracks and crevices to the water table, it dissolves the rocks, which eventually form caves. This carbonic acid creates more than 90 percent of the world's limestone caves. These types of caves are typically very wet and have streams and sometimes lakes or large waterfalls in them. However, there are no flowing rivers or streams in any of the hundreds of caves in the Guadalupe Mountains and there is no evidence that these huge cave chambers were dissolved by carbonic acid. Instead, these caves were formed by sulfuric acid just above the water table- a rare type of cave development.

Cave Formation in the Guadalupe Mountains

There are more than 130 known caves within the Carlsbad Caverns Nation Park. They are some of the biggest and longest caves in the world.

Since the 1970s, geologists have come to understand that sulfuric acid played the major role in the dissolution of most Guadalupe Mountain caves.

Between 12 and 2 million years ago, as the Guadalupe Mountains were rising, hot springs were releasing hydrogen sulfide (H_2S) gas that mixed with oxygen, in air-filled fractures and cavities just above the water table to become sulfuric acid (H_2SO_4). This is the same acid used in car batteries. This acid converted the limestone along fractures and voids into gypsum, which dissolves in water, forming the huge chambers.

Proof of the sulfuric acid origin can be seen by the large (up to 15 feet thick) gypsum deposits on the floor and walls in some of the cave passages. Gypsum, which is easily dissolved in water, is not usually found in large quantities in most caves. It is a by-product of the chemical reaction of limestone and sulfuric acid. Gypsum also formed beautiful crystals in Lechuguilla Cave.

Cave Decorations

The magnificent speleothems (cave formations) that continue to grow and decorate Carlsbad Cavern are due to rain and snowmelt soaking through limestone rock, then eventually dripping into a cave below and evaporating. That water absorbed carbon dioxide (CO_2) gas and dissolved calcite ($CACO_3$) from the limestone above the cave. Wherever that water drop evaporates in the cave atmosphere, a small amount of calcite is left behind. Thus, drip-by-drip, over the past million years or so, Carlsbad Caverns has slowly been decorating itself.

The slowest drips tend to stay on the ceiling long enough to deposit their mineral there. Common speleothems found on the ceiling include stalactites, soda straws and draperies. The faster the dripping, the more likely it is to make some type of decoration on the floor. A wide range of decorations on the cave floor include totem poles, flowstone, rim stone dams, lily pads, shelvestone, cave pools, and of course stalagmites.

Most formations in Carlsbad Caverns are made of calcite (CaCO3), but they can also be made of other minerals like gypsum (CaSO4 · H2O) and aragonite (CaCO3), which is another form of calcite. Pure calcite speleothems are white or clear, but other elements can also be present to give the formations different colors. Common elements leached from the rock or soil are iron and manganese, which can make formations red or brown.

Cross Section of the Caverns from the Entrance

Backreef: Upper layer: The limestone in the entrance section of the cave was once muddy sediment at the bottom of the shallow lagoon. This area is called the backreef because it was located behind the reef. This layer is called the Tansill Formation. Mud cracks can be seen on the cave's ceiling, indicating that the Tansill Formation was often above the sea level.

Backreef: Second layer: The 20-story thick limestone making up the lower layer of the backreef and is called the Yates Formation. The Yates Formation may be seen when traveling from the top to the bottom of Devil's Den. When looking to the north wall from the Whale's Mouth, the dividing line between the Tansill and Yates Formations may be seen, as a row of stalactites.

Reef: The reef is observed from the bottom of Devil's Den down to Lower Cave. The reef is solid, not like the layers of limestone observed in the backreef. In some areas, fossils of sponges and other sea creatures can be seen, especially on the wall by the elevators.

Forereef: At the Bottomless Pit, layers of limestone in the walls are diagonal, not horizontal like the backreef layers higher in the cave. This area is in the talus (chunks of the reef that broke and fell away from the reef) slope. There are less cave formations in this back section of the Big Room because water migrating down from the surface is directed away from the cave by these diagonal bedding planes.

Geology Of Carlsbad Caverns National Park

By Geology and Ecology of National Parks

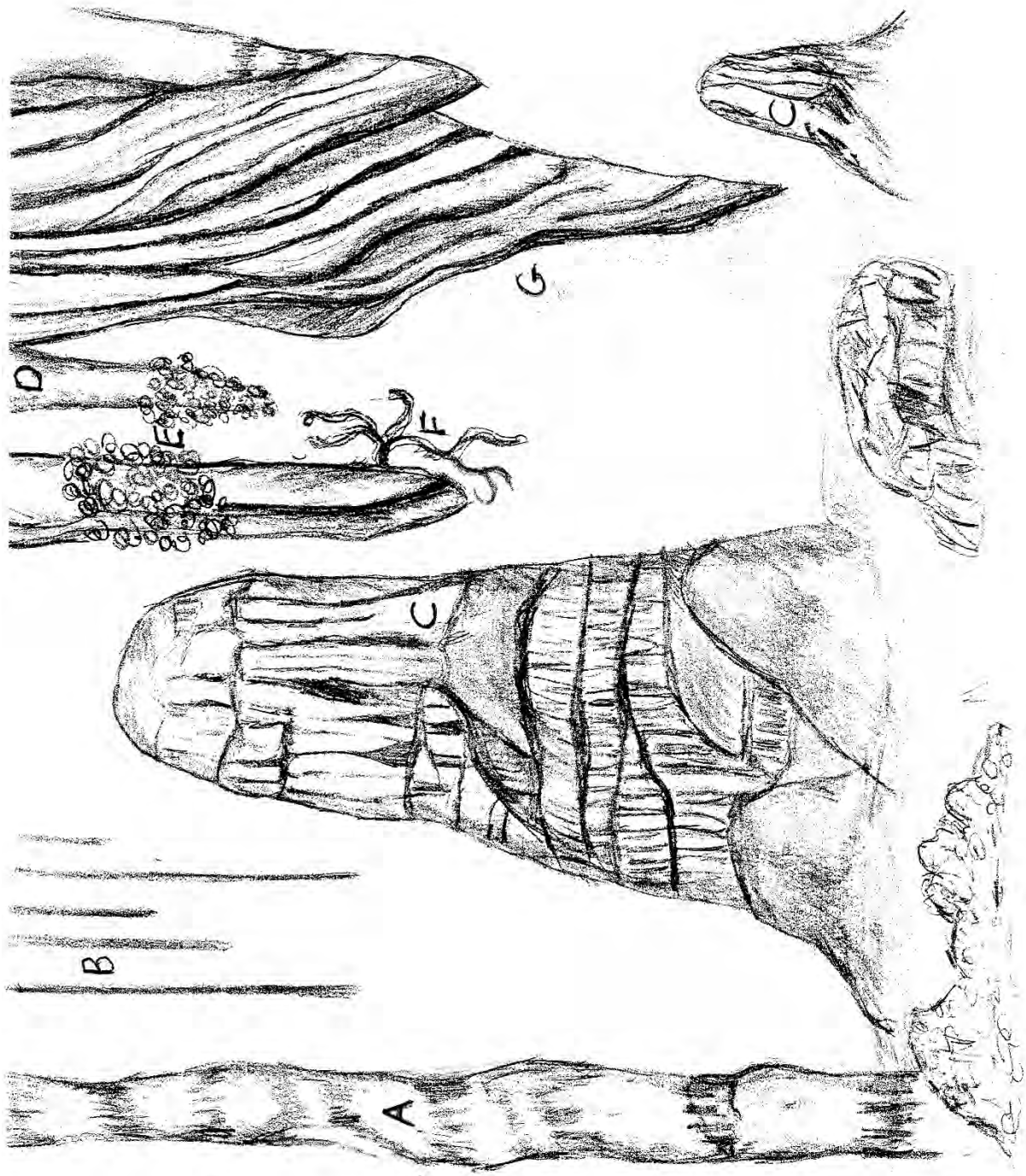
The area where Carlsbad Caverns is located today was the coastline of an inland sea 250 million years ago. Due to the warm, shallow, tropical seas, the reef formed from mostly sponges and algae instead of coral, like many reefs today. Landward of the reef redbeds, evaporites, lagoonal mudstones, pisolitic grainstones, and back-reef grainstones were deposited during this time period. Today, the reef deposit makes up the Capitan Limestone formation, which is 750 feet thick, and most of the National Park is within this limestone formation. Eventually, by the end of the Permian, the sea dried up and the reef became buried by sediment for tens of millions of years. Fossils from this time period can be seen within Carlsbad Caverns, including ammonites, crinoids, snails, nautiloids, bivalves, brachiopods, and trilobites.

Over the past 20 million years local faulting and stresses of the Earth's crust uplifted the reef sediment by nearly 10,000 feet, creating the Guadalupe Mountains, and the sediment eroded, exposing the reef. Within the Guadalupe Mountains there are more than 300 caves, and 119 known caves within Carlsbad Caverns National Park. The Big Room in Carlsbad Caverns is the largest cave chamber in North America, with 8.2 acres of floor area. Additionally, Lechuguilla Cave is the deepest and third-longest cave in the United States.

The caves in Carlsbad Caverns are unusual, as they formed from sulfuric acid instead of carbonic acid. Most caves in the world are formed when water interacts with carbon dioxide and seeps downwards. The location of the Guadalupe Mountains played a key role in the creation of these caves. Carlsbad Caverns National Park is located near the border of New Mexico and Texas, and close to the Permian Basin, which hosts large oil fields. Hydrogen sulfide-rich water rose from the oil reservoirs as late as 12 million years ago and mixed with groundwater to form sulfuric acid. The limestone was dissolved at the water table, and therefore, Carlsbad Caverns was dissolved from below and not from above. Gypsum blocks, a byproduct of sulfuric acid dissolution, can be seen today on the floor of the Big Room of the Carlsbad Caverns.

Eventually, the roof of the cave collapsed, creating an above-ground entrance to the cave, and allowing air to circulate through the cave. While the cave did not form due to carbonic acid dissolution, after the roof collapsed, several of the structures within Carlsbad Caverns were formed by carbonic acid dissolution. Speleothems, including stalactites and stalagmites, are formed from dissolved limestone. The speleothems in Carlsbad Caverns are due to rain and snowmelt soaking through limestone, and the water absorbing gasses and minerals from the limestone. When this water evaporates and emits carbon dioxide, calcite remains and slowly builds up over time. Stalactites form on the ceiling, while water that falls to the floor deposits minerals, creating stalagmites. There are several other types of speleotherms found within Carlsbad Caverns National Park, including columns, soda straws, draperies, helictites, and popcorn.

The Guadalupe Mountains are situated within a desert, and therefore these caves are drier than typical cave systems. Therefore, few speleothems are growing today.



A. Column
B. Soda Straw
C. Stalagmite
D. Stalactite
E. Popcorn
F. Helictite
G. Draperies (Flowstone)

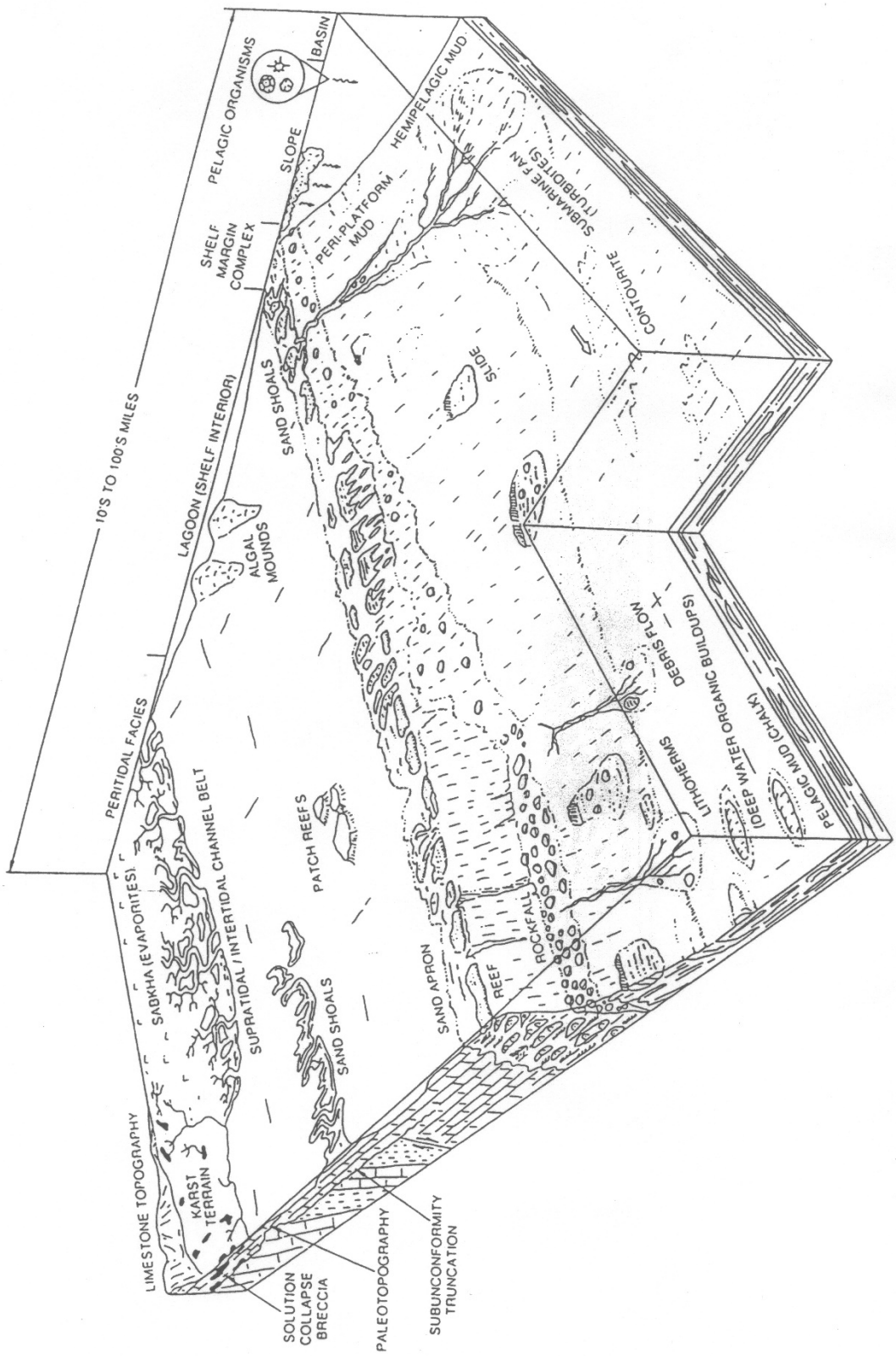

10'S TO 100'S MILES
PERITIDAL FACIES
LAGOON (SHELF INTERIOR)
ALGAL MOUNDS
SAND SHOALS
SHELF MARGIN COMPLEX
SLOPE
PELAGIC ORGANISMS
BASIN
PERI-PLATFORM MUD
HEMIPELAGIC MUD
SUBMARINE FAN (TURBIDITES)
CONTOURITE
SLIDE
DEBRIS FLOW
LITHOHERMS
(DEEP WATER ORGANIC BUILDUPS)
PELAGIC MUD (CHALK)
SABKHA (EVAPORITES)
SUPRATIDAL / INTERTIDAL CHANNEL BELT
PATCH REEFS
SAND SHOALS
SAND APRON
REEF
ROCKFALL
LIMESTONE TOPOGRAPHY
KARST TERRAIN
SOLUTION COLLAPSE BRECCIA
PALEOTOPOGRAPHY
SUBUNCONFORMITY TRUNCATION

Figure 14

SECTION 5

ECOLOGY

Section 5: Ecology

The term "ecology" means "a study of the home" and our home truly is the natural world. But the city dweller is often too far removed from those parts of the world which provide life support and that connection is frequently missed. Even if we don't notice the link between our breakfast cereal and the plains dung beetle, a relationship exists nevertheless. In fact, one basic tenet of ecology is that everything is connected to everything else.

Ecologists divide the world into three main levels:

• Level 1 - species populations - collections of individuals of the same species living together in the same place

• Level 2 - communities - collections of species living together in a particular kind of environment

• Level 3 - ecosystems - collections of species living together in a community PLUS all the non-living parts of their environment

Volumes have been devoted to the study of species populations (level 1) and the capacity of the environment to support them. Volumes have also been devoted to the study of the physical components in an environment (level 3). This section will concentrate on level 2, the community level, which stresses the interrelationships between the different plant, animal, fungal, and bacterial species which live together in a given environment.

A biological community can be quite small (the species living together on a rotting log or in a balanced aquarium). It can be of moderate size (an acre of prairie on a railroad right-of-way), or it can include an entire forest. Regardless of its size, every community has a definite structure. It is not just a random collection of species which happen to be in the same place. All the living things are interdependent and each species has a role, or function, in the community called a niche. The niche includes what that species eats as well as what eats it.

Food Chains

All members of a biological community are linked together by their feeding relationships, so we can make a good start at understanding the community by following these linkages, which we call food chains. These food chains follow a universal pattern beginning with green plants and continuing on with plant eaters, meat eaters, or larger meat eaters.

A food chain shows how each living thing gets its food.

All food chains begin with sunlight. Without the light from the sun, there would not be any plants or animals. The sun's radiant energy is passed along to each member of the food chain.

Producers

Plants are the foundation of every food chain. The plants combine sunlight, water, and carbon dioxide in a process called photosynthesis. Through photosynthesis, plants produce oxygen and carbohydrates - a simple sugar (food). The "food" the plant produces is the energy that the plant needs to live. Because plants make their food, they are called producers.

Consumers

Consumers are animals that cannot make their own food. They get their energy from other plants and animals. A food chain can have as many as three or more consumers.

- **Primary Consumers: Animals that only eat plants are called herbivores.**
- **Secondary Consumers : Animals that catch and kill herbivores**
- **Tertiary Consumers: Animals that eat secondary consumers.**

Scavengers

Scavengers are animals that eat dead animals (carrion). Their role in the ecosystem is to contribute to the decomposition (breaking down) of dead animal remains. Scavengers open up animal bodies so they can eat them.

Decomposers

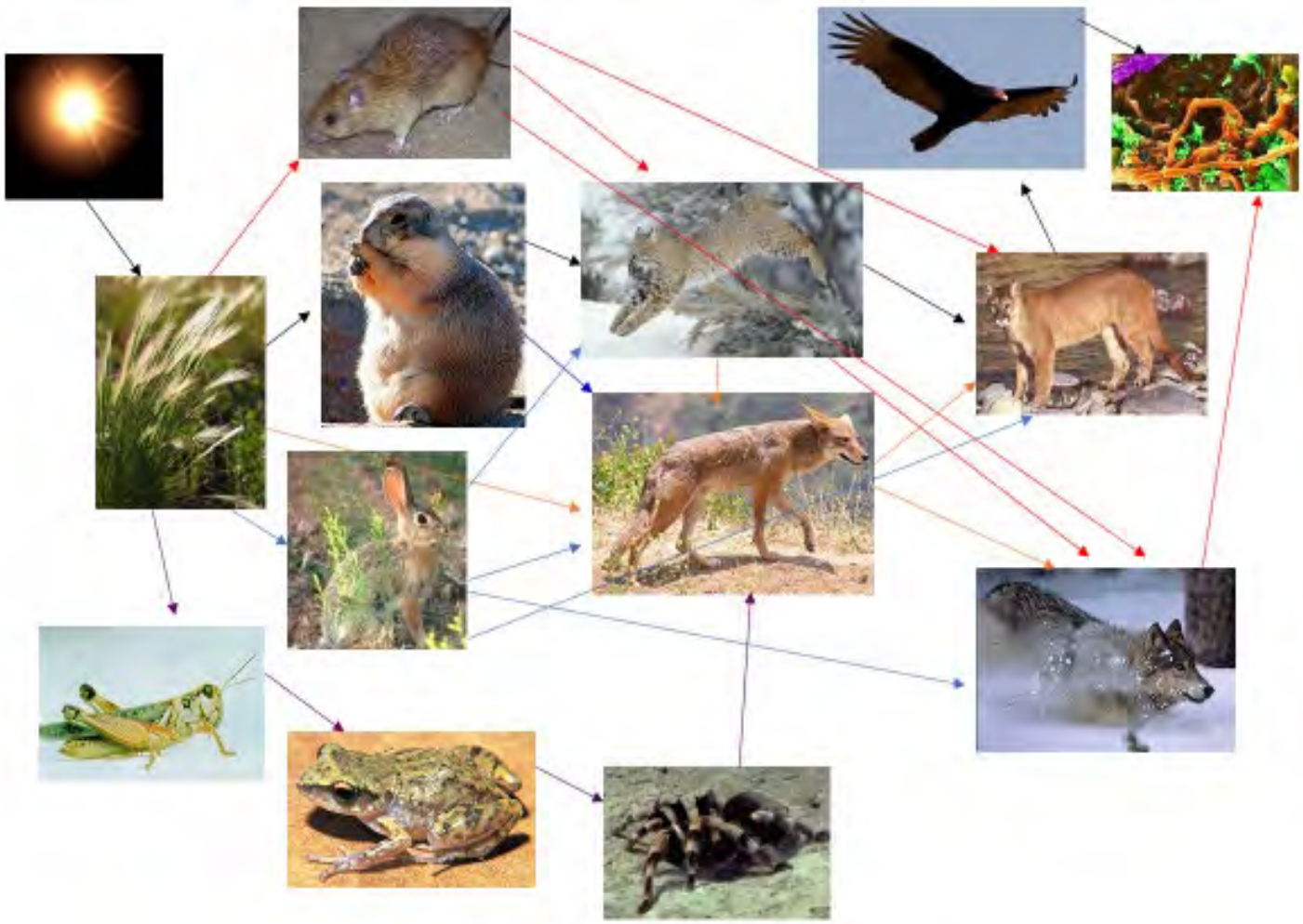
Once scavengers have broken down the carrion into smaller pieces, the decomposers finish the process. Decomposers eat carrion and dead plants and break them down into nitrogen, carbon, and other nutrients that are returned to the soil to be recycled by plants and then repassed to animals up through the food chain again.

Food Web

The food chain is useful as a working tool in tracing who eats whom, but by itself gives a less than complete picture of what is happening in a biological community. The feeding relationships in a community are more accurately reflected by a food web.

This desert food web shows how using just one plant there can be several food webs that can interact with each other.

The points of the arrows are used to show the animal that is doing the eating.



Population Interactions

Food web relationships are based upon predation, one of the five major interactions between the species populations in all biological communities. These five interactions include: predation, parasitism, commensalism, mutualism, and competition.

Predation is probably the most conspicuous and easily identified of these interactions. When a lion catches, kills, and consumes a zebra, we know that predation has occurred.

Parasitism somewhat resembles predation in that for both types of interactions, one party benefits and the other does not. In parasitic relationships, however, the parasite is usually smaller than its food supply (called the host). A predator is usually larger than its prey. If the parasite attaches to the outside of the host, it is referred to as an ectoparasite. A tick would be considered an ectoparasite and its host might be a dog. On the other hand, parasites living inside the host are called internal or endoparasites. A tapeworm would be considered an endoparasite and its host might be a frog.

Many host populations have developed resistance to those parasites which share their ecological community, and have come to be less adversely affected by those parasites. When this process reaches a point where the host organism is unaffected, we call the relationship commensalism. Commensalism occurs when an association of two species populations benefits one of them and leaves the other unaffected. Not all commensal associations began as parasitic ones, but some did. Tiny mites live in the facial hair follicles of most people, who are utterly unaware of their presence.

Logically it follows that the other extreme of the parasitism-commensalism trend would be a species population interaction in which both parties' benefit. Such an association is called mutualism. One example is the zebra and the cowbird: the bird gets its food by cleaning ticks off the zebra, which in turn gets rid of the parasites which otherwise might be harmful to it. Another example is the lichen (pronounced LIKE en). Lichens are composed of algae living in close association with fungi on land. The fungi provide support and protection for the algae, while the algae provide food for the fungi.

The term symbiosis is a blanket term for parasitism, commensalism, and mutualism.

Good or Bad Animals?

In the study of natural history and the environment the terms "good" and "bad" do not apply. A plant or animal is neither good nor bad. It is part of a community filling a niche within a complex web of life. It may be a food source for another animal and, in turn, may eat other creatures. It may aid in the dispersal of seeds, in plant pollination, in aerating the soil. In order to carry out an intelligent ecological study, we must control many of our prejudices and emotions. For example, we often think of rattlesnakes and scorpions as being bad and colorful songbirds or furry mammals as being good. Usually predators are the "bad guys" and the prey the "good guys." But, "good," "bad," "cute," "ugly," "fierce," or "enemy" are terms that get in the way of an objective look at the natural world around us and interfere with a genuine appreciation of life.

Endangered Species and their Communities

Saving endangered species requires that the community of which they are an integral part also be saved. There are three main reasons for this. First, many animal species have become so well adapted to their biological community that they are unable to live outside of it. Second, it is more sensible to save a community than a single species. By preserving a community, we can insure the preservation of all those species within it. Last, but not least, we know comparatively little about the workings of most biological communities and how much human survival depends upon them. Until we have much more information, it would be unwise to destroy the things upon which our very lives may depend. Ecologist Aldo Leopold said that the first rule of intelligent thinking is to save all the parts.

The major causes that wildlife become extinct (from largest to smaller) in the United States are:

Habitat destruction (farming, building, etc.)
Competition with introduced species
Controlled as pests
Always rare
Past exploitation
Pesticides

Unknown
Illegal killing

Habitat destruction invariably occurs when the landscape is altered. In an effort to preserve any endangered species, their "critical habitat" is also designated as entitled to protection under the Endangered Species Act. This is one way of trying to "save all the parts."

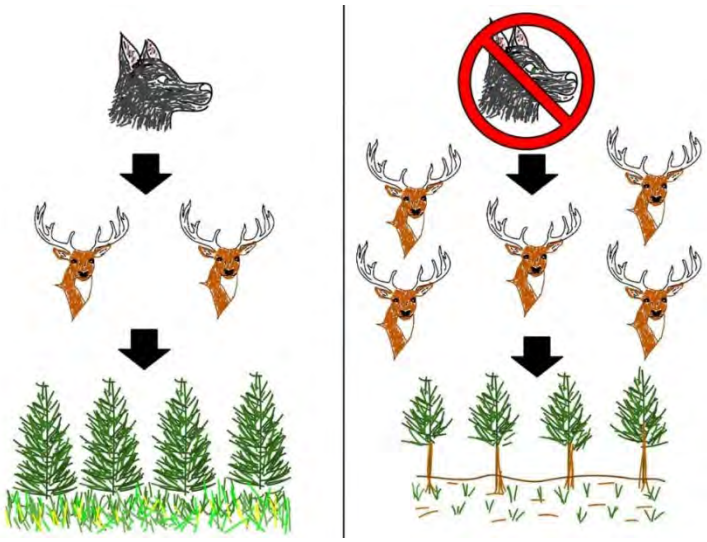
Introduced species are the second greatest factor contributing to the number of endangered species. These affect the community inhabitants in the following way: the transplanted species is often removed from the presence of its natural predators, which keep its numbers in check; then it is inserted into a community that has never evolved defenses against it or the capacity to compete with it. One example of such an introduction is the English sparrow brought into the United States to remind British immigrants of their homeland. Within a few decades this species spread throughout the Eastern United States and currently can be found in localities from coast to coast, all to the detriment of native U.S. birds with similar niches. Ecologist Paul Ehrlich agrees that it is good conservation to save all the parts, but he adds, "and don't put them in the wrong place."

Notice that hunting is not nearly as significant a factor contributing to the number of endangered species in the United States as are landscape habitat destruction and competition with introduced species. Many people mistakenly assume that hunting is still a major (or the only cause) of endangerment. To be sure, illegal hunting still takes its toll, particularly outside the United States where funds for law enforcement are not as available. In many situations, however, regulated hunting has had positive results in wildlife management.

Keystone Species

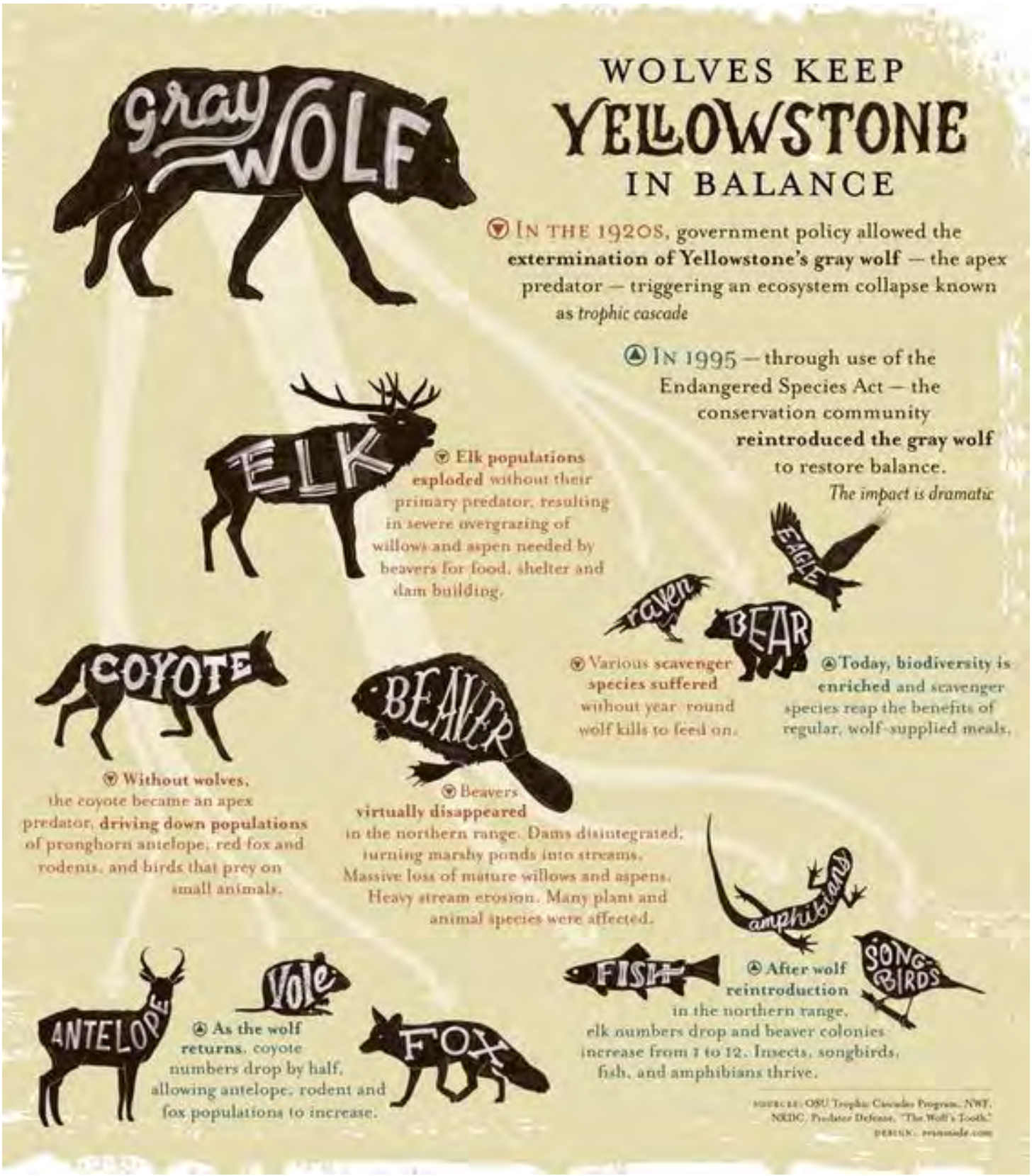
A keystone or indicator species plays a critical role in maintaining the structure of an ecological community, affecting many other organisms in an ecosystem and helping to determine the types and numbers of various other species in the community. Without keystone species, the ecosystem would be dramatically different or cease to exist altogether.

An excellent example of a keystone species is the gray wolf. When they had been eliminated from Yellowstone National Park, the ecosystem was greatly changed. Without the wolves, herbivores (elk, deer) began to over-graze the grasses and trees (willows, aspen). This resulted in beavers losing their food sources. Rivers and streams were affected because the beaver could not build their dams which slowed the water down to a normal working system. Once the wolves were reintroduced, they helped keep the browsers and grazer in check. Today, elk are scared of wolves. They've now learned to move faster and graze for shorter periods in a specific area. This means that they can browse on different species of vegetation and at different intensities.



This has allowed the local vegetation to grow under much less pressure from elk and other grazers. Stream bank vegetation such as willows and aspens is growing again, for the first time in decades. Restoration of vegetation has allowed for the habitat of native birds, fish, and beaver and other species to flourish once again.

Wolves have reduced the number of coyotes and the impact they cause on other species, like pronghorn (sometimes called antelope.) Wolves' predation have lowered the population of coyotes as much as 50%, which has subsequently led to an increase in the pronghorn rates from 20% of their previous numbers to a present day 70%.



SECTION 6

ANIMAL ADAPTATIONS

Plants and animals have special adaptations that help them survive in the environment they live in.

Animal Adaptations

Animals' adaptations can be physical, behavioral, or physiological.

1. **Physical Adaptations are special body parts such as shapes, skin, color, etc. that help the organisms survive in their natural habitat. These can include:**
   - **body size**
   - **color (for camouflage, attracting a mate, keeping cool, some change color of fur depending on the season)**
   - **fur and feathers (for protection from cold nights and shielding them from the hot sun.)**
   - **eyes (for finding food, detecting predators, the ability to see in certain light.)**
   - **sense of smell (for finding food, detecting predators, marking territory)**
   - **type of mouth or beak**
     beaks- for eating special diets
     mammals- have special teeth for their special diets
     snakes- to aid in the swallowing of food
   - **type of feet (mammals- plantigrade (walks on the whole foot), unguligrade (walks on the tips of their toenails), digitigrade- (walks on their toes)**
     (birds- perching, running, scratching, climbing, swimming, grasping)
   - **legs (long to hold body above the hot ground, for escaping a predator)**
   - **ears (for hunting, cooling off animal, detecting predators)**
   - **tails (for balance, keeping warm or cooling off, for defense, for attracting a mate)**

2. **Behavioral Adaptations are when an animal changes its behavior to survive in the environment.**
   - **Making a shelter for keeping cool or warm, protection, newborn shelter**
   - **Time of activity -diurnal (day), crepuscular (dusk and/or dawn), or nocturnal (night) Some animals will change their time of activity so they can avoid heat or cold.**
   - **Hibernation (sleep during winter), estivation (sleep during the summer), migration (travel from a colder climate to a warmer climate) This helps animals cope with hot or cold weather.**

3. **Physiological Adaptation are metabolic changes in an animal that help them to survive.**
   For example: the capability to:
   - **produce venom, toxins, or poisons.**
   - **maintain constant body temperature.**
   - **obtain the water they need from the plants and/or animals they eat.**
   - **store fat so when they cannot find food, they can live off the fat.**
   - **employ special kidneys to allow them to keep most of the water from their urine and return it to its body.**
   - **eat more food to prepare for winter.**
   - **store water in their bodies to be used when it is very dry.**
   - **employ special salt glands that allows the secretion of salt without the loss of water.**

Desert Plant Adaptions

Is it a spine or a thorn?

- **Thorns are modified branches made of the same substance as the branch from which they grow. Thorns protect the plant from herbivores, baffle wind, reflect sun and create shade. Many plants have thorns- trees such as mesquite, shrubs such as cat's claw, and even wildflowers such as the prickly poppy.**

- **Spines are modified leaves. They are formed of different material from the stems out of which they grow. Cactus have spines.**

Cactus Adaptions

Cactus are succulents and are 95% water and can lose up to 85% of that water before it dies. They have many adaptations that help them survive in harsh desert conditions.

Cactus Roots

- **The extensive widespread roots near the ground surface absorb the most water in the shortest time before the moisture evaporates.**
- **Some larger species have a deep taproot that anchors the plant and stores water.**
- **After a rain the roots will quickly sprout temporary root hairs to gather the moisture. Then, after the soil dries out, the root hairs die away. This prevents water loss back into the soil and saves the plant from having to use its energy to maintain them.**
- **The root cells have a very high concentration of salts. An essential adaptation that translates to a higher water absorption rate.**

Cactus Covering

- **Waterproof, waxy coatings, with thickest coating on the sunny side to avoid losing so much water**

Cactus Water storage

- **As a succulent, cactus store water in spongy, fleshy leaves, stems or roots**

Cactus Stems

- **Stems (called a pad for some cactus) swell and shrink depending on the amount of water they have (much like a camel.)**
- **Some have more than one stem, which provide shade for the other stems.**
- **Some stems have accordion like folds so they can expand to hold more water when it rains, and as the plant shrinks, the folds provide some shade on parts of the plant.**
- **The columnar cactus have an internal woody skeleton for support and storing water.**
- **Stems have fewer stomata that open at night when photosynthesis occurs preventing less water loss.**
- **Can endure high temperatures.**
- **Some have a solution that acts like anti-freeze to help the plant endure colder temperature.**

Cactus Spines

- **Spines are modified leaves that prevent water transportation.**
- **Some have white or pail-colored spines to reflect sunlight.**
- **Spines help prevent some animals from eating them.**
- **Spines provide shade from the sun.**
- **Spines help regulate the airflow around the plant. By breaking up the airflow, spines create a layer of air (or what could be called a microclimate) that serves as insulation against changes in temperature as well as accelerated evaporation brought on by hot air or wind.**
- **Spines of cholla and prickly pears can become attached to animals' fur and be carried to new areas where the connected pad cans root and become new plants.**
- **Spines help collect moisture (rain, fog, mist, or dew) and drip it to the bottom of the plant where the shallow roots absorb it.**
- **Spines are slow growers which means they use less water.**
- **Some have so many spines they create a shield to keep the sun off them.**

Cactus Flowers

- **Different cactus flowers have different shapes to attract special pollinators.**
- **Some open their flowers and produce a special order to attract pollinators.**

Cactus Growing Conditions

- **Some will grow low to the ground to protect them from the sun.**

- **Some begin growing under the shelter of another plant (nurse plant) for protection from the elements.**

Desert Annuals Forbs (Ephemerals-Short Lived)

- **Many desert wildflowers are annuals.**
- **They respond to rain by flowering, bearing fruit and going to seed in a short growing season of a few weeks or months.**
- **These plants avoid the periods of drought by dying and leaving seeds.**
- **They wait for the right season and the right rainfall (which might take years) before they sprout.**
- **Some species will produce different size seeds- larger ones to produce vigorous sprouts and smaller ones to produce less robust ones when there are marginal growing conditions.**
- **Their seeds are coated with a germination inhibitor and need a lot of water to wash this coating off, which ensures the plant will have enough moisture to complete its brief lifecycle.**

Desert Perennials

- **May have small, spiny leaves that reduce the impact of solar radiation.**
- **May drop their leaves when water is unavailable.**
- **May remain dormant for long periods and then recommence growth and reproduction when the environment is more suitable.**

Desert Trees and Shrubs

The desert trees and shrubs may have:

- **long roots to obtain groundwater.**
- **extensive, horizontal roots to quickly absorb rainwater.**
- **leaves that are coated with a resin or a fuzzy covering to prevent water loss.**
- **leaves can be glossy to reflect the sun's rays.**
- **leaves that can be dropped during a drought.**
- **thorns to protect them from animals.**
- **small leaves to prevent water loss.**
- **leaves that fold in half or even drop off to prevent water loss.**
- **bitter taste or be toxic when eaten by animals.**
- **The ocotillo uses its stem to carry on photosynthesis when it does not have leaves.**

Desert Yuccas and Agaves

- **Are succulents that store their water in their leaves.**
- **Open their stomata at night to prevent great water loss.**
- **Have shallow radiating root systems to catch water quickly.**
- **Some yuccas have a tap root to reach deeper for water.**
- **Have leaves with waxy coatings to prevent great water loss.**
- **Have sharp points (the agaves are furthered armed with wickedly barbed margins (edges) along the leaves.**
- **The rosette shape of the agave and the spatula shape leaves channel water to the base of the plant.**

SECTION 7

PLANTS

Section 7: Plants: Botany

Taxonomy of Plants

Have you ever wondered why plants have the names they have? Most plants have several names. The common name is the name most people call the plant. Each language may have its own common name for an individual plant, and often, especially for plants that have wide geographic ranges, there is more than one common name for each plant. These common names are also used for different plants, especially in different regions. Using only common names can result in much confusion. Since many plants have important properties, such as medicinal or food uses, it is important to communicate very clearly about which plant you are discussing.

Carolus Linnaeus (1707-1778) a Swedish scientist, developed a system (Species Plantarum, 1753) for giving each plant species its own unique name. This name is called the plant's "scientific name" and follows Linnaeus's formula for "scientific nomenclature." The species name, sometimes called the binomial, has two main parts: the genus and the specific epithet (descriptor). Other parts of the specie's name include the author(') who have first identified the plant and the family name that groups related genera (plural of genus) together.

The genus is the first word in the binomial and is always capitalized. Although it comes first, it is more like a person's last name. The genus describes a group of plants that are related. The second word, or the specific epithet, is unique within that genus to one species of plant. It is usually not capitalized. It is easy to think of the specific epithet like someone's first name. For example, at school there may be several people names Katie, but in a family, there is usually only one person with that name. To keep the Katies straight at school, a last name is often used. This is usually the same last name as other members of Katie's family. People familiar with Katie's brother may be able to recognize that she is related to him either by her last name or by features.

Plants are like that too. The scientific name for the cottonwood found in the Middle Rio Grande bosque is Populus diltoides var. wislizenii. These names mean it is a tree (wood) with cottony seed. The genus Populus shows it is a poplar tree; deltoides refers to the leaf shape (deltoid or triangular); and the last name is for Frederick A. Wislizenus, who collected plant specimens in New Mexico in 1846.

There are several kinds of poplars or cottonwoods that grow in New Mexico. The Fremont cottonwoods found in the San Juan and Gila Rivers is Populus fremontii. Populus angustifolia or narrowleaf cottonwood grows along mountain streams. Another mountain tree is quaking aspen, or Populus tremuloides. Although these trees are all in the same genus (Populus), they are each individual species. When both the genus and the specific epithet are used together, they are known as the species name.

Plant classification have undergone many changes because of advancements in science.

Originally Linnaeus's system relied purely on human judgement in order to compare the characteristics of various organisms. The development of microscopes allowed cells to be examined in far more detail. Organelles within the individual cells could be distinguished and this allowed a more scientific approach of classification.

The development and study of biochemistry and the processes undertaken inside the cells, in some cases, have allowed any ambiguities within this classification system to be clarified.

The comparisons of DNA sequences have allowed the relationship of organisms to be explored further. In some cases, species that are more closely related may have fewer differences contained within the DNA sequences. DNA testing has led to changes in some plants' classifications.

Desert Plants: Designed for Drought

The crucial factor for the survival of desert plants has always been water supply. Water in the desert is not only scarce it is undependable. When rain falls, it often falls in torrents. Yet the storms may be followed by long periods with no precipitation at all. Strangely enough, many desert plants use water freely when it is plentiful. During the rainy season, some desert plants lose more water through transpiration than do plants living in areas of abundant rainfall, but water loss is radically curtailed with the onset of drought.

Desert plants have a remarkable array of adaptations for surviving water shortages.

- **Some desert plants (cacti, yuccas, agaves) are succulents which means they store water in their leaves, stems and/or roots.**

- **Cacti, for instance, resist drought by hoarding water when it is plentiful, then drawing on their reserve when it is scarce.**
- **Other plants, such as desert annuals, evade drought by producing dormant seeds that will not sprout during dry weather.**
- **Still others endure the effects of drought by shedding their leaves, thereby reducing water usage to a minimum. Whether the adaptation is in leaves, stems, roots, or in a combination of these, or whether the adaptation is shedding, shrinking, or something else, desert plants are perfectly fitted to an environment which offers an abundance of water one day and none the next.**

Plant Indicators of the Chihuahuan Desert

Indicators are species or group of species that are abundant in an area

- **Ocotillo Fouquieria splendens (found in Sonoran and Chihuahuan Deserts)**
- **Creosote Bush Larrea tridentata (found in Mojave and Chihuahuan Deserts)**
- **Lechuguilla Agave lechuguilla (found only in the Chihuahuan Desert)**

Is it a Spine or a Thorn?

- **Thorns are modified branches made of the same substance as the branch from which they grow. Thorns protect the plant from herbivores, baffle wind, reflect sun and create shade. Many plants have thorns- trees such as mesquite, shrubs such as cat's claw, and even wildflowers such as the prickly poppy.**
- **Spines are modified leaves. They are formed of different material from the stems out of which they grow. Cactus, agave, and yuccas have spines.**

YUCCA AND AGAVE ADAPTATION

- **Yuccas and agaves are succulents that store their water in their leaves.**
- **They open their stomata (minute openings in leaves that help with photosynthesis and transpiration) at night to prevent great water loss.**
- **They have shallow radiating root systems to catch water quickly.**
- **Some yuccas have a tap root to reach deeper for water.**
- **Leaves have waxy coatings and they have sharp points (the agaves are furthered armed with wickedly barbed margins).**
- **The rosette shape of the agave and the spatula-shaped leaves channels water to the base of the plant.**

NEW MEXICO AGAVE (Agave neomexicana)

See Plant Plate 2

FAMILY	**Agavaceae**
OTHER NAMES	**New Mexico century plant, century plant**
TYPE OF PLANT	**Agave (succulent)**
SIZE	**18-24" tall 24-30" wide**
FLOWERS	**1. During the last summer of the plant's life, it will quickly (in about 1 ½ months) send up a stalk that looks like a reddish asparagus (up to 10 feet high)** **2. The bell-shaped yellow to orange flower tufts bloom for several weeks.** **3. Blooming time: May-June**
LEAVES	**1. The grey to blue–green leaves grow in a symmetrical rosette shape and are so tightly bound together that, as they begin their growth, they leave their shape and spine impressions on each other.** **2. The leaf edges are lined with numerous backward arching spines. The spines are sharps are dark burgundy.** **3. The tip of each leaf has a single sharp, dark burgundy spine.**
LIFE SPAN	**10 to 30 years. They die after blooming.**
RANGE	**New Mexico, Texas, Arizona**
HABITAT	**Dry, rocky limestone desert slopes, grasslands**
PROPAGATION	**1. Rhizomatous suckers or small plantlets called pups grow from the bottom of the parent plant before it blooms and dies.** **2. Seeds**
OTHER	**1. At one time, people mistakenly believed that "century plants" lived 100 years before they**

INFORMATION	**bloomed. The life span is usually 10 to 30 years.** **2. The plants spends years getting enough water and carbohydrates in their hearts (base) so they will be able to quickly send up one thick stem and its flowers. The plant blooms only once at the end of its life cycle. Growing the stalk uses up the plant's supply of water and food.** **3. The Mescalero Apache can tell when a century plant is getting ready to bloom because ants become attracted to the sweet liquid it produces.** **4. The plant needs to be baked for 2 days to break down the complex carbohydrates into a useful food and to break down the toxic sap, so it will be safe to eat.**
ADAPTATIONS	**1. The arrangement and shape of the leaves' rosettes act as a funnel for rainwater to reach the plant.** **2. They have special cells in their leaves for storing food and water.** **3. They open their stomata during the night to limit the loss of water during photosynthesis.** **4. They have shallow, fibrous, radiating roots to get as much rain water as possible.**
WILDLIFE USAGE	**Sap: ants; Nectar: insects, hummingbirds, grosbeaks, orioles, bats; Pithy flower stalks provide homes for: carpenter bees, caterpillars of giant skipper butterflies; Leaves: agave weevils; Seeds: rodents**
HUMAN USAGE	**Sap: syrup; Heart (base): food, alcoholic drinks; mescal, tequila, pulque; Leaves: fresh or dried: GI tonic, indigestion, constipation, paper (from the outer layer of the leaves; pounded to separate the fibers for weaving and sewing of ropes, nets, baskets, sandal, fibers soaked: to make a scalp disinfectant, a tonic for hair loss; Roots:(grated): shampoo, as tincture to treat: muscle spasms, stomach cramps, intestines, bladder; the top three feet of the flower's shoot can be food: eaten raw- it tastes a lot like jicama, baked, boiled, roasted; Plant: landscaping, glue, red coloring; Flowers can be eaten: boiled, baked or raw**
NATIVE AMERICAN USAGE	**Heart (base): Apache made Mescal by lifting out the center leaf bases (buds) of the century plant and roasting them for 1 to 3 days in an underground pit. The food could be eaten or dried and often used in the winter. When the mescal was mixed with water, it could be fermented to become an alcoholic drink used in religious ceremonies.; Roots: Shampoo, soap, baked and eaten; Leaves: The leaves were first soaked, then pounded to release their fibers. The fibers were next dried and then combed to separate the threads. The leave's fibers were used to make: clothing, rugs, brushes, bowstrings, nets, slings, shoes, ropes; Leave points: a needle with the fiber thread already connected, awls, dart points; The plants were used to treat: indigestion, infected wounds, chest congestion, chapped lips, rashes, sunburns; Seeds were: ground into flour, cooked into a porridge-like mush**

LECHUGUILLA (Agave lechuguilla)
See Plant Plate 2

FAMILY	**Asparagaceae**
OTHER NAMES	**Shin dagger**
TYPE OF PLANT	**Agave (succulent)**
SIZE	**Plant is 12 to 18 inches tall with the stalk reaching from 6 to 12 feet tall.**
FLOWERS	**1. The flowers can reach 6 to 16 feet high.** **2. Lechuguilla is the only agave that does not have any branches of flowers growing from the flowering stalk. The flowers are attached directly to the stalk.** **3. The flowers are tubular reddish pink, white, yellow, or green and bloom for a few weeks.** **4. Blooming time: April to August**
FRUIT	**About 1-inch-long oblong pod**
LEAVES	**1. The tough leathery leaves are 12 to 18 inches long and 1 to 2 inches wide.** **2. The leaves' margins are lined with numerous sharp spines and the tips have a single sharp spine that curved inward towards the plant.**
LIFE SPAN	**10 to 12 years The plant will die after it blooms.**
HABITAT	**Dry rocky limestone slopes 2,800 to 6,200 feet high, grasslands, creosote bush, pinon-juniper lands**
PROPAGATION	**"Pups" from the parent, seeds**
OTHER INFORMATION	**1. Though sometimes listed as an indicator species of the Chihuahuan Desert, it can also be found in the Sonoran Desert.** **2. Having used up all its energy to grow its stalk and flower, the plant will die after it blooms.** **3. The sharp points can easily penetrate leather thus giving the name "shin-daggers". Spanish Conquistadors, settlers, cowboys, and their horses had many nasty encounters.**

	Fallen riders could become impaled on their sharp 2-inch points. 4. Lechuguilla often grow in large, spreading groups that can make it difficult to walk through an area. 5. The plant is toxic to cattle and sheep. 6. The plant needs to be baked for 2 days to break down the complex carbohydrates into a useful food and to break down the toxic sap so it will be safe to eat.
ADAPTATIONS	1. Its sharp points protect it from animals. 2. The arrangement and shape of the leaves' rosettes act as a funnel for rain to reach the roots. 3. They have special cells in their leaves for storing food and water. 4. They open their stomata during the night to limit the loss of water during photosynthesis. 5. They have shallow, fibrous, radiating roots to get as much rain water as possible.
WILDLIFE USAGE	Flowers: insects, bats, birds; Stalks when young and tender: deer, javelina
HUMAN USAGE	Leaf fibers: ropes, mats, industrial brushes; Liquid in plant: sold as sport drink in Mexico; Sap: alcoholic beverage, soaps; One of its saponins (a foamy organic chemical) called smilagenin has been used in treating Alzheimer's disease
NATIVE AMERICAN USAGE	Leaves: (uncooked) poison for arrow tips; Leaf fibers: baskets, cords and ropes, sandals, clothing, small containers, mats, nets; Roasted heart and bloom stalks: food (not toxic when cooked); Sap: soap, fish killing poison when put in water, arrow-tip poison; Stalks: dart shafts, tools (fishing poles, spear shafts), firewood, walls and roofs of houses

BANANNA YUCCA (Yucca baccata)

See Plant Plate 1

FAMILY	Asparagaceae
OTHER NAMES	Datil yucca, blue yucca
TYPE OF PLANT	Tree like yucca
SIZE	4-6 feet high; 10-15 feet wide
FLOWERS	1. The flowerhead is made up of thick clusters of greenish, creamy-white, often with a purplish tinged, bell-shaped 6 petaled flowers that grow on a 2- to 3-foot-tall flower stalk. 2. Flowers might not bloom every year. 3. Blooming time: April to June
FRUIT	1. Green fleshy capsule pods (2 to 3 inches long) that turn dark brown and leathery and looks like a short, fat banana 2. Each pod has three sections, and each of those contain a double line of large, black seeds.
LEAVES	1. Twenty-nine to 30-inch-long thin stiff, spine-tipped and 1 1/4 to 2 1/2 inches wide 2. The blue-green to yellow-green leaves have coarse fibers along the edges, and sharp pointed end tips.
ROOTS	Fibrous highly branched radiating roots
STEMS/TRUNK	Short to non-existent
RANGE	Arizona, California, New Mexico, Colorado, Texas, Utah, parts of Mexico
HABITAT	Grasslands, deserts, pinyon/juniper/oak regions
PROPAGATION	Seeds, stem cuttings, pups
OTHER INFORMATION	1. The plants are named after the 4-5-inch banana shaped fruit they produce.
ADAPTATIONS	1. The waxy leaves reflect the sun's rays and restrict the loss of stored water. 2. The rosette leaves help funnel the rain and dew moisture to the roots. 3. They open their stomata during the night to draw in the carbon dioxide. Photosynthesis occurs during the day so the plant does not lose water through the stomata. 4. The plants depend on the yucca moths to pollinate their seeds. The moths lay their eggs in the pistil of the flowers and leaves some pollen. Their larvae will feed on some of the developing seeds, but most of the seeds will mature. 5. Their stems store and conduct water. 6. They are tolerant of cold winters. 7. They are drought tolerant.
WILDLIFE USAGE	1. Flowers: deer, birds, insects
HUMAN USAGE	Flowers: eaten raw; Fruit: roasted and eaten, pureed into something like applesauce; Seeds: dried and ground into flour
NATIVE AMERICAN	Blossoms: eaten raw or baked; Pods: eaten raw when young, dried to be eaten later; when baked- taste somewhat like sweet potatoes; ground up and made into cakes; Leaves: mats,

USAGE	**baskets, cords, needle with thread fibers attached; Stalks: used to whip patients asking to be relieved of bad dreams (Zuni); used to wake up people who fell asleep during ceremonies (Zuni)**

SOAPTREE YUCCA (Yucca elata)
See Plant Plate 1

FAMILY	**Asparagaceae**
OTHER NAMES	**Sometimes mistakenly called soapweed yucca**
TYPE OF PLANT	**Yucca**
SIZE	**6 to 15 feet tall**
FLOWERS	**1. Waxy, 6 petals, four-inch-long greenish creamy white bell-shaped blossoms that grow in a cluster on a 15-foot-tall stalk. 2. Blooming time: May to July**
FRUIT	**1. Green fleshy 1 ½ to 3-inch-long pod that turns brown 2. Each pod has three sections; each contains a double line of small, thin rough seeds.**
LEAVES	**Stiff leaves are 1 to 3 feet long and ½ inch wide that end in a sharp tip. They are blue-green to yellow-green and have fine fiber edges. When the leaves are young, they have a white stripe along the edge.**
STEMS/TRUNK	**The 10 to 18 feet tall trunk is covered with dead leaves that hang downward.**
HABITAT	**Gently sloping desert hills, grasslands, desert washes, desert flatlands**
PROPAGATION	**Rhizomes, seeds**
OTHER INFORMATION	**1. New Mexico's state flower 2. The older plants have a definite trunk and may have several branches.**
ADAPTATIONS	**1. They have a radiating root system to enable them to catch more rain water. 2. They are cold hardy to 0 degrees. 3. The plants depend on the yucca moths to pollinate their seeds. The moths lay their eggs in the pistil of the flowers and leave some pollen. Their larvae will feed on some of the developing seeds, but most of the seeds will mature.**
WILDLIFE USAGE	**1. Flowers Attract: birds, butterflies, yucca moths**
HUMAN USAGE	**Roots: tea to reduce inflammation, salve; Plant: used in alcoholic and carbonated beverages and ice cream; used to treat high blood pressure, headaches, inflammation of the intestine, high cholesterol, diabetes, poor circulation**
NATIVE AMERICAN USAGE	**Pounded Roots & Trunk: soap and shampoo; Buds and Flowers: food eaten raw or cooked; Fruit: when baked taste similar to potatoes, mixed with berries and made into cakes and dried for winter; Leaf Fibers: mats, baskets, belts, rope ladders, sandals, cradle board ties, twine Young Flower Stalks: food; Leaves: paintbrushes to decorate pottery; Whole Plant: used to catch fish by paralyzing them; Stalks: used to whip patients asking to be relieved of bad dreams (Zuni), used to wake up people who fell asleep during ceremonies (Zuni)**

SOAPWEED YUCCA (Yucca glauca)
See Plant Plate 1

FAMILY	**Asparagaceae**
OTHER NAMES	**Small soapweed, narrow leaf yucca, Great Plains yucca**
TYPE OF PLANT	**bush like member of the lily family**
SIZE	**1 to 3 feet high, 1 to 3 feet wide**
FLOWERS	**Waxy, bell-shaped, 6 petals, pale green or greenish white**
FRUIT	**Green fleshy pod**
LEAVES	**1 to 3 feet long light evergreen**
ROOTS	**They have a radiating root system to enable them to catch more rain water.**
STEMS	**Stalk with flower cluster 3 -4 ½ feet tall**
HABITAT	**Dry sandy plains and prairies, sand hills**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Depends on the yucca moth for pollination**
ADAPTATIONS	**They are cold hardy to 0 degrees.**
WILDLIFE USAGE	**Pollen: yucca moth, butterflies, birds**
HUMAN USAGE	**1 Buds and flowers: food eaten raw or cooked**
NATIVE	**Pounded roots & trunk: soap, shampoo; Buds and flowers: food eaten raw or cooked;**

AMERICAN USAGE	**Fruit: when baked taste similar to potatoes mixed with berries and made into cakes and dried for winter; Leaf fibers: mats, baskets, belts, rope ladders, sandals, cradle board ties, twine, paintbrushes to decorate pottery; Young flower stalks: food; Stalks: used to whip patients asking to be relieved of bad dreams (Zuni), used to wake up people who fell asleep during ceremonies (Zuni)**

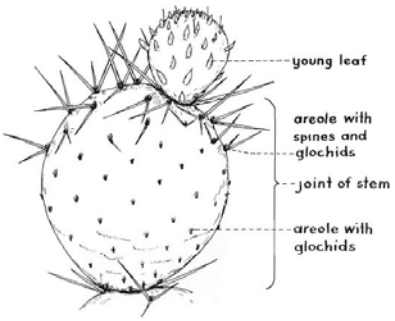
TORREY YUCCA (Yucca treculeana)
See Plant Plate 1

FAMILY	**Asparagaceae**
OTHER NAMES	**Spanish dagger, great yucca, old shag, Spanish bayonet**
TYPE OF PLANT	**Tree-like yucca**
SIZE	**Usually 3 to 10 feet, but sometimes taller**
FLOWERS	**1. The flower cluster grows on a 2 ½ to 3 feet tall stalk. 2. Waxy, bell-shaped, 6 petals, 4 inches long, creamy-white or tinged with purple flowers 3. Blooming time: April and May, but a few may bloom in the fall.**
FRUIT	**1. Greenish fleshy capsule pods (4 to 5 ½ inches long) that turn dark brown and leathery 2. Each pod has 3 sections, and each of those sections contain a double line of large black seeds.**
LEAVES	**1. Blue-green to yellow-green, up to 5-foot-long stiff leaves that end with sharp tips 2. The leaves have long thread-like fibers along the edges.**
STEMS/TRUNK	**1. Trunk on an older plant, can have several flowering branches growing from it. 2. The trunks have an irregular appearance from the lower dry leaves that flatten against them, giving the plant a shaggy appearance.**
ROOTS	**1. Radiating roots spread up to 35 feet to gather infrequent rainfall before competing plants can, resulting in yuccas often having a dry patch around them. 2. The fleshy tap root can grow 20 feet deep and be several inches thick.**
RANGE	**Southern New Mexico, west Texas**
HABITAT	**Grasslands, desert flats, open hillsides**
PROPAGATION	**Rhizomes (pups), seeds**
OTHER INFORMATION	**1. A signature plant of the Chihuahuan Desert 2. They closely resemble the shorter banana yuccas. 3. It normally grows with 1 head, but it may have up to 8 heads on a single stem.**
WILDLIFE USAGE	**1. Pollen: yucca moths, other insects**
HUMAN USAGE	**Plant: landscaping; foaming and flavoring agent in carbonated beverages; apply to skin for: sores, skin diseases, bleeding, sprains, joint pain, baldness, dandruff; Roots: made into medicines that treat osteoarthritis, high blood pressure, migraine, inflammation of the intestine, high cholesterol, diabetes, poor circulation, liver disorders, gallbladder disorders**
NATIVE AMERICAN USAGE	**Leaf fibers: ropes, mats, sandals, baskets, cloth, cradle board ties, belts, paintbrushes to decorate pottery; Fruit: food eaten raw or roasted, dried and ground for winter use; Roots: red color fiber for making baskets, soap, shampoo; Seeds: ground into flour, cooked into a mush Stalks: used to whip patients asking to be relieved of bad dreams, (Zuni) used to wake up people who fell asleep during ceremonies (Zuni)**

YUCCA COMPARISON

	Banana	Torrey	Faxon	Soaptree	Soapweed
Trunk	1. Stemless 2. up to 3 feet tall and 6 feet wide 3. Single or clumped	1. Grayish-brown 2. usually 3 to 10 feet, but may be up to 18 to 20 feet tall 3. often branched 4. Older plants look shaggy because trunks are covered with dead leaves	1. 15 to 20 feet tall 2. sometimes will branch out forming 2 heads	1. gray trunk 2. 10 the 18 feet tall 3. usually unbranched 4. dead leaves bend downward and cover the bottom of the trunk 5. 6 to 15 feet	1. stemless 2. The plant is 1 to 3 feet tall and 1 to 3 feet wide
Leaves	1. Up to 30 inches long 2. narrow 3.sharply pointed tip 3. edged with long wavy white thread-like hairs 4. blueish green	1. 3 to 4 1/2 feet long 2. edges of the stiff straight leaves curl upward 3. sharply pointed tip 4. edged with thread-like hairs 5. blue-green to yellow-green	1. 3 feet long 2. evergreen dark green 3. sharp tips 4. reddish or black margins 5. edged with curly threads (whose leaves are slightly wider, longer, thicker, and greener),	1. 1 to 3 feet long light pale green, about ½ inch wide 2. flat, yellowish leathery 3. fine white threads along edges 4. sharp flexible tip	20 to 30-inch-long evergreen leaves
Flower	1. Waxy, bell-shaped 6 petals, white creamy flowers with a red-purple tinge 2. Stalk with flower cluster- up to 3 feet tall 3. May not bloom every year.	1. Waxy, bell-shaped, 6 petals, 4-inch-long ivory to creamy white flowers or tinged with purple 2. stalk with flower clusters- 2 1/2 to 3 feet tall	1. Waxy, bell-shaped, 6 petals, creamy white 2. stalk with flower clusters- 3 to 4 foot tall	1. waxy, bell-shaped 6 petals, 2 inches long white to light green flowers 3. flower stalk with flower cluster-15 feet tall or 4 to 6 ft. above the plant	1. waxy, bell-shaped, 6 petals, pale green or greenish white flowers. 2. stalk with flower cluster- 3 to 4 ½ feet
Fruit	1. Green fleshy 2 to 3-inch-long pod that turns dark brown and leathery 2. pods look like short, fat bananas 3. Each pod has three sections, and each of those contains a double line of large, black seeds	1. Greenish fleshy 4 to 5 ½ inch long pod that turns dark brown and leathery 2. Pods are 4 to 5 1/2 inches long, 1 1/2 inch in diameter 3. Each pod has three sections, and each of those contains a double line of large, black seeds	1. Red pod 2 to 3 inches long 2. Each pod has three sections, and each of those contains a double line of large, black seed	1. Green fleshy 1 1/2 to 3-inch-long pod that turn brown. 2. Pods are 1 ½ to 3 inches long. 3. Each pod has three sections, and each of those contains a double line of small, thin, rough seeds	Woody, oblong cream –colored pod 3. Each pod has three sections, and each of those contains a double line of small, thin black seeds

CACTUS ADAPTATIONS



Cactus are succulents and are 95% water. They and can lose up to 85% of their water before they die. Succulents store water in their leaves, stems, and/or roots. Cactus are the only succulents that have areoles, a kind of highly reduced branch. Flowers, spines, glochids (hair-like spines or short prickles, generally barbed, that detach easily only on prickly pear plants), new branches grow from the areoles.

Roots

- **The extensive widespread roots near the ground surface absorb the most water in the shortest time before the moisture evaporates.**
- **Some larger species have a deep taproot that anchors the plant and stores water.**
- **After a rain the roots will quickly sprout temporary root hairs to gather the moisture. Then, after the soil dries out the root hairs die away. This prevents water loss back into the soil and saves the plant from having to use its energy to maintain them.**

- **The root cells have a very high concentration of salts. An essential adaptation that translates to a higher water absorption rate.**

Covering

- **Waterproof, waxy coatings, with thickest coating on the sunny side to avoid losing so much water**

Water Storage

- **As a succulent, store water in spongy, fleshy leaves, stems, or roots**

Stems

- **Stems (called a pad for some cactus) swell and shrink depending on the amount of water they have (much like a camel.)**
- **Some have more than one stem, which provide shade for the other stems.**
- **Some stems have accordion like folds in their stem so they can expand to hold more water when it rains, and as the plant shrinks, the folds provide some shade on parts of the plant.**
- **The columnar cactus have an internal woody skeleton for support and storing water.**
- **Stems have fewer stomata that open at night when photosynthesis occurs preventing less water loss.**
- **Can endure high temperatures.**
- **Some have a solution that acts like anti-freeze to help the plant endure colder temperature.**

Spines

- **Spines are modified leaves that prevent water from transpiration (water loss during evaporation).**
- **Some have white or pale-colored spines to reflect sunlight.**
- **Spines help prevent some animals from eating them.**
- **Spines provide shade from the sun.**
- **Spines help regulate the airflow around the plant. By breaking up the airflow, spines create a layer of air – or what could be called a microclimate – that serves as insulation against changes in temperature as well as accelerated evaporation brought on by hot air or wind.**
- **Spines of cholla and prickly pears can become attached to animals' fur and be carried to new areas where the connected pads can root and become new plants.**
- **Spines help collect moisture (rain, fog, mist, or dew) and drip it to the bottom of the plant where the shallow roots absorb it.**
- **Spines are slow growers which means they use less water.**
- **Some cactus have so many spines they create a shield to keep the sun off them.**

Flowers

- **Different cactus flowers have different shapes to attract special pollinators.**
- **Some open their flowers and produce a special odor to attract pollinators.**

Some Places to Grow

- **Some will grow low to the ground to protect themselves from the sun.**
- **Some begin growing under the shelter of another plant (nurse plant) for protection from the elements.**

CANE CHOLLA (Cylindropuntia imbricata)

See Plant Plate 3

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Walking stick cactus, tree cholla**
TYPE OF PLANT	**Cactus-large shrub or small tree**
SIZE	**3 to 9 feet tall (but can be up to 15 feet) and 3 to 4 feet wide**
FLOWERS	**1. The 3-4-inch magenta flowers bloom in May.** **2. The flowers will last for several weeks.**
FRUIT	**Bumpy, yellow-green, egg-shaped 1"to 2" fruit that stays on the plant for a year or more** **Look like tiny clumps of bananas.**

LEAVES	**1. Stout long spines may be white, yellow, or grayish color** **2. Clusters of 6 to 8 tiny barbed spines called glochids** **3. Both long and tiny spines grow out of the areoles.**
STEMS	**Upright multiple segmented, cylindrical 1-inch wide from a woody central trunk**
RANGE	**Northern Mexico and primarily in the arid regions of the Southwestern United States in the state of Oklahoma, Texas, New Mexico, Arizona, Colorado, and Nevada**
HABITAT	**Desert plains, semi –desert, grasslands, pinon/juniper woods, mountainside between 2,000 to 7,000 feet**
PROPAGATION	**1. Seeds** **2. Joints that have become detached from the parent plant and take root**
OTHER INFORMATION	**1. Four to five years after droughts, the stem joints will invade areas where other plants have died.** **2. They stop growth at the end of the summer and will being growing by producing new branches the next spring.** **3. The most common cholla in New Mexico.** **4. The Roman Catholic Penitentes of New Mexico formerly tied fresh stems to their bare backs in Holy Week processions.** **5. The plant may turn purple in winter or during dry periods, and the stems become thinner.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.** **1. They are spread by animals getting the joints caught in their fur and then falling off in a new location.**
WILDLIFE USAGE	**Fruit: deer, cattle, pronghorn, desert bighorn sheep; Home for: cactus wrens, curved-billed thrashers; Pollen: bees; Dead fallen wood: homes for desert wood rats; Nectar sometimes develops on the upper part of the areoles: ants**
HUMAN USAGE	**1. Dry wood: Dead stems decay to leave a hollow wooden tube with a pattern of lengthwise slits. Fires, picture frames, walking canes, lamp stands** **2. Plant: landscaping**
NATIVE AMERICAN USAGE	**Fruit: dye; Thorns: sewing needles, fishing hooks; Dry Wood: tool handles**

CHRISTMAS CHOLLA (Opuntia leptocaulis)
See Plant Plate 3

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Desert Christmas Cholla, Desert Christmas Cactus, Slender Stem Cactus**
TYPE OF PLANT	**Short, bushy low shrub-like cactus**
SIZE	**1. Usually 2 to 4 feet tall.** **2. They can reach almost 6 feet tall if it is intertwined with a tree or other support.**
FLOWERS	**1. The small, ½ inch wide greenish, yellow, or bronze flowers grow along the stems.** **2. They open in the afternoon for about 3 hours and close by nightfall.** **3. Blooms in May and June**
FRUIT	**The grape-shaped berries turn bright red in December and stay on the plant through mid-winter.**
LEAVES/SPINES	**1. Two-inch-long spines often covered with sheaths that grow out of small clusters of reddish bristles** **2. There is usually just one white or golden-brown spine per areole, angled slightly downwards, but some plants are mostly spineless.**
STEMS	**1. Smooth, long, thin, round slender (about ¼ inch) stems** **2. They have the thinnest stems of any southwestern cholla.** **3. New growth is dark green. With age, the branches and trunk develop a scaly bark and turn pale tan.**
RANGE	**Chihuahuan Desert of New Mexico, Texas, southern Arizona, and Oklahoma**
HABITAT	**Deserts, grassland, sides of canyons, often in over-grazed areas, chaparral**
PROPAGATION	**Detached segments will root near the parent plant, seeds.**
OTHER INFORMATION	**1. They tend to form thickets that can become almost impenetrable to humans and livestock.** **2. They are most slender of all the chollas.** **3. They grow best under the protection of another plant to for impenetrable thickets. .**

ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.** **1. They will intertwine with a tree or other plants for support.**
WILDLIFE USAGE	**Fruit: scaled quail, wild turkey; Joints: white tailed deer; Plant: protection for nesting birds especially cactus wrens; Pollen: hummingbirds,**
HUMAN USAGE	**Buds: taste like a combination of green bean, artichoke heart and asparagus.; Fruit: can be eaten raw of as jam or jelly, wine**
NATIVE AMERICAN USAGE	**Tohono O'odham Indians ate the buds.**

PENCIL CHOLLA (Opuntia arbuscula)
See Plant Plate 3

FAMILY	**Cactaceae (cactus family)**
TYPE OF PLANT	**Shrub like cactus**
SIZE	**3 to 5 feet tall**
FLOWERS	**1. 1-inch salmon color bloom in late spring and early summer** **2. Many years they do not bloom.**
FRUIT	**Green, to pale yellow, spineless**
LEAVES/SPINES	**Solitary spines rather than in clusters. Spines are yellow or tan with an orange tip.**
STEMS	**Segments 2 to 4 inches long and ¼ inch narrow, pencil-size, grayish color. The only cholla with grooved surface.**
RANGE	**Arizona, New Mexico, Oklahoma, Texas**
HABITAT	**Dry, sandy, gravelly washes, plains, valleys, and in deserts often with creosote bushes**
PROPAGATION	**Detached segments root near the parent plant, seeds**
OTHER INFORMATION	**1. These plants often grow in low and hidden clumps of grass and shrubs and are hidden from animals until they make contact with them.** **2. They grow with a trunk instead of a sprawling shrub.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.**
WILDLIFE USAGE	**Plant: provides shade for smaller plants; Stems: food for rodents**
NATIVE AMERICAN USAGE	**1. Fruit: eaten cooked or raw**

CLARET CUP (Echinocereus triglochidiatus)
See Plant Plate 4

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**King's Cup, scarlet hedgehog cactus, scarlet beehive cactus**
TYPE OF PLANT	**hedgehog cactus**
SIZE	**6 to 12 inches high**
FLOWERS	**The cup shaped flowers are red to red-orange with a bright green stigma. Flowers bloom from April-July. They last three to five days.**
FRUIT	**Seeds in red, juicy egg-shaped pod**
LEAVES/ SPINES	**Spines up to 2.5 inches long are yellow, pink, and turn whitish-gray after their first year**
STEMS	**Large dome-shaped tightly packed mound of green stems that can number from a few to hundreds.**
RANGE	**South Arizona, most of New Mexico, a small part of south Colorado, the Big Bend area of west Texas, and west towards San Angelo**
HABITAT	**Desert grasslands, limestone hills, mountains and uplands, scrublands, pinon-juniper forest**
PROPAGATION	**Seeds, stem cuttings, dividing the plant**
OTHER INFORMATION	**1. They are the first cactus to bloom in the spring at the Living Desert Park.** **2. They are the most widespread of all the hedgehog cactus.** **3. Clumps may have over 100 members, each up to 10 inches in length, and cover an area of several square feet.** **4. They are often in partly shaded locations that may be obscured by twigs or long grass, but will become very visible when blooming in the spring.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.**

WILDLIFE USAGE	**Nectar: hummingbirds, bees; Fruit: eaten by many animals**
NATIVE AMERICAN USAGE	**Stems: Sugar added to mashed stems to make: sweet cake, candy; was roasted by the Isletas and placed on sores to reduce swelling; Fruit: eaten raw (spines are brushed off easily when the fruit is ripe), made into a preserve**

EAGLE CLAW (Echinocactus horihalonius)
See Plant Plate 5

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Devil's head, blue barrow (not turk's head)**
TYPE OF PLANT	**Small barrel cactus**
SIZE	**2-6 inches high, about 1 to 6 inches in diameter**
FLOWERS	**1. Bright pink with rose-magenta centers measuring 2 to 3 inches in diameter that bloom on the top of the plant** **2. Flowers open around midday and close for the night.** **3. They bloom mostly in June, but they may also bloom several times after a summer or fall rainfall.** **4. Plants growing near each other usually bloom at the same time.**
FRUIT	**Seeds are in an oblong pink or red pod enclosed in a long white woolly or hairy base at the top of the plant.**
LEAVES/SPINES	**1. Reddish, pinkish, tannish, or brownish spines from ¾ to 1 ½ inches long** **2. Some spines curve like an eagle's claw.** **3. Each rib is lined with areoles bearing up to 10 spines that are straight except for the three bottom spines that curve downward looking like an eagle's claw.**
STEMS	**1. They almost always have 8 broad, rounded ribs with deep grooves in between.** **2. This cactus is gray-green to blue-gray in color and spherical, hemispherical, columnar, or flat-topped in shape.**
RANGE	**Chihuahuan Desert of New Mexico, Texas, Arizona, and Mexico**
HABITAT	**Arid, rocky hilltops and slopes, common in limestone soil and volcanic rock or in clay and gypsum soil**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Almost always a single plant, but rarely 2 or even 3 plants can be found growing next to each other.** **2. Eagle's claw is the smallest of the three U.S. species of Echinococcus.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.** **1. It has very sharp, curved spines to protect the plant from animals, humans, and the sun.** **2. The deep grooves of the stem channel water to its roots.**
WILDLIFE USAGE	**Pollen & Nectar: bees, flying insects; Fruit: tortoises, birds, pack rats; Wool at top of plant: birds use it to line their nests**
HUMAN USAGE	**1. The plant was once used for making cactus candy.**

HORSE CRIPPLER (Echinocactus texensis)
See Plant Plate 5

FAMILY	**Cactaceae (cactus family)**
TYPE OF PLANT	**Cactus**
SIZE	**2 to 4 inches high, 4 to 12 inches wide**
FLOWERS	**1. Fringed edged, cup shape, rosy pink or violet with red centers and yellow stigma, about 2 to 2 ½ inches wide** **2. Blooms: April-May** **3. Opens in late morning and closes at night** **4. Blooms last 1 to 3 days.**
FRUIT	**1. Round fleshy green pod 5/8 to 2 inches long** **2. Turn bright red when ripe with black seeds that are protected by white areoles** **3. Young fruit will have some white wool that will disappear when it ripens.**
SPINES	**1. Gray, pale tan or pink to red 1 ½ to 3 inches long** **2. Clusters of spines grow out of each areole that form along the edges of the ribs (that are prominent and wide.)** **3. Each cluster has 1 central spine (up to 3 inches long) that curves downward or straight out and 6 to 7 (shorter length) that spread out from the center.**

STEMS	**1. Pale grayish green or deep green stems topped with short dense cream-colored wool. 2. 13 to 27 narrow vertical ribs**
RANGE	**West, central, south Texas, southeastern New Mexico, parts of Oklahoma and Mexico**
HABITAT	**Desert, grassland, scrubland, sand and limestone soils**
PROPAGATION	**Seed**
OTHER INFORMATION	**It has a flat or dome-shaped top.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section. 1. It grows only 1 to 2 inches above the ground and can be hidden by grasses. 2. The spines can puncture a horse's hoof. 3. Cold hardy to zero degrees 4. Can tolerate increased amounts of water without dying.**
HUMAN USAGEUSAGE	**Cactus collections**

LITTLE NIPPLE CACTUS (Mammillaria heyderi)
See Plant Plate 5

FAMILY	**Cactus (cactus family)**
OTHER NAMES	**Dumpling cactus, big needle cactus, nipple beehive cactus**
TYPE OF PLANT	**Cactus**
SIZE	**4 to 6 inches in diameter**
FLOWERS	**1. Cream or yellow 3-inch wide 2. Bloom: March-May 3. Blooms in a wooly ring at the top of the stems**
FRUIT	**Small bright red round or egg shaped with brown seeds**
LEAVES	**10 to 18 slender radial spines from 5/8 to 2 inches long that spread out in all directions from center of areole**
STEMS	**Long mammary-like tubercles, from which the plant gets its name**
ROOTS	**Long fleshy taproot**
RANGE	**Southeast Arizona, much of New Mexico, south Texas (along the Rio Grande), and part of Oklahoma**
HABITAT	**Stony crest, pinyon-juniper foothills, deserts, grasslands, scrublands, clay and gravelly soil below 4,000 feet**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Mammillaria heyderi is a very short cactus that can be difficult to spot in the winter when it is nearly below ground level and may be partially covered in gravel. In the spring and summer, it is usually above surrounding ground and more visible. 2. Cold hardy to 10 degrees 3. The plant is noticeably flat on the top.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.**
HUMAN USAGE	**1. Pulp: cooked for relief of earache.**

GREEN PITAYA (Echinocereus viridiflorus var. chloranthus)
See Plant Plate 4

FAMILY	**Cactaceae (Cactus Family)**
TYPE OF PLANT	**A small cactus with one cylindrical stem or several in a clump**
SIZE	**Up to 8 inches tall by 3 inches in diameter**
FLOWERS	**1. Bronze flowers with sharply pointed petals that grow along the ribs at almost any point on the stem of the plant 2. The flowers only partly open, giving them a funnel-shape. 3. Bloom Time: April and May**
FRUIT	**1. Spiny, thin skinned, fleshy 2. As the fruit ripens, the spines loosen and are easily brushed off.**
LEAVES/SPINES	**Reddish spines mostly at the top of the plant 14 to 24 radical spines around an areole**
STEMS	**Cylindrical**
RANGE	**Southern New Mexico, southeast through Davis Mountains and Big Bend, Texas**
HABITAT	**Dry plains and hills**

PROPAGATION	**Seeds**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.**
HUMAN USAGE	**Sweet edible fruit**

PRICKLY PEAR (Opuntia)

See Plant Plates 6 & 7

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Napol (Spanish)**
TYPE OF PLANT	**Cactus**
SIZE	**Up to 3 feet and 5-8 feet wide**
FLOWERS	**Usually yellow, but they can be orange, red or purple** **They bloom from April -August.**
FRUIT	**1. Called tunas** **2. Turns purple-red when they are ripe and full of seeds**
LEAVES/SPINES	**1. The spines are the leaves of the plant- so water is not lost through them.** **2. The spines grow out of areoles** **2. Their spines protect the plant from animals that are looking for food.** **3. The spines provide some shade for the plant.** **4. Prickly pears have two types of spines (modified leaves):** • **large, smooth fixed spines** • **small, almost hair like spines called glochids (little spine hairs found only on prickly pears.) The glochids detach easily from the pad and can penetrate the skin.** 
STEMS	**1. The pads (stems) have a waxy covering to hold the water that is stored in them.** **2. The side of the plant exposed to the most sun has a thicker waxy covering.** **3. The pads swell during rains and shrink during droughts much like a camel's hump does.** **4. The pads close their stomates during the day to prevent loss of water. During the night, they open these pores to let in the needed carbon dioxide.** **5. The gas is stored in a special acid in the plant and then released when photosynthesis takes place during the day. This process prevents the plant from losing a lot of its moisture. It also causes the plant to grow more slowly which helps conserve the water needed to help the plant grow.** **6. The pads begin to grow with spring rains and will continue to grow until the dry season begins.**
LIFE SPAN	**30 years**
HABITAT	**Desert grasslands, rocky slopes, sandy soil, pinon-juniper woodlands up to 8,000 ft.**
PROPAGATION	**Seeds, pads that break off and roots**
OTHER INFORMATION	**1. Christopher Columbus took the prickly pear to Spain.** **2. They are found in every state in the United States except Maine.** **3. The shallow roots absorb rain water near the surface.** **4. Some are very cold tolerant which allows them to have a large growing range.** **5. They are fire resistant.** **6. They grow and spread quickly and will even choke out other plants.**
WILDLIFE USAGE	**Pollen: bees, insects; Fruit: insects, bird, packrats, jackrabbits, coyotes, wood rats, deer; Pads: deer, packrats, jackrabbits, desert cottontail, bison, chipmunk, tortoises, javelina (usually about 1/2 of its food), black-tailed prairie dogs; Plant: packrats put nest in the center of a prickly pear patch**
NATIVE AMERICAN USAGE	**Flowers: food; Fruit (tuna):food, juice, tea used for: anti-diarrheal, swollen prostate, urinary tract infection, fight tuberculosis, strengthen immune system; Nopales (Pads): food, split, soaked in water, used to cover wounds, earaches, used as a poultice for snakebites, insect bites, burns, minor cuts, and boils; Juice: soothe skin of minor rashes, sunburns, windburns; Seeds: ground into flour; Spines: scraped infected eyelids, scraped infected tattoo; Cochineal (a scale insect that eats prickly pear and grow in fluffy white colonies) scraped and used as a red dye**

RAINBOW HEDGEHOG (Echinocereus dasyacanthus)

See Plant Plate 4

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Texas rainbow cactus, spiny hedgehog cactus, golden rainbow hedgehog**
TYPE OF PLANT	**Cactus hedgehog**
SIZE	**1. 4 to 9 inches singular cylindrical stem** **2. Can have small clusters of 2 to 10 stems; may branch from the base**
FLOWERS	**1. Outer petals are long and pointed and form a cup shaped flower of up to 3 to 4 ½ inches wide. The petals are usually pale yellow, but they can be dark yellow, golden, yellow, orange, red, pink, or white/near white.** **2. The shorter inner petals often are dark yellow with green base.** **3. Blooming time: April-May.** **4. Flowers bloom for about 1 week- opening in the morning and closing at night.**
FRUIT	**1. Round green or greenish purple 2 ½ inches long pod that ripens to a darker purple** **2. The pulp is very juicy and can be white to purplish-pink in color.**
LEAVES/SPINES	**1. Usually cream or white, but can be pink to pale yellow with spines up to ¼ inch long covering the green stems** **2. Between 15 to 25 spines grow out of each plant's areoles causing them to intertwine with other spines growing from mother areoles.** **3. Each year as the plant grows, it adds a slightly different colored band of spines (depending on growing conditions) which gives the plant a rainbow appearance.**
STEMS	**1. Grow up to 15 inches high and 4 inches in diameter.** **2. As the plant grows older, it sometimes branches in several heads.** **3. Each stem has 12 to 24 narrow ribs.**
RANGE	**Northern Mexico, extreme southeast Arizona, south New Mexico, and far west Texas, along the Rio Grande and north into Pecos County**
HABITAT	**Scrubland, grassy plains, canyon sides and limestone terraces, up to 5,000 feet elevation**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Genus Echinocereus. Echino- ("spiny") refers to the very thorny covering of this genus, and *cereus* ("wax candle") comes from the stately appearance of its upright species.** **2. Deer and rabbit resistant.**
ADAPTATIONS	**See general adaptation information at the beginning of the cactus section.**
WILDLIFE USAGE	**Fragrant flowers: bees, butterflies, birds**
HUMAN USAGEUSAGE	**Fruit: eaten; Plant: landscaping**
NATIVE AMERICAN USAGE	**Fruit: eaten**

STRAWBERRY HEDGEHOG (Echinocereus engelmannii)

See Plant Plate 4

FAMILY	**Cactaceae (cactus family)**
OTHER NAMES	**Engelmann's hedgehog cactus, porcupine hedgehog cactus, hedgehog cactus, strawberry cactus, purple torch**
TYPE OF PLANT	**Cactus hedgehog**
SIZE	**4 to 12 inches tall**
FLOWERS	**1. Funnel shaped 4 to 5 inches tall and 3 to 4 inches tall bright pink to magenta flowers** **2. The inner petals are toothed and have a center base of dark red.** **3. Blooming time: April through May** **4. Flowers close at night and reopen in the morning and usually last for 5 days**
FRUIT	**1. Red fruit that tastes and smells like ripe strawberries** **2. Fruits are globular shape, 1 inch in diameter and turns reddish brown when ripe.** **3. The areoles on fruit are very spiny and easily detach when ripe.** **4. The black seeds are 1/10 of an inch long.**
LEAVES/SPINES	**1. 5/8 to 4 inches long spines that are somewhat translucent tan, brown, or straw colored.** **2. Spines will turn white when older.**
STEMS	**1. The dense cluster consisting of 20 to 100 cylindrical stems is up to 3 feet tall and up to 3 feet**

	across. 2. Covered in spines
RANGE	Arizona, south New Mexico and the Big Bend area of west Texas.
HABITAT	Desert plains, gravelly hills, rocky (limestone) slopes below 5000
PROPAGATION	Pups, seeds
OTHER INFORMATION	1. The strawberry hedgehog is one of the most common species of hedgehog cactus in the southwestern USA. 2. Hedgehogs, unlike most other cacti, have flowers that grow right out of the skin, rather than from the areoles.
ADAPTATIONS	See general adaptation information at the beginning of the cactus section. 1. Their stems grow in clumps, which helps reduce the amount of sun exposure.
WILDLIFE USAGE	Pollen: hummingbirds and other birds, insects; Fruit: birds, rodents, squirrels; Stems: rodents
HUMAN USAGE	Fruit : food
NATIVE AMERICAN USAGE	Stems: sweet cake made by mashing them and adding sugar; Fruit: eaten (spines are brushed off easily when the fruit is ripe)

OCOTILLO (Fouquieria splendens)

See Plant Plate 8

FAMILY	Fouquieriaceae (candlewood family)
OTHER NAMES	1. Candlewood, coachwhip, flaming sword, Jacob's staff, Devil's walking stick 2. The name candlewood came from the white flame that is created when ocotillo is burned. 3. Ocotillo means "little torch" in Spanish
TYPE OF PLANT	1. Large woody shrub with elongated spiny branches. 2. They are a succulent, but not a cactus because they grow real leaves that do not grow out of areoles.
SIZE	15 to 20 feet tall and 8 to 10 feet wide
FLOWERS	1. One half to 1-inch-long tube-like reddish orange flowers that have five strongly fused petals with 10 or more stamens 2. The flowers grow at the top of the stems in clusters 6 to 10 inches long. 3. Blooming time: March and April, sometimes in the fall
FRUIT	Greenish football-shaped three-valved capsules that contain thin, flat, feather weight papery winged seeds that allows for wind dispersal
LEAVES/ SPINES	1. Ocotillos are leafless most of the year. 2. They have two types of leaves. • Primary leaves are the first to develop when the plant is growing. These elongated leaves grow on oversized leaf stalks and midrib. When the leaf falls off, the leaf stalk and part of the midrib harden to become the sharp stiff spine. At the end of each spine is a growing point from which the secondary leaves develop. • After the new spines are established, the secondary leaves are the leaves that appear within two to three days of a good rain. These leaves grow in clusters of 2 to 12 directly below the spines. They have very short stems and are narrow and about 2 inches long. These oval leaves are small, but they can produce the plant sugar needed for the stems to perform photosynthesis. They will lose their leaves when the moisture is gone. By the plant becoming dormant, the plant slows down its growth, so it uses less water, food, and energy. They can put leaves on many times during the summer whenever there is enough rain.
STEMS	1. The spiny stems (canes) are grayish, partly green, thick, waxy (to keep moisture in), and woody that grow from a short trunk. 2. Up to 75 thin stems grow out of the plant's base, but rarely divide any further into secondary stems. 3. The stems store water, which allows the plant to live during dry seasons. 4. Stomates in the stem allow the plant to photosynthesize when leaves are absent.
LIFE SPAN	60 to over 100 years
RANGE	They grow throughout the Sonoran and Chihuahuan Deserts from southeastern California to western Texas and south into Mexico.
HABITAT	Ocotillo is abundant in the Southwest because the soil is well drained on rocky slopes, mesas, out washed plains, and desert grasslands.

PROPAGATION	**seeds and cuttings**
OTHER INFORMATION	**1. It is an indicator of the Chihuahuan Desert**
ADAPTATIONS	**1. The plant will flower and produce seeds even if it does not have leaves.** **2. The stems help direct water to the roots.** **3. The roots are shallow (less than 6 inches) and widely spread out to gather water quickly. Their shallow roots soak up the rainwater before it can reach other plants that have deeper roots.** **4. The sharp spines protect the plant from hungry animals and provide some shade for the plant.** **5. Ocotillos produce a lot of seeds each year assuring that there will be more ocotillos. The seeds' thin coating allows them to sprout quickly when it becomes wet.** **6. Photosynthesis occurs not only in the leaves but also, in the stems (which also have chlorophyll) when leaves are not present.** **7. They are cold tolerant to about 10 degrees Fahrenheit.**
WILDLIFE USAGE	**Nectar: hummingbirds, ants, carpenter bees; Flowers: ground squirrels; Leaves: mule deer, white-tailed deer, bighorn sheep**
UMAN SAGE	**Branches: fences- if cuttings are planted, they will form a "living fence"; corrals, Ramadas, as tincture for: lymph system, varicose veins, walking sticks** **Flowers: have a tangy flavor in salads, are dried and used as a tea, in bathing water helps relieve fatigue; Plants: landscape**
NATIVE AMERICAN USAGE	**Flowers and Roots: fatigue, slow down the bleeding of a wound Roots: painful cough, dried and made a powder to put on wounds (Apaches); Flowers: sweet tea, salad, cough medicine, eaten raw (Cahuilla), soaked in water for a refreshing drink (Cahuilla) Seeds: ground to make cakes and mush; Stems: fences around crops, ramadas, furniture by binding them with rawhide strips (Pimas), wrapped around sides of huts and then thatched laid on top of them (Papagos); Nectar: hardened and eaten it like candy (Tohono O'odhams, Papagos); Thorns: pierced skin during initiation rites (Papagos)**

TREE AND SHRUB ADAPTATIONS

- **Some grow long roots to bring groundwater to them.**
- **Some have extensive, horizontal roots that can quickly absorb rainwater.**
- **Some have leaves that are coated with a resin or have a fuzzy covering to prevent water loss.**
- **Some have glossy leaves to reflect the sun's rays.**
- **Some will lose their leaves during a drought.**
- **Some have thorns to protect them from animals.**
- **Some have small leaves to prevent water loss.**
- **Some will fold their leaves in half or even drop them to prevent water loss.**
- **Some are bitter or toxic when eaten by animals.**
- **One uses its stem to carry on photosynthesis when it does not have leaves.**

PLANT GALES
See Plant Plate 12

NOTE: An excellent example of plant galls is located on the oak tree just outside the return door of the Visitors' Center. You will also see galls on some of the mesquite and acacia plants in the park.

- **A plant gall is an abnormal swelling on a plant's leaves, bark, flowers, buds, acorns, or twigs. It is a plant-animal relationship that can be caused by a wasp, beetle, moth, gnats, aphid, or a fly. Mites, nematodes, fungi, and bacteria can also cause galls.**
- **Insect galls can range in size from 1/16 of an inch to 2 inches. They can have very different shapes: egg-shaped, round, pine cone shape, column, oblong, abnormal shape, dunce caps, bottle-shaped, flower-shaped, buttons, or spindle-shaped.**
- **The gall is made up of plant tissue that is a reaction to the chemical of the invader. The type of insect is what will cause the shape of the gall. In spring or early summer while the plant is still growing, an insect will deposit her egg or eggs and a special chemical into the plant. This chemical causes the gall to begin forming. As the egg and later the larva grows, it continues to release the chemical to allow the gall to expand with the insect.**
- **Galls do not usually hurt a healthy plant.**
- **Galls that form on twigs usually take two or more years to form. They usually begin as a blister-like leaf gall and later develop into a knotty twig gall by mid-summer. It will take one or two years for the adult insect to mature and emerge from the gall.**

ALGERITA (Berberis trifoliolata)
See Plant Plate 13

FAMILY	**Berberidaceae (barberry family)**
OTHER NAMES	**Desert holly, chaparral berry, wild currant, desert barberry, holly grape**
TYPE OF PLANT	**Evergreen shrub**
SIZE	**4 to 6 feet high and up to 6 feet wide**
FLOWERS	**Clusters of bright yellow flowers with strong, sweet scent that blooms from February to April**
FRUIT	**Small, tart. shiny red berries that ripen in May and June**
LEAVES	**The blue-green leaves resemble holly with sharp edges. When it rains, the bush looks bright gray**
STEMS	**The inner wood is bright.**
RANGE	**Western half of Texas west to Arizona and south to Northern Mexico**
PROPAGATION	**Cuttings, seeds, and it will resprout after it has been disturbed.**
ADAPTATIONS	**Drought-tolerant, very resistant to deer**
WILDLIFE USAGE	**Berries: insects, birds, small mammals, deer; Leaves when young and tender: cattle, goats, sheep, white-tailed deer; Plant: protection for wildlife**
HUMAN USAGE	**Berries: sweetened drink, tea, wine, jelly, pies, cobblers; Roots and stem bark: gastric irritation, liver problems, toothaches; Plant: barrier hedge, landscaping; Tender leaves: eaten; Wood and roots: yellow dye**
NATIVE AMERICAN USAGE	**Fruit: eaten fresh (Mescalero and Chiricahua Apache, Yavapai, Jemez, Blackfoot, Cheyenne), made into jelly (Apache), paint for ceremonial dances (Apache), face paint and paint for ceremonial objects (Zuni); Roots: fevers, stomach aches (Indians in Mendocino County, California), open wounds, gum problems, scorpion bites (Navajo), blood remedy (Olympic peninsula in Washington tribe), laxative (some Pacific Northwest tribes, Navajo) toothaches, curing deer hides, ceremonies (Hopi); Inner Bark soaked :eyewash (Apache) Bark: chewed to treat gum diseases (Hopi); Leaves and twigs: stiff joints (Navajo); Wood and roots: yellow dye for hides and baskets; Wood: campfires, carvings, tools, ceremonies (White Mountain Apache) Leaves: ceremonies (Hopi)**

ALLIGATOR JUNIPER(Juniperus deppeana)

See Plant Plate 9

FAMILY	**Cupressaceae (conifer family)**
OTHER NAMES	**Western juniper, checkered bark juniper**
TYPE OF PLANT	**Evergreen tree**
SIZE	**40 to 60 feet tall with 35 feet spread**
CONES	**Non flowering** **1. Males produce small pale-yellow clusters of pollen cones at the end of twigs.** **2. Female produce orange-brown berry-like cones with a whitish waxy coating, 5-15 mm in diameter, that have 2-6 seeds** **3. It takes 2 years for the berries to mature to the purplish green or reddish-brown color**
LEAVES	**Dark blue-green scaly leaves hang in clustered wisps frequently dotted with resin on adult trees and needle-like on younger trees**
STEMS/BARK	**1. Hard, dark gray-brown bark cracked into 1 to 2-inch checkered plates resembling alligator skin** **2. The trunk can be single or more often multiple stems.**
LIFE SPAN	**500 to 800 years or more**
RANGE	**Arizona, New Mexico, W Texas; and Mexico**
HABITAT	**Woodland and lower elevation pine forest from 2,400 to 8,000 feet**
PROPAGATION	**Nuts**
ADAPTATIONS	**1. Hardy to -40 degrees**
WILDLIFE USAGE	**Berries: band-tailed pigeons, quail, jays, mockingbirds, coyote, fox, opossum, ringtails, ants, deer, turkeys, bears; Needles: pronghorn, deer; Plant as shelter: hummingbirds, woodpeckers, Mexican jays, sparrows**
HUMAN USAGE	**Wood: fence posts, firewood, furniture, telephone poles, logs for homes** **Berries: flavoring for meat, treat digestive problems, urinary tract infections**
NATIVE AMERICAN USAGE	**Bark: colds, fevers, constipation, clothing, mattresses, kindling; Berries: beads, diuretic, stop bleeding, fevers, colds, food, tea to treat: stomach aches, colds, tuberculosis, sore throats, diabetes, female contraceptives; Ashes: red dye; Twigs toasted to treat: bruising, swelling Pitch: chewing gum, water-proofing; Berries and roots: brown and purple dyes; Roots: bathed horses to make their hair shine; Berries and twigs : tea for respiratory problems; Needles for incense to: cleanse a house, driving out infectious disease; Root with poplar leaves: backaches**

AMERICAN TARBUSH (Flourensia cernua)
See Plant Plate 14

FAMILY	**Asteraceae (aster family)**
OTHER NAMES	**American tar wort, varnish bush, black bush**
TYPE OF PLANT	**Perennial semi-evergreen, strongly aromatic shrub**
SIZE	**1 to 6 feet and 7 feet wide**
FLOWERS	**1. Composite flower:** **Ray flowers: none Disk flowers: several hanging, small, yellow, inconspicuous** **2. Blooming time: September - December**
FRUIT	**Hairy dry fruit (about .39-inch-long) that contains 1 seed**
LEAVES	**1. Small thick oval sticky leaves that have a faint tar odor** **2. Leaves appear in the summer once there is enough moisture in the soil.** **3. Some winters it sheds all it leaves, however some winters it will retain some of its leaves.** **4. Leaves are deep green above, and lighter beneath.**
STEMS/BRANCHES	**Black, brittle**
ROOTS	**1. Form a network of roots that may extend over 13 feet horizontally to collect rainwater** **2. Most roots are shallow but a few extend up 16 feet deep into the soil.**
RANGE	**1. Primarily in the Chihuahuan Desert** **2. Common in the Trans-Pecos region, into Texas and south into Mexico**
HABITAT	**1. Desert scrub and desert grassland** **2. Often found with creosote bush, whitethorn acacia, catclaw acacia, soto, broom snakeweed, honey mesquite, mariola.**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. The flowers and fruit are toxic to sheep, cattle, and goats.** **2. It is an indicator of Chihuahuan Desert.**
ADAPTATIONS	**1. Most parts of the plant have a resinous, tar-like scent and a bitter peppery taste that keeps animals away from it.** **2. The plant can retain its leaves in the winter if there is enough moisture.** **3. The plant will produce leaves depending on the moisture. It will produce a first set of small scale-like leaves during a dry spring and a second set of larger leaves later in the season as moisture increases. If the spring is wetter, it will begin growing its leaves earlier.** **4. As overgrazing of grasslands occurs, the plants can spread their territory.** **5. Although the plants drop their seeds in the winter, they will not sprout until summer rains come.** **6. The plant will not produce many flowers in a dry summer.**
WILDLIFE USAGE	**Seeds: ants; Leaves and branches: black-tailed jackrabbits, desert cottontail, white-throated woodrats, beetles, flies; Plant home for: spiders, insects; Cover for: woodrat, cactus mouse, western harvest mouse, kangaroo rat, sparrows, mockingbird, Pecos clicker grasshopper**
HUMAN USAGE	**Leaves and Flowers: indigestion, diarrhea, respiratory disorders**

APACHE PLUME (Fallugia paradoxa)
See Plant Plate 13

PLANT FAMILY	**Rosaceae (rose family)**
TYPE OF PLANT	**Deciduous to semi-evergreen shrub**
SIZE	**3 to 6 ft. (up to 8 ft.) tall by 6 ft. wide**
FLOWERS	**1. One to 2-inch-wide 5 pedal, round, white flowers with yellow stamen, style, pistil centers that bloom from April through October.** **2. The petals fall away and leave the long slender plume-like pinkish styles that attach to a developing fruit, which is a small achene (a small, dry one-seeded fruit that does not open to release the seed)** **3. The flowers resemble apple blossoms.**
FRUIT	**1. The single, dry seeds have a white/pink feathery tail that is up to 2 inches long.** **2. These pink styles will be carried off by the wind.** **3. The fruit appears on the plant while it is still producing its white flowers.**
LEAVES	**1. The small leaves are gray-green and remain on the plant during mild winters.** **2. The upper green surface of the leaves are hairy and the underside is duller in color and scaly.**

STEMS	**The light gray or whitish branches have peeling bark.**
RANGE	**Mojave Desert, Chihuahuan Desert, Great Basin Desert, Sonoran Desert**
HABITAT	**Desert, gravelly, and rocky slopes, dry washes, hillsides, juniper-pinon woodland between 3,000 to 8,000 feet.**
PROPAGATION	**Seeds, woody rhizomes, cuttings**
OTHER INFORMATION	**1.They have a deep root system that allow them to access more water. 2. They are deer resistant. 3. They grow in all four deserts of the United States. 4. The plant received its name because of the appearance of the pink 2-inch-long styles resemble an Apache war bonnet. 5. These thick shrubs appear unkempt, but when they are in full bloom, they are very showy.**
ADAPTATIONS	**1. Extremely drought tolerant 2. Hardy to -30 degrees 3. Following a fire, they will regrow from their roots.**
WILDLIFE USAGE	**Nectar: bees, butterflies, wasps; Shelter: for animals; Flowers, leaves, branches: deer; Seeds: birds**
HUMAN USAGE	**1. Plant: landscaping, preventing erosion**
NATIVE AMERICAN USAGE	**Stems: Broom, arrow shafts, Apache cradleboard, baskets; the spring twigs can be boiled and drunk for indigestion and spring fevers; Inner Bark: used like aspirin; Leaves: steeped to create a hair tonic (Hopi), internal cleanings, a purifying bath; Roots: boiled in water for coughs, ground with wild tobacco for rheumatic joints, mixed with horehound, flour and water to massage swollen body parts, cording; Flowers: made into a poultice to reduce inflammation for humans and horses; reduce stomach gas**

BEAR GRASS (Nolina enumpens)

See Plant Plate 8

FAMILY	**Lillaceae (lily family)**
OTHER NAMES	**Indian basket grass, soap grass, squaw grass, fire lily, elk grass**
TYPE OF PLANT	**Large tufted grass**
SIZE	**3 to 5 feet wide, 4 to 5 feet tall**
FLOWERS	**1. The flowering stalk (up to 7 feet) appears in the center of the plant from April through May with many small reddish, purplish; or reddish- purple saucer shaped fragrant flowers. 2. The flowers bloom from the bottom up looking like a fluffy, upside-down ice cream cone.**
FRUIT	**Brown seeds**
LEAVES	**A clump of long grass-like leaves up to 4 or 5 feet long.**
STEMS	**Bear grass resembles a very coarse grass, growing from a woody caudex or central stem at or just below the ground surface.**
LIFE SPAN	**5 to 7 years after it blooms**
HABITAT	**Limestone slopes with rocky-clay soil, open forest, and meadows**
PROPAGATION	**Seeds and underground shoots**
OTHER INFORMATION	**1. The seeds are poisonous to livestock. 2. Closely related to yuccas and agave**
ADAPTATIONS	**1. It is fire-resistant and is the first plant to grow back from its underground rhizomes.**
WILDLIFE USAGE	**Flower: insects**
HUMAN USAGE	**Can be used to stabilize rocky slopes and as an ornamental plant.**
NATIVE AMERICAN USAGE	**Roots: baskets, hair tonic when boiled, treated sprains when boiled; Leaves: baskets and trays, tepee floor covering, split and woven into cordage, roof thatching, used as drying mats for baked agave stems and banana yucca fruit, spoons formed from the leaf base; Immature flower stalks about 30 inches tall: roasted or boiled for food; Stems: soap**

SOTOL (Dasylirion wheeleri)

See Grass/Sotol Plate 1

FAMILY	**Nolinaceae It was formerly in the agave family.**
OTHER NAMES	**Desert candle, desert spoon (because the base of the leaves has a spoon-like shape)**
TYPE OF PLANT	**1. Slow growing evergreen shrub. 2. Once thought to be an agave, fairly recently, scientists have decided that Sotol holds a**

	closer relationship with Sacahuista (bear grass), a grassy-looking plant with serrated leaves that grow in thick fountain-like clumps.
SIZE	2 to 5 feet tall
FLOWERS	1. The plant sends up to a 15-foot stalk. 2. At the top portion of the stalk are thousands of flowers. 3. They bloom every year or every few years depending on favorable conditions. 4. The male and female flowers are borne on separate plants and are pollinated by insects. 5. The gender of the plant, being mostly white colored for males and purple-pink for females 6. Blooming time: June-July
FRUIT	The seeds are in three-winged, papery shells that are dispersed by the wind.
LEAVES	1. Long, narrow (less than ½ inch) ribbon-like, flexible, bluish green or yellowish green color with saw-like teeth on the margins and often split at the tips. 2. Mature specimens may wear a sheath of dead leaves from previous seasons around the trunk.
LIFE SPAN	15 years to reach maturity
RANGE	Northern and eastern Sonora, Mexico, southwestern New Mexico, southeastern Arizona
HABITAT	Desert grasslands, rocky hillsides between 3,000 to 5,000 feet elevation.
PROPAGATION	Seeds
OTHER INFORMATION	1. Sotols do not have a trunk. 2. The "heart" (central stem) is where the plant stores its moisture and carbohydrates (which includes poisonous compounds.) The heart can become edible once it is baked in an earth oven for 36 to 48 hours. 3. The mature plant "heart" can be taken to a distillery where it can then be cooked and/or steamed, shredded, fermented, and distilled. 4. It is known as the state drink of Chihuahua, Durango and Coahuila, Mexico.
ADAPTATIONS	1. Their rosette leaves funnel rain and melted snow to the plants' roots. 2. As a succulent, they have waxy leaves and tissues that retain water. 3. They open their stomata to collect carbon dioxide during the night to minimize transpiration. 4. Drought resistant 5. Cold hardy
WILDLIFE USAGE	Base: (Heart): black bears, cattle, many animals live in base; Trunks split open during dry spells, allowing wildlife access to the spongy interior and leaf bases; Pollen: butterflies hummingbirds, flies, bees and wasps, other insects,
HUMAN USAGE	Plant: security barriers, alcoholic drink called sotol (one plant makes one bottle), during droughts, the base with the leaves removed can be fed to cattle, landscape
NATIVE AMERICAN USAGE	Leaf Fibers: mats, baskets, roofs, structures, sandals, ropes; Immature Stalks were boiled for: food and drink; Stalks used in headdress of Mountain Spirit dancers , lance, spear Base: wine-like drink; Seeds: food; Cooked heart: pounded into thin patties that could be sun dried and eaten months later

BROOMWEED (Gutierrezia sarothrae)
See Plant Plate 16

PLANT FAMILY	Asteraceae (sunflower family)
OTHER NAMES	Snakeweed, broom snakeweed
TYPE OF PLANT	Perennial woody shrub that is domed or fan-shaped when flowering
SIZE	About 1 to 3 feet tall, 3 feet wide
FLOWERS	1. Composite flower: Ray flowers: 7 yellow flowers Disk flowers: 2 to 6 yellow flowers 2. Hundreds of small round yellow flower heads cluster in tufts at the end of the stems producing a yellow dome, fan shaped plant 3. Blooming time: August through October
FRUIT	Oval fruit filled with seeds
LEAVES	Narrow yellow-green, shiny, thread-like 2 inches long
STEMS	Woody base with erect stems
LIFE SPAN	Less than 10 years, but has been known to live 18 years
HABITAT	Sunny arid grasslands, desert shrub lands, sandy soil, poor caliche soil, rocky slopes
PROPAGATION	Seeds and cuttings

OTHER INFORMATION	**1. Considered to be a noxious weed. 2. Can cause death or abortion to livestock. 3. It has spread when grassland has been overgrazed. 4. They can have tap roots that are over 6 feet long. 5. When burned, the plant's leaves smell like pine.**
ADAPTATIONS	**1. They can become dormant during a summer drought. 2. The chemical make-up of the plant defends it from insect infestation and discourages the growth of other plants near them. 3. The plant has a resinous waxy coating making it drought tolerant. 4. The seeds are dormant for months after ripening, giving them time to germinate when the weather conditions are better.**
WILDLIFE USAGE	**Leaves: grasshoppers; Flowers: bees, butterflies, birds; Plant: mule deer, pronghorn**
HUMAN USAGE	**Flowering stems: Early settlers used the dried stems for brooms; bath for: arthritis, rheumatism, sore muscle tea for: nausea from hangovers, stomach aches; Leaves: chewed for toothaches Plant: fire kindling, stabilize soil**
NATIVE AMERICAN USAGE	**Stems: broom, broom for sweeping spines off prickly pear tunas; Roots: help deliver placenta after childbirth, diarrhea, urinary infection, respiratory ailments; Flower Concentrate: laxative for horses; Plant: colds, coughs, dizziness, ward off evil; Ashes of Plant: rubbed on body to treat headaches, dizziness; Chewed Pulp: wounds, snakebites, insect stings; Tops of plant: boiled to drink and bathe in to relieve arthritis pain**

CAT'S CLAW MIMOSA(Mimosa aculeaticarpa)
See Plant Plate 12

FAMILY	**Fabaceae (legume, pea, bean family)**
OTHER NAMES	**Wait-a-minute tree**
TYPE OF PLANT	**Deciduous straggling thicket forming shrub**
SIZE	**Shrub- 8 feet tall and 4 to 6ft. wide.**
FLOWERS	**1. Strongly scented white, whitish, or pinkish fuzzy globe shaped 2. Blooming time: April, May**
FRUIT	**The fruits are flat pods up to four centimeters long, flattened between the seeds and splitting open when ripe. There are recurved prickles on the edges of the pods.**
LEAVES	**The alternate small, deciduous leaves are bi-pinnate with a varying number of small oblong leaflets.**
STEMS/TRUNK	**Stems: flexible, angled, and alternating directions at each node Trunk: gray to black, shaggy Twigs: hairy and armed with stout backward pointing spines that can be 2 inches long**
RANGE	**Northern Mexico, Texas, southern New Mexico and Arizona. It is common in the Trans-Pecos.**
HABITAT	**Chaparral, gravelly flats, dry soils on mesas, rocky slopes, hilltops, grasslands, pinyon-juniper regions, and pine-oak communities**
PROPAGATION	**Seed, regeneration (sprouting) occurs following damage to the above-ground portion of the plant.**
OTHER INFORMATION	**1. This tree is also called Wait-a-Minute Tree because someone that gets caught by the sharp thorns must wait a moment to get loose from the plant. 2. Mimosa is from the Greek word "mimos", to mimic, which refers to its sensitive leaves which move rapidly when touched.**
ADAPTATIONS	**1. The plant is fire tolerant and sprouts readily after bushfires 2. Thorns protect the plant from most foraging animals. 3. They tend to form dense impenetrable thickets which must be avoided by any creature bigger than a rabbit.**
WILDLIFE USAGE	**Flowers: hummingbirds, butterflies, moths, flies; Seeds: rodents and other small mammals, scaled quail and other birds, deer; Plant: deer, pronghorn, livestock when there is no other**

	forage available, provides shelter for ground birds, small mammals such as rodents
HUMAN USAGE	**Roots : erosion control**

COTTONWOOD (Populus fremontii)
See Plant Plate 10

FAMILY	**Salicaceae (willow family)**
TYPE OF PLANT	**Deciduous tree**
SIZE	**1. Cottonwood trees are the fastest growing trees in North America. 2. A young tree can add 6 feet or more in height each year. 3. 100 feet tall, 75 feet wide 4. Tree diameter about 6 feet at maturity**
FLOWERS	**1. Female trees produce tiny, red blooms 2. Blooming time: spring**
FRUIT	**Hairy encapsulated seeds with cottony coverings in dangling chains in the fall that will be carried by the wind**
LEAVES	**1. Bright green triangular to diamond-like in shape, that turn yellow in the fall 2. The leaves, which appear to shimmer and shake in the wind, creating a very distinctive sound and visual appearance is caused by the petiole (a stalk that attaches a leaf to the plant stem) that is flattened sideways.**
STEMS/TRUNK	**Gray and tends to be deeply ridged and grooved**
LIFE SPAN	**100 years**
RANGE	**Three different species grow throughout the USA.**
HABITAT	**Riparian zones near rivers and lakes**
PROPAGATION	**Seeds**
OTHER INFORMATION	**The word cottonwood in Spanish is alamo. 2. Some taller trees bear scars where they have been struck by lightning, illustrating the durability of these trees.**
WILDLIFE USAGE	**Shoots and stems: rabbits, deer, elk, moose**
HUMAN USAGEUSAGE	**Tree: windbreak, shade trees; Pulp: high grade book and magazine paper; Wood: pallets, crates, boxes**
NATIVE AMERICAN USAGEMERICA	**Trunk: dugout canoes, forage for horses, bitter tea, food from inner bark; Trees : trail markers and meeting places; Roots: kachinas (Hopi)**

CREOSOTE (Larrea tridentate)
See Plant Plate 15

FAMILY	**Zygophyllaceae**
OTHER NAMES	**Greasewood, chaparral, "little stinker"**
TYPE OF PLANT	**Evergreen shrub**
SIZE	**Average 3-6 feet tall, but some can grow to 12 feet high if they get enough water.**
FLOWERS	**Small yellow flowers with wide twisted petals that appear throughout the year following rain, but most abundant from February- August**
FRUIT	**Furry white capsules that contain 5 seeds carried on animals' fur and by the wind**
LEAVES	**1. The small thick waxy leaves have a special resin to keep animals from eating them. 2, They are a rich, greasy, yellow green color when moisture is present, but turn a waxy olive-drab color during drought or freezing weather. 3. The plant may lose some of its leaves during the winter, but it will never lose all of them.**
STEMS	**1. Many stems rise at an angle from the ground and are bush at the tips. 2. The gray stems have rings of black around them.**
LIFE SPAN	**1. Up to 200 years 2. One plant in the Mojave Desert of California has been radio carbon dated and found to be 11,400 years old and measures 70 feet across. This plant is nicknamed "King Clone."**
RANGE	**All four southwestern deserts. Southern Nevada, extreme southwest Utah, southeastern California, southern third of Arizona, southern New Mexico, into west Texas and south into Mexico**
HABITAT	**It occurs on the plains and slopes of foothills in a variety of soils, along gravely soil and alluvial fans in Southwest deserts in conjunction with mesquite.**

PROPAGATION	**1. Seeds, but seedlings usually do not get enough water to survive.** **2. The best propagation is through cloning in which all the creosote plants in an area have the same genetic make-up. New plants form when the old shoots die in the center of the plant and new shoots form along the outside of the root crown. In this way, the new shoots move away from the original plant and as they root, they become separate plants, forming clonal rings.**
OTHER INFORMATION	**1. Its Spanish name, hediondilla, means "little stinker." The plant gives off a distinct thick sweet odor when it rains or during high humidity.** **2. The plant gets its name because its leaves smell like the creosote that comes from petroleum.** **3. It is the most common non-grass plant in the Chihuahuan Desert.** **4. The creosote gall midge (a fly) lay eggs on the plant's branches. When the larvae hatch, they chew on the twigs which causes a gall (an abnormal chemically induced growth) to form. The larvae live in the galls until they emerge as a fly.** **5. It is a plant indicator of the Chihuahuan Desert.**
ADAPTATIONS	**1. They have taproots that are 60 to 80 feet deep.** **2. They have other roots that will spread as much as two times wider than the surface plant so they can get as much water as possible.** **3. Their roots monopolize the soil nutrients, starving plants near them.** **4. To make sure a creosote gets enough rainwater, the roots of the established plants are so good that they do not let any new plants get enough water to grow close to them unless they have a different root system that will not interfere with theirs.** **5. Their small, thick, waxy leaves help prevent loss of moisture during photosynthesis.** **6. The leaves have a special resin that cause most grazing animals to leave them alone.** **7. Creosote turn the edges of their leaves toward the sun rather than having the broad surface reduce the amount of water lost from transpiration.** **8. They bloom in the spring before the summer rains come to protect their flowers and fruit from predator insects.** **9. Their leaves grow more in the rainy season because their leathery coating protects them from insects.** **10. They open their stomata in the morning when the humidity is relatively high and the loss of water is the lowest. Thus, photosynthesis occurs then and shuts down when the sun rises higher.** **11. Their seeds will not sprout until there is enough water to allow the seedling to grow.**
WILDLIFE	**Leaves: jackrabbits and kangaroo rats if there is no other food to eat, creosote katydid, creosote grasshopper, Tachardiella larvae (a scale insect); Nectar: bees; Shelter: lizards, desert rodents like kangaroo rats, insects like crickets, grasshoppers, praying mantids**
HUMAN USAGE	**Plant treats: herpes, dry skin, cracks in feet and hand, brittle hair and nails, digestion problems; Leaves: an awful tasting tea used to treat cancer; A resinous secretion of lac insects; shellac The shrub is still widely used as an herbal medicine in Mexico; Landscape**
NATIVE AMERICAN USAGE	**Leaves: respiratory problems, tuberculosis, rheumatism, chickenpox, dysmenorrhea, steam inhaled as a decongestant (Cahuilla, Pima), a gargle for sore throats, general oral health and toothaches (Pima), a liniment (Cahuilla), saddle sores on horses (Pima); Leaves chewed: reduce swelling and prevent infection from: spider bites, scorpion bites, insect bites, snake bites; Leaves powered: disinfectant on new born navel (Pima), deodorant for skin and feet Pima), antiseptic for wounds (Cahuilla); Smoke from burning plant: remedy for laziness (Pima), Tohono O'odham held their feet above the smoldering branches to ease sore feet pain; Charcoal: greenish-blue tattoo pigment; Branches: thatch roofs, arrow shafts, handles for rattles, Fire wood heated and bound on painful areas (Cahuilla); Plant treated: colds, sore throats, coughs, aches and pains of joints and muscles, stomach cramps, menstrual cramps, childbirth pain, bruises, wounds, burns, rheumatism, diarrhea, fever, allergies, flu, infections, tuberculosis; Lacquer-like deposits: formed on the plant by lac scale insect water-proof baskets, handles for tools, glue used to mend pottery and attach arrowheads, boiled to prepare a medicine for a common cold and tuberculosis (Pima)**

CRUCIFIXION THORN (Holacantha emoryi Gray)

See Plant Plate 14

FAMILY	**Simaroubaceae (Quassia)**
OTHER NAMES	**Crown of Christ, althorn**
TYPE OF PLANT	**Perennial, deciduous shrub or tree**

SIZE	**Up to 18 feet tall**
FLOWERS	**Five- sixteenth of an inch wide, with 5 rounded, greenish petals in clusters near the ends of twigs, in spring and early summer**
FRUIT	**1. Three-fourths of an inch or more in length; reddish brown egg shaped, upright, long pointed capsules containing 5 cells. 2. Seeds mature in the fall, but remain attached to the plant until spring or even longer.**
LEAVES	**Very small, scale like, greenish, very short lived**
THORNS	**The very sharp thorns at the end of the branches are either lighter or darker than the stems.**
STEMS/ BRANCHES	**1. Yellow-green twigs are 1/8 inch in diameter with small black rings at forks, often ending in spines or dead tips. 2. The young branches are covered with very short, fine hairs. 3. Older branches are streaked with gray-brown bark.**
BARK	**Yellow-green, smooth, becoming frayed, rough, slightly fissured and shreddy at base.**
RANGE	**Mojave and Sonoran deserts**
HABITAT	**Dry, rocky desert washes, slopes, and plains from 500 to 2,000 feet.**
PROPAGATION	**Seeds**
OTHER INFORMATION	**Photosynthesis occurs in the branches**
ADAPTATIONS	**Drought and cold tolerant**
WILDLIFE USAGE	**Seeds: birds**
NATIVE AMERICAN USAGE	**Sap of buds: treat pimples (Yavapai)**

DESERT WILLOW (Chilopsis linearis)
See Plant Plate 10

FAMILY	**Bignoniaceae (bignonia family)**
OTHER NAMES	**Orchid of the desert**
TYPE OF PLANT	**1. The desert willow is not a true willow. 2. It is a deciduous small tree or a large shrub.**
SIZE	**15 to 25 feet tall; 15 to 20 feet wide**
FLOWER	**1. 1 1/2-inches orchid-like pink, lavender, or white flowers that grow in pairs 2. Following rain, they will produce a spurt of flowers. 3. Blooming time: April to August**
FRUIT	**1. Green, long narrow, cigar-like 4- to 8-inch-long pods that turn brown when ripe. 2. Pods contain flat, tan seeds that have dual hair "wings" to help carry them a longer distance. 3. The split pods stay on the tree through the winter even though the seeds have already fallen.**
LEAVES	**Long flat, narrow light green 3 to 6 inches long on slightly drooping branches**
ROOTS	**An extensive system that effectively bind soil and rocks which prevents erosion.**
STEMS	**The trunk grows up to 6 inches in diameter and has dark brown, scaly bark.**
LIFE SPAN	**50 to 75 years**
RANGE	**Mojave, Sonoran and Chihuahuan deserts from southern California to southwest Texas, as well as northern Mexico between 1000 and 5000 feet.**
HABITAT	**Along desert washes and rivers, grasslands, valleys from 1,300 to 5,500 feet**
PROPAGATION	**Seeds, cuttings**
OTHER INFORMATION	**1. Chilopsis is from the Greek word for lip that refers to the liplike shape of the flowers. 2. It is classed as a phreatophyte, and is an indicator that water is not too far below the surface during part of the year.**
ADAPTATIONS	**1. Their funnel shaped flowers attract hummingbirds. 2. They are very drought tolerant. 3. They have long slender leaves to prevent the loss of water.**
WILDLIFE USAGE	**Pollen: bees, hummingbirds, butterflies (including monarch) and some moths (sphinx and geometer); Seeds: rodents, birds; Plant shelters: birds including hummingbirds, blister beetles**
HUMAN USAGE	**Tree: erosion control ; Wood: thatch roofs, fence posts, firewood, anti-inflammatory Flowers: tea and poultice: indigestion, hemorrhoids, cough; Leaves and Bark: skin and nail infections, scratches**
NATIVE	**Limbs: bows, baskets, baby cradles, grain storage units, house frames**

AMERICAN USAGE	

ESCARPMENT LIVE OAK (Quercus fusiformis)

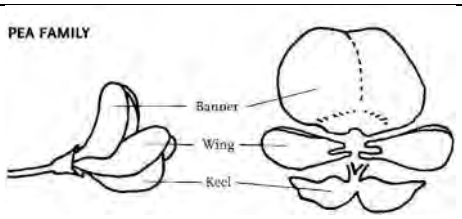
FAMILY	**Fabaceae (legume, pea, or bean family)**
OTHER NAMES	**Plateau live oak, scrub live oak, west Texas live oak, live oak**
TYPE OF PLANT	**Medium evergreen shade tree or thicket-forming shrub**
SIZE	**20 to 40 feet tall; 25 to 40 feet wide**
FLOWERS	**Male: rust color on same tree with the female flower Female: green catkins 2 to 3 inches long**
FRUIT	**Elongated acorns ¾ to 1 inch long.**
LEAVES	**1. Small, glossy, thick, leathery, evergreen leaves from 1 to 3 inches long are oval and sharply toothed, resembling holly foliage** **2. Upper surface a glossy light to dark green, grayish- green beneath**
STEMS/BARK/ TRUNK	**1. Very dark colored, smooth gray or off white when young, becoming heavily textured and very dark with age** **2. A short, tapering trunk supports picturesquely gnarled branches and limbs that over time will spread horizontally a great distance from the main trunk.**
LIFE SPAN	**Hundreds of years**
ANGE	**From the Glass Mountains and Arbuckle Mountains of southern Oklahoma south through the center of Texas to the mountains of Coahuila, Tamaulipas, and Nuevo Leon in Mexico**
HABITAT	**Rocky alkaline drought areas, limestone hills and uplands**
PROPAGATION	**1. Seeds that sprout as soon as they drop in the fall 2. Roots**
OTHER INFORMATION	**1. They lose their leaves in the spring when the swelling buds push them off, but the new leaves will quickly emerge.** **2. They were used for shipbuilding and other construction during Colonial times**
APTATIONS	**1. It has an expansive root system that makes it drought tolerant.** **2. Its small, glossy, thick leaves help it retain water.**
WILDLIFE USAGE	**Acorns: squirrels, turkey, deer, birds, black bears, butterflies**
HUMAN USAGE	**Acorns: food; Wood: wine and whisky barrels, furniture, flooring, fires-including barbeque grill**
NATIVE AMERICAN USAGE	**Acorns: cooking oil, bread, drink, food; Leaves: rugs; Bark: dyes**

FAIRY DUSTER (Calliandra eriophylla)
See Plant Plate 13

FAMILY	**Fabaceae (legume, pea, or bean family)**
OTHER NAMES	**Mock mesquite, calliandra (Greek for beautiful stamens)**
TYPE OF PLANT	**Evergreen shrub**
SIZE	**Up to 3 feet tall and 3 feet wide**
FLOWERS .	**1. The inconspicuous 1/5-inch flower with its 5 reddish or pink petals are small, but growing from the center are 20 or more pink 1-inch-long stamens that provide the fairy-like look of the flower.** **2. Blooming time: February through May and may bloom again in the fall.**
FRUIT	**Seeds in Flat reddish-brown seedpods**
LEAVES.	**1. Appears in usually 6 to 8 major leaflets, with each leaflet having 12 pairs of small, tightly spaced Minor leaflets** **2. Fine white hairs appear on the immature leaflets.**
STEMS	**Woody, densely branched stems**
RANGE	**Southern California, Arizona, New Mexico, Texas and Northern Mexico**
HABITAT	**Deserts, grasslands, sandy or rocky areas, along dry washes**
PROPAGATION	**Seeds, rhizomes**
WILDLIFE USAGE	**Pollen: butterflies, bees, flies, hummingbirds; Leaves: deer, javelina; Seeds: doves, finches, quail; Plant: host to the statira sulphur butterfly**
HUMAN USAGEUSAGE	**Plant: erosion control; landscaping**

NATIVE AMERICAN USAGEMERICAU	**Leaves and stems: taken after childbirth**

FEATHER DALEA (Delea Formosa)
See Plant Plate 15

FAMILY	**Fabaceae (legume, pea, bean family)**
OTHER NAMES	**Featherplume, Indigo Bush, Pea Bush, Plume Dalea**
TYPE OF PLANT	**Small semi-evergreen thorn less shrub**
SIZE	**3 feet tall and 4 feet wide**
FLOWERS	**1. Two-inch clusters of 2 to 10 flowers grow on short stalks. It is hard to distinguish individual flowers within the cluster.** **2. Each fragrant flower has four overlapping purple petals and one larger detached yellow petal.** **3. The yellow petal (the banner) attracts pollinators to the plant.** **4. After the plant is fertilized, the yellow petal turns to a maroon color signaling the flower is no longer producing pollen.** **5. Each flower is surrounded by hairy sepals that help protect it and remain even after the petals have fallen off and helps give the plant its somewhat fuzzy and feathery appearance.** **6. Blooming time: March to June, but they may bloom again in September following the monsoon rains.**
STRUCTURE OF FLOWER	  **The banner at the top, develops outside of the others petals before the flower has opened, two lateral petals called wings, and two lower petals that are usually fused and form a keel that encloses the stamens and pistil**
FRUIT	**Flat, shaggy-haired pod containing 1 to 2 seeds**
LEAVES	**1. Alternate, short, compound gray-green leaves which have 5 to 10 pairs of thick leaflets that fold up along the edges or tip.** **2. The leaves grow mostly on the lower branches.**
STEMS	**Grayish thornless woody branches**
RANGE	**Arizona, New Mexico, southeast Colorado, west Texas and far west Oklahoma**
HABITAT	**Poor, dry, rock, limestone, caliche soil**
PROPAGATION	**Seeds**
ADAPTATIONS	**It can survive temperatures to around 0 degrees.**
WILDLIFE USAGE	**Leaves and Branches: deer, rabbits, pronghorn; Flowers: bees, butterflies. nectar insects**
HUMAN USAGE	**Plant: low maintenance groundcover, erosion control**
NATIVE AMERICAN USAGE	**Flowering branches: sweet tasting tea, tea for colds and flu, relive bone pain (Apache)** **Leaves: digestive track cleansing (Jemez, Acoma, Laguna), increasing endurance in long distance runners (Jemez, Acoma, Laguna)**

WILDLIFE USAGE	**Bark: cicada lay eggs; Nectar: insects; Fruit: quails, doves, mammals such as rock squirrels; Plant: wrens build nests among the thorns, ground cover for quail, woodrats use twigs for nest, protection for small mammals, lizards rest under the plant**
HUMAN USAGE	**Roots: used for soap**
NATIVE AMERICAN USAGE	**Roots: shampoo (Apache, Pima), ash for sore eyes (Pima) Thorns: pricked skin over rheumatic pain (Pima); Branches: planting stick (Havasupai); Berries: mashed & added to water for drink (Yavapai), boiled to syrup (Tohono O'odham), dried & later soaked in hot water to eat, fermented for drink (Tohono O'odham), beaten with sticks and eaten (Pima), mashed to eat (Mohave, Maricopa)**

FOUR WING SALTBUSH (Atriplex canescens)

See Tree/Shrub Plate 6

FAMILY	**Chenopodiaceae (goosefoot family)**
OTHER NAMES	**Old man saltbush**
TYPE OF PLANT	**Evergreen shrub**
SIZE	**2 to 3 feet high, but can reach 8 to 15 feet high**
	1. They can be dioecious (male and female flowers are on different plants.) 90% of the plants are diecious. **2. They can be monoecious (male and female flowers are on the same plant.) 10 % of the plants ae monoecious.** **3. Sometimes the plants can switch from being dioecious to monoecious and back again. Between 20 to 40% of the plants may switch sex, probably depending on the weather conditions.** **4. Female flowers grow in open, elongated clusters 2 to 16 inches long, arising from the sides of the stem.**
FRUIT	**1. La rge paper like green winged seeds that turn yellow and then tan when matured.** **2. At maturity, the flat tan seed has four paper like large, membranous fringed wings that arise at right angles to the seed.** **2. Some years, plants may be cloaked with seeds.**
LEAVES	**1. Ever green grayish green 1-inch-long linear leaves that have tiny bladder hairs on their surface. These bladder- hairs rupture and release salt called scurf that makes the leaf look like it is covered with dandruff.** **2. The scurf helps protect the plant against water loss.** **2. The leaves have a salty taste.** **3. Some researchers believe that the salts in the leaf's tissues act like antifreeze, enabling the plant to continue to photosynthesize longer in winter.**
ROOTS	**Extensive system**
STEMS/BRANCHES	**1. Branches arise freely from the base and are brittle and hard at maturity.** **2. Young branches are covered with collapsed bladder hairs that create a scurfy, grey-green appearance and help protect the plant against water loss.**
RANGE	**Salt rich sandy soils throughout the Rocky Mountain Region from South Dakota to Mexico and west to California.**
HABITAT	**Dry mesas, alkaline salt habitats, grassy uplands and prairies, pinon-juniper areas, gravelly washes, sandy soil, drifting sands, salt deserts**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Four-wing saltbush gets its common name from the seed, which has four paper-like wings that project from the seed at right angles. "Saltbush" refers to the alkaline soil habitats in which the plant grows** **2. This plant is the widest distributed saltbush plant in the nation.**
ADAPTATIONS	**1. They can live in a wide range of soils including salty or mineralized.** **2. Their seeds are easily carried by the wind to different locations.** **3. A fungus forms a beneficial association with the roots of the seedlings at germination. The fungus provides access to essential nutrients that the plant's roots may not be able to take up on their own. This gives the seedling a competitive advantage over other seedlings.**
WILDLIFE USAGE	**1. Fruit: quail, squirrels, rabbits, porcupines; Leaves and branches: deer, pronghorn; Seeds: birds, small mammals; Flowers: caterpillars**
HUMAN USAGE	**1. Plant as browse for cattle, sheep, goats, horses; erosion control**
NATIVE AMERICAN USAGE	**Ashes: mixed with corn dough for pita bread by Hopis, used as a lye to soften corn hulls (Navajo), added to corn to make hominy, added to mahogany to intensify the red dye (Navajo) Twigs and Leaves: yellow dye for Navajo rugs; Seeds: cooked like oatmeal, ground up to make a drink called pinole, parched and ground into a flour for bread and porridge (Paiute, Navajo); Leaves: cooked as greens, raw as a snack food, respiratory aliments (Navajo), with roots to alleviate coughs (Navajo), soap for hair and cleaning itchy rashes from measles and chicken pox Blossoms: soap for treating ant bites (Zuni), pudding (Navajo); Wood: arrows for young men manhood rites (Navajo), Older leaves and stems:added to corn in roasting pits to make it salty; Roots: poultice to treat toothaches (Navajo)**

GOLDENBALL LEADTREE (Leucaena retusa)

See Plant Plate 11

FAMILY	**Leguminosae (legume, pea, bean family)**
OTHER NAMES	**Littleleaf leadtree, lemonball**
TYPE OF PLANT	**Deciduous small tree or large shrub**
SIZE	**Usually about 6 feet high, but can be up to 25 feet high, up to 25 feet wide**
FLOWERS	**1. One-inch globe-shaped bright yellow puffballs of showy stamens 2. Blooming time: April-May and may bloom intermittently through the summer after a rain**
FRUIT	**3 to 10-inch-long brown pods**
LEAVES	**Its bright green, twice-pinnately compound leaves cast a filtered shade**
STEMS/ TRUNK	**1. The bark is cinnamon-colored and flaky. 2. The wood is brittle and can break in high winds and ice storms. 3. Single or multi-stem**
RANGE	**Texas, New Mexico, northern Mexico**
HABITAT	**Rocky, limestone areas and dry canyons**
PROPAGATION	**Seeds**
OTHER INFORMATION	**It looks like an acacia, but it does not have thorns.**
ADAPTATIONS	**1. Adapts to different soils, but prefers good drainage. 2. Very drought tolerant. 3. Withstand reflected heat.**
WILDLIFE USAGE	**Leaves: deer; Flowers: carpenter bees, honeybees**
HUMAN USAGE	**Plant: landscape**

Graythorn (Zizphus obtusifolia)

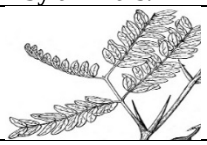
See Tree/Shrubs Plate 6

FAMILY	**Rhamnaceae (Buckthorn family)**
OTHER NAMES	**Loteplant, gumdrop tree, Texas buckhorn**
TYPE OF PLANT	**Perennial shrub**
SIZE	**Up to 8 feet tall, but usually 3 to 6 feet**
FLOWERS	**1. Small star shaped yellow, greenish-yellow, or whitish-green have five petals, five stamens and a distinct floral disc 2. Blooming time: spring and during other seasons depending on available moisture.**
FRUIT	**A blue-black, juicy, thin skin berry is about the size of a pea and containing one hard seed.**
LEAVES	**1. Small, oblong, grayish green leaves that are deciduous with drought and frost 2. Soft down or fine short hairs cover the leaves**
STEMS	**1. A thicket of gray-green to blue-gray stems coated in waxy whitish hairs having sharp straight thorns along the stems with small leaf nodes 2. Photosynthesis occurs in the stems and thorns since the plant has only leaves for a short period of time.**
RANGE	**Arizona, California, Texas and marginally in Utah and extreme southwest Oklahoma**
HABITAT	**1. Shrubby deserts, grasslands, prairie, and along washes and river flood plains where they tap into ground water 2. Found among mesquites, ocotillos, and creosote.**

HONEY MESQUITE (Prosopis glandulosa)

Se Plant Plate 11

FAMILY	**Fabaceae (legume, pea, bean family)**
OTHER NAMES	**Glandular mesquite, Devils Tree by ranchers, Tree of Life by Native Americans**
TYPE OF PLANT	**Deciduous shrub or small tree**
SIZE	**1. Shrub: 2 to 3 feet when growing in limited water areas 2. Tree: 10 to 30 feet high (some 50) 10 to 30 feet wide when growing in a permanent water area**
FLOWERS	**1. Clusters of 3-inch-long pale green or yellow spikes (catkins) 2. Each of the dozens of tiny 5 petal flowers that are sweet smelling attract pollinating insects. 3. Blooming time: March into summer**

FRUIT	**1. Yellow seedpods, slightly curved about 4-10 inches long that contain 10 to 30 hard beans** **2. Seeds can lie dormant for years.** **3. Most pods fall to the ground and are destroyed by insects, fungi, or eaten by animals.**
LEAVES	**Compound leaves bearing 12 to 20 flat, oblong yellow-green leaflets 2 inches long and 3 1/6-inch-wide on either side of a long leaf stem** 
STEMS/ BARK	**1. Mesquite can grow either as a single or multiple-stemmed tree.** **2. Branches have very sharp thorns 2 to 3 inches long.** **3. Bark is reddish to dark brown.**
LIFE SPAN	**100 years**
RANGE	**California, Arizona, New Mexico, Texas, Mexico**
HABITAT	**Deserts, plains, prairies, washes, stream banks, arroyos**
PROPAGATION	**Seeds, root division**
OTHER INFORMATION	**1. The average water use of an 8 to 12 feet tree is 15 to 20 gallon of water per day** **2. Early-day ranchers called mesquite "the devil with roots," because it absorbs all the water in its surroundings causing other plants and trees to wither away and die, allowing more mesquites to move in and take over, and because of its vicious thorns.** **2. IUCN (International Union for Conservation of Nature) considers mesquite to be one of the world's 100 worst invasive species outside its native habitat range.** **4. Mesquite is the most common shrub/small tree of the desert Southwest.**
ADAPTATIONS **.**	**1. Their sharp, pointy thorns and the taste of the plant protects the tree from herbivores.** **2. <u>Seeds</u>:** • **Their small, wax coated seeds minimize transpiration.** • **Their abundant seeds have a protective coating that gives them a better chance to reproduce.** **3. <u>Roots</u>:** • **Their lateral roots are far reaching (50 feet) and out-compete other plants for moisture.** • **Their tap roots can reach 150 to 200 feet which allows them to find subsurface water.** • **Mesquite taproots can extend as much as 200 feet below the surface and the surface roots may extend 50 feet or more past the outer edge of the crown.** • **The tree can easily switch from utilizing one water source to another.** **4. <u>Leaves</u>:** • **Since the leaves are small and coated by wax, the loss of water into the atmosphere through evaporation is minimized.** • **They are one of the last trees to leaf out, so it is less likely to be damaged by a late freeze.** • **During extreme drought, the mesquites may shed their leaves to further conserve moisture.**
WILDLIFE USAGE	**<u>Flowers</u>: bees, butterflies, insects; <u>Pods</u>: food for scaled quail, coyote, rodents, feral hogs, javelinas, deer, jackrabbits, bruchid beetles <u>Plant</u>: cover for deer, javelina, turkey, quail, small mammals, nesting for birds**
HUMAN USAGE **.**	**<u>Beans</u>: Pioneers called them "manna from heaven" and ate them during droughts, made coffee, fed to livestock when there was no grass; <u>Wood</u>: Spanish missions, colonial haciendas, ranch \ houses, fencing, furniture, flooring, paneling, sculptures, fuel for fireplaces and barbecue grills <u>Bark</u>: roofing, tea for diarrhea; <u>Pods</u>: eye wash, food- flour, molasses, can be made into flour to control diabetes; Tea made from <u>leaves, twigs, bark, pods</u>: cuts; <u>Tar</u> (made into mucilage): sore throats, laryngitis, stomach inflammation including ulcers acute pain; Flowers: bees-make delicious honey; <u>Plant</u>: shade; Boiled <u>roots</u> for balm: colic, flesh wounds; <u>Gum</u>: ailing eyes, ease sore throat, clear up dysentery. relive headaches** **One of the major uses of this tree is that it is a nitrogen-fixing tree, which means that it restores nitrogen in the soil allowing grasses to grow. Nitrogen-fixing bacteria grow on their roots and enrich the soil.**

NATIVE AMERICAN USUAGE	**The mesquite was an important source of food for many tribes. The Pima Indians of Arizona call it the "Tree of Life."** **Seed Pods: therapeutic tea, syrup, cakes that were saved for winter, beer, pudding, sweet drink, thirst quencher; Bark: basket, fabrics, herbal infusion for eye infections; Plant: bladder infections, chapped lips, sunburns, rashes, sore gums in babies, sore eyes, induce vomiting, headaches, stomach troubles; Flowers: eaten raw, roasted and made into balls to eat, made into tea; Wood: digging tools, bows and arrow; Sap: snack, glue, wash for wounds; Boiled roots for balm: colic, flesh wounds; Gum: ailing eyes, ease sore throat, clear up dysentery, relive headaches, gastrointestinal problems; Leaves: crushed and mixed with water and urine to cure headaches; Thorns: sewing needle**

LITTLE LEAF SUMAC (Rhus microphylla)
See Plant Plate 13

FAMILY	**Anacardiaceae (Sumac)**
OTHER NAMES	**Desert sumac, scrub sumac, small-leaf sumac**
TYPE OF PLANT	**Deciduous shrub or small tree**
SIZE	**Usually, 5 to 6 ½ ft. but can grow up to 12 feet**
FLOWERS	**1. The greenish-white flowers grow in 4-inch clusters** **2. Blooming time: between March and May before the leaves appear**
FRUIT	**Clumps of hairy red-orange round fruit that ripens from July to August** **The berries remain on the plant during the winter.**
LEAVES	**5 to 9 small leaflets per leaf**
STEMS/BRANCHES	**Clumps of dense dark, stiff smooth branches that become rough with age**
RANGE	**Arizona, New Mexico, Oklahoma, Texas**
HABITAT	**Desert plains, mesas, foothills, dry uplands, shrub lands**
PROPAGATION	**Seeds and root cuttings**
ADAPTATIONS	**1. Seed are spread by birds and other animals.** **2. The seeds will remain viable for 10-20 years.** **3. Shrubs that get burned will sprout again.**
WILDLIFE USAGE	**Leaves: pronghorn, mule deer; Fruit: turkey, quail, ground squirrel, rodent, raccoon, ringtail, gray fox; Nectar: bees**
HUMAN USAGE	**Berries (but they have a sour taste): food, tea made from it can soothe a sore throat, can be licked like a lollipop for a lemony thirst quencher, dried and ground to make into jam or mixed with sunflowers; Pulp and Inner Bark: dye**
NATIVE AMERICAN USAGE	**Berries: fresh or dried for the winter, ground into flour, and used by Cahuilla in soup, mixed with baked agave and dried for storage by Mescalero Apache, drink- Indian lemonade powdered to treat smallpox sores; Bark: chewed to treat colds; Leaves: chewed for stomachaches, used to cause impotency as a form of birth control by Ramah Navajo; Limbs: Hopi used for prayer sticks; Dried Plant: fires in the Hopis' kiva**

MARIOLA (Parthenium incanum)
See Plant Plate 15

FAMILY	**Asteraceae (sunflower family)**
OTHER NAMES	**New Mexico rubber plant**
TYPE OF PLANT	**Perennial evergreen small shrub**
SIZE	**2 to 3 feet tall, 3 feet wide, usually 2 feet tall**
FLOWERS	**1. Composite Flowers: 1/3 inch in diameter** **Ray flowers: 5 oval, deeply notched, white flowers Disk flowers: cream-colored central disks** **2. Flowers resemble small cauliflowers.** **3. Blooming time: July - October**
FRUIT	**1. A small, dry, one-seeded fruit in which the seeds sit free inside the hollow fruit, attached only by a stem** **2. The seeds do not split open when ripe (think sunflower seeds).**

LEAVES	**Small deeply-lobed leaves covered with grayish white hairs that give off a pleasant odor when crushed**
STEMS	**1. Intricately-branched from the base** **2. The lower stems are woody**
RANGE	**Although it is most typical of the Chihuahuan Desert, this plant can also be found in some parts of Arizona, New Mexico, Texas, Nevada, and Utah, southern Mexico**
HABITAT	**Dry limestone soil, caliche soil, rocky desert grasslands and chaparrals, usually alkaline or caliche soil**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1.The stems and leaves are very aromatic and bitter.** **2. Some people are allergic to the latex and sap.**
ADAPTATIONS	**1. Very drought tolerant** **2. Hardy to at least 15°F**
WILDLIFE USAGE	**Plant: bees, butterflies, birds**
HUMAN USAGE	**1. Xeriscape landscaping, erosion control** **2. It contains small amounts of rubber, but not enough to be of commercial use.** **3. In Mexico, it is used to treat rheumatism.**
NATIVE AMERICAN USAGE	**Leaves: boiled to make a drink similar to coffee (Apache), boiled and rubbed solution over a pregnant woman's abdomen to relieve discomfort (Apache)**

MESCAL BEAN (Sophora secundiflora)
See Plant Plate 11

FAMILY	**Fabaceae (legume, pea, bean family)**
OTHER NAMES	**Texas Mountain Laurel, Texas mescal bean**
TYPE OF PLANT	**Evergreen shrub or tree**
SIZE	**10 to 15 ft.- up to 36 ft. tall, but usually about 15 feet tall and 6 to 14 feet wide**
FLOWERS	**1. Fragrant (they smell like grape Kool-Aid) bluish-purple flowers that grow in 3 to 7-inch drooping clusters** **2. Blooming time: March to May**
FRUIT	**1 to 8 oval bright red seeds in a woody seedpod**
LEAVES	**Dense, dark green, glossy, leather-like**
RANGE	**West/south Texas and southeast New Mexico; introduced to Arizona**
HABITAT	**Brush land, limestone hillsides, canyons, along arroyos, mountainous terrain**
PROPAGATION	**From basal shoots, seeds**
OTHER INFORMATION	**1. The seeds are so poisonous that one can kill a human.** **2. This plant is not used to make the alcoholic drink mescal.** **3. The same seed coating that protects the seed from drought, will allow it to be swallowed and pass through our bodies without harm, in most cases.** **4. The flowers' scent is so strong that it should not be brought inside to be used as a bouquet.**
ADAPTATIONS	**1. Drought tolerant** **2. Deer resistant**
WILDLIFE USAGE	**Nectar: bees, butterflies; Branches: birds**
HUMAN USAGE	**1. Landscape**
NATIVE AMERICAN USAGE	**Seeds: jewelry, ceremonies-used as a hallucinogen before it was replaced by peyote (Mescalero Apache held the Red Bean Ceremony); Sap :yellow dye**

MEXICAN BUCKEYE (Ungnadia speciose)
See Plant Plate 11

FAMILY	**Sapindaceae (soapberry family)**
OTHER NAMES	**Texas buckeye**
TYPE OF PLANT	**An irregularly shaped shrub or small tree usually with light gray or dark brown multiple trunks**
SIZE	**Typically grow 8 to 12 ft. tall, but they can reach up to 30 ft.**

FLOWERS	**1. Fragrant clusters of bright pink flowers** **2. Blooming time: spring before leaves appear**
FRUIT	**1. Three shiny round black seeds grow in a three-cell pod** **2. The seeds somewhat resemble buckeye seeds.** **3. The seeds are very poisonous.** **4. The pods stay on the tree through the winter even if the seeds have fallen out.**
LEAVES	**Leaves are 6 to 12 inches long, with serrated margins, and an elongated tip. They are poisonous. They turn a rich yellow in the fall.**
HABITAT	**Grow on mountain slopes and rocky canyons in limestone outcroppings. They prefer alkaline soil.**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Mexican Buckeyes are such unusual plants that they are the only species in their 3 genus.** **2. New branches are smooth; however, they become fissured with age.** **3. The leaves and seeds both contain a chemical called "saponin," which is toxic if eaten in large doses. Small amounts caused dizziness, and abdominal discomfort.** **4. In northeastern Mexico in caves occupied by people as far back as 8000 years, remnants of Mexican Buckeye have been found associated with hallucinogenic Peyote and Mescal bean remains, so it is assumed that the species' toxic seeds were used in certain rituals.** **5. Livestock usually know better than to browse the tree's toxic foliage.**
ADAPTATIONS	**1. Cold-hardy to 5 degrees Fahrenheit.** **2. Deer resistant**
WILDLIFE USAGE	**Flowers: bees, butterflies, moths**
HUMAN USAGE	**Plant: Landscaping**
NATIVE AMERICAN USAGE	**Foliage and seeds: used to make tips of arrows poisonous; Seeds: sometimes carried for good luck, necklaces, children's marbles**

MEXICAN PINON PINE (Pinus cembroides)
See Plant Plate 9

FAMILY	**Pinaceae**
OTHER NAMES	**Mexican nut pine**
TYPE OF PLANT	**Small to medium size bushy evergreen pine tree**
SIZE	**20 -35 feet tall**
FLOWERS	**1. Blooming time: spring if there has been enough moisture in late winter or early spring**
CONES	**1. Pine cones: 1.2 to 2-inch long, irregular rounded shape that contain twenty or more nuts** **2. Nuts: edible, oily, reddish to yellow-brown, oval to globular ½ to 1 ¾ inches long nuts** **3. Nuts are not produced every year.**
LEAVES	**Finely toothed edge needles up to 2 inches long, in pairs of two1**
STEMS/TRUNK	**Short trunk, horizontal branching**
LIFE SPAN	**Hundreds of years**
RANGE	**Arizona, New Mexico, Utah**
HABITAT	**It often grows with juniper trees in foothill woodlands, mesas, or canyons, often on dry, rocky ridges, and semi-arid regions of the southern Rocky Mountains**
PROPAGATION	**Nuts**
OTHER INFORMATION	**1. The piñon pine is the state tree of New Mexico.** **2. The pinon-juniper zone is the first area of trees going into the mountains from the desert zone.** **3. The Mescalero Apache did not rely on the nuts because the crops were unpredictable.** **4. Pinon means pine nut in Spanish.**
ADAPTATIONS	**Drought-resistant**
WILDLIFE USAGE	**Nuts: western scrub jay, Steller's jays, wild turkeys, Clark nutcrackers, black bears, mule deer, wood rats, mice, ground squirrels, chipmunks; Bark: porcupines**

HUMAN USAGE	**Trees: windbreaks, xeriscape landscaping (low water use); Timber: firewood, building material; Pine Nuts: food; Needles: tea, mild diuretic; Inner Bark: bronchial mucus; Pitch: bronchial mucus, urinary tract infection, warmed to remove a splinter**
NATIVE AMERICAN USAGE	**Nuts: food, a food used in the Mescalero girls' puberty rites; Pollen: used during prayers to bless important items; A dye was made to make wool black; Pitch: glaze for pottery (Jemez Pueblo), an antibiotic for cuts; Timber: building material, fuel, mortars for ground seeds; Needles and resin: from inhaling smoke: colds, skin, stomach; Gum: turquoise paint**

MORMON TEA (Ephedra viridis)

See Plant Plate 15

FAMILY	**Ephedraceae**
OTHER NAMES	**Squaw tea, cowboy tea, canyon tea, yellow horse, Brigham tea, joint fir, Mexican tea**
TYPE OF PLANT	**Woody gymnosperm (naked seeds) shrub**
SIZE	**2 to 4 feet high**
FLOWERS	**1. Like other gymnosperms (pines and junipers), Mormon Tea doesn't have flowers. 2. It has tiny male and female cones on separate plants. 3. Blooming time: February to May**
FRUIT	**The female cones have 2 to 3 bracts surrounding two naked seeds**
LEAVES	**Tiny and hardly noticeable leaves that grow out of the joints**
STEMS	**Slender, jointed green stems forming in whorls at nodes along the stalk.**
ROOTS	**Roots are 6 to 7 feet deep and fibrous which capture the shallower water and the deeper water.**
RANGE	**Chihuahuan Desert, Sonoran Desert, Mojave Desert, Great Basin Desert**
HABITAT	**Mesas, plains, sandy soil including dunes, dry rocky spaces, gravel terraces, canyon walls, often on limestone**
PROPAGATION	**Spores, stem cuttings, sprouting at the crown**
OTHER INFORMATION	**1. The plant is sometimes called a joint fir due to the jointed, needle-shaped stems that give a similar appearance to a small fir tree. 2. It is said that Mormon tea got its name from the early Mormon settlers who used the beverage to comply with their religion's rule of prohibiting caffeine consumption.**
ADAPTATIONS	**1. The newer green branches perform photosynthesis. 2. The special shaped stomata restrict transpiration. 3. They produce an abundance of seeds. 4. They can tolerate weakly saline and slightly saline-alkaline soil. 5. They must have well drained soil.**
WILDLIFE USAGE	**Stems: deer, pronghorn, bison; Seeds: birds, small mammals**
HUMAN USAGE	**Spanish Colonialists used the plant for: fever, kidney problems; in recent times, the plant has been used: in dietary supplements and weight control products, in asthma, in cold medications, allergy medications. Because it was found to cause heart attacks and strokes it has been banned by the National Football League since 2001 and has fallen out of popularity. Drinking Mormon tea may result in: stomach disorders, liver damage, augmented urination, constipation, throat and nose cancer; Stem: usually made into a tea: diuretic, tonic, blood purifier, reduce fevers, treat asthma and other respiratory conditions, anemia, rheumatism, stomach ulcers, kidney problems, asthma symptoms, made into a poultice to heal sores; chewed: sunburnt lips Twigs boiled with alum: light tan dye**
NATIVE AMERICAN USAGE	**Stems: tea and its seeds were ground to treat: headaches, colds, fever, kidney ailments ; Seeds: made into flour for: bread, cake, mush treated: coughs, headaches, colds, fever, kidney ailments; Stalks: a drink (still made today); Bulbs: slow cooked for food; Leaves: baskets, mats, sandals, ropes; Twigs: Paiute and Shoshones made tea: kidney regulator, bladder disorders; Navajos boiled with leaves and alum light tan dye; Plant: Apache made a tea: purify the body, diarrhea**

ONE SEED JUNIPER (Juniperus monosperma)

See Plant Plate 9

FAMILY	**Cupressaceae (cypress family)**
OTHER NAMES	**single-seed juniper, one-seed juniper**
TYPE OF PLANT	**It is an evergreen coniferous shrub or small tree**

SIZE	**10 to 30 feet**
CONES	**1. Blooming time: fall/winter** **2. Male and female cones are on separate trees.** **3. Male cones are less than 1 inch long and shed their pollen in late winter.** **4. Female seed cones are fleshy, round, resinous usually single-seeded and starts green but matures to a reddish-brown cone that looks like a berry.** **5. Dry cones turn to a rust color.** **6. Each cone has one seed that matures about 6-8 months after pollination.** **7. One seed juniper typically produces large seed crops at 2-to 5-year intervals.**
LEAVES	**Tiny, green, and scale-like**
STEMS/TRUNKS	**1. The shaggy gray-brown bark hangs in strips, exposing bright orange-brown underneath** **2. Several trunks arise from the ground .** **3. The lower branches usually obscure the trunks.**
RANGE	**Arizona, New Mexico, southern Colorado, western Oklahoma (Panhandle), and western Texas, and in Mexico**
HABITAT	**Desert grassland and pinon-juniper ranges, dry rocky soil**
PROPAGATION	**Seeds**
WILDLIFE USAGE	**Fruit: Gamble's quail, gray foxes, coyotes, raccoons, ground squirrels, chipmunks; Twigs: deer**
NATIVE AMERICAN USAGE	**Bark: sandals, green dye; Wood: firewood, building material; Seeds: necklaces. food** **Berries: green dye**

ROMER ACACIA (Senegalia roemeriana)
See Plant Plate 12

FAMILY	**Fabaceae (legume, pea, bean family)**
OTHER NAMES	**Roemer catclaw, round-flower catclaw, sweet acacia**
TYPE OF PLANT	**Semi-green shrub or small tree**
SIZE	**Shrub- 3 to 7 ft. tall** **Tree- up to 20 feet tall 15 to 20 feet wide**
FLOWERS	**1. Cream to greenish 3/8-inch ball flowers** **2. Blooming time: early spring**
FRUIT	**Narrow leathery fruit-brown to reddish flat curved pods up to 4 inches long papery or woody bean pod**
LEAVES/THORNS	**1. Short curved thorns like catclaw acacia** **2. New leaves can be reddish.** **3. Leaves divided into numerous leaflets**
RANGE	**New Mexico, Texas, adjacent Mexico**
HABITAT	**Well drained slopes and uplands, sandy or gravelly or limestone soil dry**
PROPAGATION	**Can re-sprout if chopped to the ground, seeds**
ADAPTATIONS	**1. Drought tolerant**
WILDLIFE USAGE	**Nectar and pollen: bees, butterflies, insects; Plant: nesting site for birds, cover for small mammals, food for white tail deer and rabbits, livestock when forage is not available; Seed: game birds, small mammals**
HUMAN USAGE	**honey from bees, firewood, thorny impenetrable hedge plant**
NATIVE AMERICAN USAGE	**Seeds: round into pinole (ground corn, cocoa, cinnamon) for porridge**

SHINNERY OAK (Quercus havardii)
See Plant Plate 9

FAMILY	**Fagaceae (legume, pea, bean family)**
OTHER NAMES	**Sand shinnery oak, Harvard oak**
TYPE OF PLANT	**Low spreading desert shrub**
SIZE	**Less than 3 feet**
FLOWERS	**1. Both male and female flowers appear on the same plant in spring.** **2. Male: slim, cylindrical flower in dense clusters**

	3. Female: longer cylindrical containing 1 to 5 flowers
NUTS	**1. Acorns develop in one year, maturing in the autumn.** **2. Acorns occur alone or in clusters of 2 or 3, and are up to almost 1 inch long.** **3. A scaly cup covers about 1/3 to 1/2 of the nut.** **4. They are ½ to 1 inch long.** **4. On average, acorn crops are produced in 3 out of 10 years.**
LEAVES	**1. Leathery, rough texture gray-green to olive color on top and whitish and densely hairy on the bottom of the leaf** **2. Leaves can be oblong, ovate, or elliptical in shape and have wavy or shallowly lobed edges.** **3. Can be up to 3 inches long**
ROOTS	**1. Extensive rhizomes can reach as deep as 29 feet.** **2. Lateral roots and woody rhizomes are widespread near the soil surface.**
STEMS/TRUNK	**1. Usually 1 to 2 m tall** **2. Bark on larger stems is light gray and scaly.** **3. Twigs are smooth brown or grayish or densely covered with short grayish or yellowish hairs, that will disappear as it grows older.**
LIFE SPAN	**Clones may reach hundreds to thousands of years old, although aboveground stems typically live only 11 to 15 years.**
RANGE	**Texas, New Mexico, Oklahoma, Arizona, Utah**
HABITAT	**Deep, sandy soil**
PROPAGATION	**Rhizomes, acorns**
OTHER INFORMATION	**1. Because of their aggressive underground rhizomes; these trees can form dense thickets of clones over large areas.** **2. Cattle and sheep can die from eating this plant.** **3. Clones may reach hundreds to thousands of years old, although above ground stems typically live only 11 to 15 years.** **4. Ninety percent or more of shinnery oak's biomass is under ground.**
ADAPTATIONS	**1. An extensive root and rhizome system assures the population of the plant, even after a fire.** **2. Water is stored in the roots.** **3. Their leaves minimize the loss of water with their thick, waxy composition.** **4. The leaves will also be dropped or leaf out postponed during times of drought.**
WILDLIFE USAGE	**Acorns: javelina, lesser prairie chickens, northern bobwhites; Leaves and Branches: deer, pronghorn, woodrats; Plant provides habitats for: black-tailed jackrabbits, desert cottontails, wild turkeys, western box turtles, snakes, lizards including sand dune lizard, scaled quail, northern bobwhites, scale quail**
HUMAN USAGE	**Plant: erosion control**
NATIVE AMERICAN USAGE	**Acorns: food**

SKELETON-LEAF GOLDENEYE (Viguiera stenoloba)
See Plant Plate 11

FAMILY	**Asteraceae (sunflower family)**
OTHER NAMES	**Golden bush daisy, resin bush**
TYPE OF PLANT	**Evergreen , herbaceous perennial shrub, but will die back in very cold weather**
SIZE	**Usually 3 feet to 6 (but usually 4)feet high and 2 to 3 feet wide**
FLOWERS	**1. Composite flower:** **Ray flowers: yellow ray deeply veined petals** **Disk flowers: range from yellowish brown to golden color** **2. Blooming time: June- October**
FRUIT	**A small, dry, hard fruit that doesn't open and contains 1 seed. (Think sunflower seeds)**
LEAVES	**Skeletal dark green**
STEMS	**Slender stem with one flower**
RANGE	**Arizona, California, New Mexico, Nevada, Texas**
HABITAT	**Well drained, dry, caliche, limestone, rocky ground in desert or sub-desert area**
PROPAGATION	**Seeds, soft-wood tip cuttings**
ADAPTATIONS	**1. Drought tolerant**

	2. Deer resistant because of its aromatic oils 3. Cold hardy to -10 degrees
WILDLIFE USAGE	Nectar: bees, butterflies, birds
HUMAN USAGE	Long blooming plant for landscaping

WESTERN SOAPBERRY (Sapindus saponaria)
See Plant Plate 10

FAMILY	Sapindaceae (soapberry family)
OTHER NAMES	Wild chinaberry, soap nuts, Indian soap plant
TYPE OF PLANT	Large shrub or small tree
SIZE	10 to 50 feet high
FLOWERS	Clusters of creamy white flowers that bloom from March to July
FRUIT	1. Tough-skinned, marble-sized black seed with wrinkled translucent amber flesh covering 2. Fruit often remains on the tree through the winter.
LEAVES	1. Deep green pinnately compound 2. Each branch will have nine to nineteen leaflets.
LIFE SPAN	30 years
HABITAT	Sand dunes, arroyos, water areas
PROPAGATION	Seeds
OTHER INFORMATION	1. Soapberry gets its name from toxic chemical compounds in the drupes, called saponins, which produce a frothy soap. 2. Ingesting the fruit will result in an upset stomach. 3. This plant will form groves in fields, woods, and along streams.
WILDLIFE USAGE	Fruit: cedar waxwings, bluebirds, robins; Leaves: soapberry hairstreak butterfly caterpillars only eat these leaves; Nectar: soapberry hairstreak butterflies, butterflies
HUMAN USAGE	Fruit: laundry detergent, shampoo, relieve scalp itches; Wood: ax handles, packsaddle frames, sliced into strips for weaving baskets; Seeds: jewelry, buttons ; Pulp: used to help make floor wax; Leaves: arthritis
NATIVE AMERICAN USAGE	Fruit: fever remedy, treat rheumatism, soap; Sap: wounds; Leaves: tea for arthritis Stems: arrow shafts

TEXAS MADRONE (Arbustus xalapensis)
See Plant Plate 10

FAMILY	Ericaceae (heath family)
OTHER NAMES	Naked Indian tree, lady's leg, bear berry Madrone is from the Spanish name for strawberry.
TYPE OF PLANT	Evergreen shrub in drier areas to small tree in wetter areas
SIZE	3 feet shrubs to 35 feet tree
FLOWERS	1. Loose clumps of small, sweet scented, white bell shaped 2. Blooming time: early spring
FRUIT	Soft, fleshy bright red or yellow-orange ¼ to ¾ inch round, bumpy berries
LEAVES	Leathery, evergreen, oblong dark green leaves up to 4 inches long
LIFE SPAN	It is extremely slow growing. It can take over a century for a madrone to fully attain an adult height of 20 to 30 feet.
HABITAT	Gravelly hillsides, canyons, mountain slopes
PROPAGATION	It is not very good at reproduction. The seedlings are palatable to deer so few seedlings survive to grow to maturity.
OTHER INFORMATION	1. A madrone is a delicate-looking, smooth-skinned tree. 2. Each year the trunk's covering flakes away which allows the tree to grow. 3. The new trunk will be smooth and can range from white to orange through shades of apricot to dark rusty red color.
WILDLIFE USAGE	Berries: deer, birds; Tree: woodpeckers
HUMAN USAGE	Bark: tanning, astringents, diuretics; Leaves: astringents, diuretics, used for smoking, urine infections stomachache, cramps, skin sore; Berries: jelly; Roots: carved into smoking pipes, woodworking

NATIVE AMERICAN USAGE	**Berries: food, unfermented cider, necklaces, Wood: tools, stirrups, handles, mine timbers, it was not used as firewood because it was considered sacred; Bark and Roots: dye**

THREADLEAF GROUNDSEL (Senecio douglasii)
See Plant Plate 16

FAMILY	**Asteraceae (sunflower family)**
OTHER NAMES	**Wooly groundsel, threadleaf ragwort**
TYPE OF PLANT	**Short, shrubby evergreen bush**
SIZE	**1 to 3 feet tall and wide**
FLOWERS	**1. Composite flowers:** **Ray flowers: bright yellow thin narrow ½ inch petal Disc flowers: purplish brown** **2. Blooming time: March - November**
FRUIT	**Seeds with white hairs attached to them**
LEAVES	**1. Gray-green long, threadlike 1 to 5 inches long** **2. They may be hairy or nearly smooth.**
STEMS	**Gray-green to whitish somewhat woody at the base**
LIFE SPAN	**3 to 6 years**
RANGE	**Colorado, Utah, Texas, New Mexico, into Mexico**
HABITAT	**Grasslands especially in overgrazed or disturbed areas, dry rocky soil in mountains, and along the sides of roads**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. The leaves and stems are covered with matted white hairs.** **2. The leaves are toxic to cattle and horses. Sheep and goats are less affected. Acute poisoning is rare, but chronic effects can occur to the horses and cattle who eat small amounts of the plants over a period of time.** **3. Spreads easily in disturbed areas.**
HUMAN USAGE	**Despite serious safety concerns, people take groundsel.** **Plant: treat worms and colic; Pressed juice: irregular or painful menstrual periods, epilepsy, applied directly to gums to stop bleeding**
NATIVE AMERICAN USAGE	**Plant: pounded and smeared over sore muscles, put in beds for a good smell, repel bedbugs, mixed with deer marrow to make a salve, placed on hot coals to produce smoke to stimulate a sick person, rubbed it over prickly pear fruit to get rid of the spines (Navajo), put it in shoes to keep their feet from sweating (Pueblos); Leaves: put in shoes to prevent sweaty feet, ground up and applied to pimples and skin diseases, treats arthritis and rheumatism**

WHITEBRUSH (Aloysia wrightii)
See Plant Plate 15

FAMILY	**Vervain (verbena family)**
OTHER NAMES	**Beebrush, Wright's beebrush, desert oregano**
yTYPE OF PLANT	**Deciduous, woody shrub**
SIZE	**4 to 6 feet high (but usually 2 feet) and 4 to 6 feet wide**
FLOWERS	**1. Vanilla scented very small (less than 1/10-inch-long) 4 to 5 pointed white flowers that grow in clusters on long (1 to 3 inches) thin woolly spikes.** **2. Blooming time: spring - fall**
FRUIT	**Small (less than 1/16 inch) brown drupe (stone or pit) with two nutlets (nut like fruit or seed) per flower**
LEAVES	**1. Up to 1 inch long by 5/16-inch-wide rounded or oval shaped, silvery green, coarse textured top, hairy underside with lightly toothed margins** **2. Usually in clusters along the stems** **3. When crushed the leaves smell like oregano.**
STEMS	**Brittle, hairy, square shaped**
RANGE	**Parts of New Mexico, Texas, Arizona, Mexico**
HABITAT	**Arroyos, rocky canyons and slopes, chaparrals, often in limestone, shrub, and woodlands**
PROPAGATION	**Seeds. softwood cuttings**
OTHER INFORMATION	**It is toxic to horses, mules, and burros.**

ADAPTATIONS	**1. Tolerates high heat** **2. Drought tolerant** **3. Deer resistant** **4. Grows in poor soil**
WILDLIFE USAGE	**Nectar: bees, butterflies, sphinx moth**
HUMAN USAGE	**Plant: flavoring for tea, a substitute for oregano, xeriscaping honey from bees**

WHITETHORN ACACIA (Vachellia constricta)
See Plant Plate 12

FAMILY	**Fabaceae (legume, pea, or bean family)**
TYPE OF PLANT	**Upright, woody, semi-evergreen shrub with multiple trunks**
SIZE	**From a few feet to 15 or 16 feet tall**
FLOWERS	**Fragrant yellow puff- balls bloom in spring and sometimes again in late summer.**
FRUIT	**Slender curved reddish-brown pods, about 2 to 5 inches long, constricted between the row of seeds and open shortly after maturing**
LEAVES	**1. Small, greenish to grayish lace-like** **2. Leaves fall off during cold weather or a prolonged drought.**
THORNS	**1. Roughly 1/2 inch in length, needle sharp, white, and paired** **2. Thorns are more obvious on younger branches and young plants.** **3. Trees can be spineless or have few spines.**
STEMS/TRUNK	**1. Younger, smooth bark is purple gray to reddish.** **2. Older branches become coarse and grooved or furrowed and grayish-brown.** **3. Branches are somewhat zigzag shape.**
ROOTS	**1. Wide-spreading lateral roots and long penetrating tap root, reaching both shallow and deeper waters.** **2. Roots harbor bacteria that can take nitrogen from the air and convert it into soil-enriching compounds.**
LIFE SPAN	**70 or more years**
RANGE	**Southern Arizona, southern New Mexico, western Texas and northern to central Mexico**
HABITAT	**Along streams, floodplains, intermittent drainages, rocky hillsides, and mesas at elevations ranging from 2,000 to 6,000 feet**
PROPAGATION	**The whitethorn acacia sprouts from seeds, but it can sprout from its root crown should its trunks and branches be damaged or killed, for example, by wildfire.**
ADAPTATIONS	**1. Because insects were only drawn to the flower the first day it blooms, the plant can self-pollinate.**
WILDLIFE USAGE	**Pods: mule deer (small amount), cattle (when food is scarce); Leaves: mule deer (small amount), rabbits; Seeds: packrats, kangaroo rat, rabbit, scaled quail. Gamble's quail, doves, pyrrhuloxias** **Bark: jackrabbits, cottontail rabbits, rodents; Cover: scaled quail, Gamble's quail, packrat** **Pollen: bees, insects, butterflies**
HUMAN USAGE	**Plants: landscaping, barrier, control erosion on a bank**
NATIVE AMERICAN USAGE	**Beans: food made from ground meal, alleviate stomachaches, treat diarrhea; Powdered pod: treated sore backs and flanks of horses; Fruit: pinole; Beans, leaves and roots: tea treated stomach, respiratory disorders; Flowers: tea exhibits sedative properties, eases hangovers** **Powdered leaves : stop bleeding, relieve chafed skin, antimicrobial wash; Roots; tea treated: sore throats, coughing, oral inflammation**

ANNUAL FORB (Ephemerals-Short Lived) ADAPTATIONS

- **Many of the wildflowers are annuals.**
- **They respond to rain by flowering, bearing fruit, and going to seed in a short growing season of a few weeks or months.**
- **These plants avoid the periods of drought by leaving seeds.**
- **They wait for the right season and the right rainfall (which might take years.)**
- **Some species will produce different size seeds- larger ones to produce vigorous sprouts and smaller ones to produce less robust ones when there are marginal growing conditions.**
- **Their seeds are coated with a germination inhibitor and need a lot of water to wash this coating off, which ensure the plant will have enough moisture to complete its life cycle.**

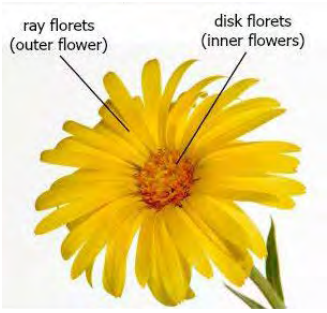
Perennials Adaptations

- **May have small, spiny leaves that reduce the impact of solar radiation**
- **May drop leaves when water is unavailable**
- **May remain dormant for long periods and then recommence growth and reproduction when the environment is more suitable**

Composite Flowers

Composite flowers are members of the Asteraceae family (sunflowers, daisies, chicory, thistle, asters, etc.) The flowers are made up of small clusters of little flowers (inflorescences) that seem like one big flower, but are smaller flowers all clustered together. The composite flower can be composed of disk florets and/or ray florets.

- **The center of the flower head is made up of tube-like flowers that are clustered together and are called disk (disc) florets.**
- **The outer "petals", called ray florets, are each an individual flower.**
- **Composite flowers can be found in three types:**



Daisy-both ray and disk

Thistle- only disk

Chicory- only ray

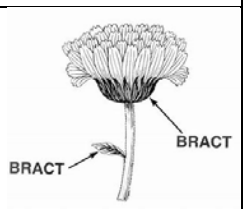
- **Heads composed of <u>both disk and ray flowers</u>, with disc flowers tightly packed in the head's "eye," while enlarged ray flowers function as petals radiating outward from the eye. Species in this group include sunflowers, asters, black-eyed Susans, chrysanthemums, dahlias, and zinnia.**
- **Heads composed of <u>only ray flowers</u> have only the outer flowers such as dandelion, chicory, endive, and wild lettuce.**
- **Heads composed <u>of only disk flowers</u> have only the inner flowers such as thistles.**

ANGELITA DAISY (Tetraneuris acaulis)
See Plant Plate 23

FAMILY	**Asteraceae (sunflower family)**
TYPE OF PLANT	**Perennial, medium growing clumping evergreen**
SIZE	**10 inches tall with a spread of up to 18 inches wide**
FLOWERS	**1. Compact flowers:** • **Ray flowers: bright yellow flowers up to 1 inch across on a 12 inches tall stem** • **Disk flowers: yellow** **2. Blooming time: from spring to fall and sometimes all through a mild winter** **3. Flower stems are about 8 inches higher than the leaves.**
FRUIT	**Fuzzy achenes (one seed attached to inside of ovary at one point) about 1/8 inch long**
LEAVES	**Two-inch-long, slender, grass-like foliage covered with very fine hairs**
STEMS	**Fuzzy, long (10 inches) thin grayish green stems**
RANGE	**Dry, open grasslands and deserts across most of the western United States (Colorado and Nebraska south through Texas and New Mexico) to northeastern Mexico**
HABITAT	**Dry plains, rocky hillsides, rocky, clay and limestone soils**
PROPAGATION	**Seeds**
ADAPTATIONS	**1. Drought resistance** **2. Hardy to 0 degrees F, but it will go dormant at 10 degrees F**
HUMAN	**Landscaping**

USAGEUSAGE	

BEEBALM (Monarda puncatata)
See Plant Plate 21

FAMILY	**Lamiaceae (mint family)**
OTHER NAMES	**Pagoda plant, spotted bee balm**
TYPE OF PLANT	**Perennial or annual wildflower**
SIZE	**1 to 3 feet high**
FLOWERS	**1. Clusters of creamy whitish flowers (called a whorl) at intervals along the stems that resemble a pagoda. The flower blooms and grows out of the bracts, which remain of the plant and form the base of the flower.** **2. Blooming time: June through October** **A bract is a part of a plant that may resemble a leaf or a petal. Structurally, a bract is most similar to a leaf, but it usually is slightly different from the plant's leaves.** 
LEAVES	**Narrow leaves that wrap (in a whorl) around the stem**
LIFE SPAN	**Short lived (1 to 2 years)**
RANGE	**Eastern Canada, the eastern United States and northeastern Mexico**
HABITAT	**Sandy dunes, prairies, semi-desert**
PROPAGATION	**Seeds, rhizomes**
OTHER INFORMATION	**The oregano-scented foliage is repugnant to mammalian herbivores.**
WILDLIFE USAGE	**Flowers: Hummingbirds, butterflies; Leaves and stems: moth caterpillars**
HUMAN USAGE	**Fresh flowers: garnish for green salads, fruit salads, cakes, or preserves ; Leaves: substitute for mint, dried for tea; Dried leaves and flowers: sachets and potpourri, liniment for painful joints and muscles, dry flower arrangements. sed in fragrance industry, Commercial mouthwashes; Plant: fever, helps cause sleep, stomach ailment, diarrhea, sore throat, infections, headaches**
NATIVE AMERICAN USAGE	**Plant: seasoning for wild game, infections, minor wounds, mouth and throat infections, alleviate stomach and bronchial ailments, headaches and fever**

RED DOME BLANKET FLOWER (Gaillardia pinnatifida)
INDIAN BLANKET (Gaillardia pulchella)
See Plant Plate 18

FAMILY	**Asteraceae (sunflower family)**
OTHER NAME	**Red dome- Common gaillardia, blanket flower** **Indian Blanket- firewheel, Indian blanket, Indian blanket flower, sundance)**
TYPE OF PLANT	**Perennial herb**
SIZE	**Up to 2 feet high and 1 to 2 feet wide**
FLOWERS	**Composite flowers:** • **Red dome- petals: yellow** **Indian Blanket- petals: orangish-red with yellow tips** • **Disk flowers are reddish brown, or sometimes purplish.** **3. Blooming time: May - June** **4. Big, long-lasting blooms grow up to 4 inches across**
FRUIT	**After blooming, the flower head (which can be up to 3 inches in diameter) forms a spherical seed ball.**
LEAVES	**Alternate, oblong or oblanceolate, up to 3 inches long**
STEMS	**The reddish green stems have a sparse covering of long, straggly hairs, bare of leaves most of the way along stem.**
RANGE	**1. Red dome: Arizona, New Mexico, Colorado, Nevada, Oklahoma, Utah, Texas** **2. Indian blanket: native to northern Mexico and the southern and central United States from Arizona east to Florida and the Carolinas.**
HABITAT	**Sandy flats, roadsides, grasslands, limestone and other soils**
PROPAGATION	**Seeds, plant division, stem cuttings**

OTHER INFORMATION	**1. The name Indian blanket comes from a legend about a blanket weaver who made a blanket using the sunset colors to show gratitude to the Great Spirit. Before he died, he asked to be buried in his yellow, red, and brown blanket so he could present it to his Maker. Since that time, the Great Spirit has blanketed the land with the flowers of the sunset.** **2. State wildflower of Oklahoma**
ADAPTATIONS	**1. Drought tolerant** **2. Can grow in many types of soil**
WILDLIFE USAGE	**Nectar and pollen: insects including butterflies, honeybees produce a dark, reddish-amber, buttery tasting honey; Seeds: finches**
HUMAN USAGE	**1. Butterfly gardens**
NATIVE AMERICAN USAGE	**Roots: Tea for stomach conditions, sooth sore nipples for nursing mothers, kidney problems Leaves: poultice for gout; Powderskin disorders; Flowers: yellow and pale green dyes; Plant: poultice for headache, heart burn, nausea**

BUFFALO BURR (Solanum rostratum)
See Plant Plate 20

FAMILY	**Solanaceae (night shade family)**
OTHER NAMES	**Spiny nightshade, Mexican thistle, Texas thistle**
TYPE OF PLANT	**Annual herb**
SIZE	**3 to 5 inches tall**
FLOWERS	**1. Yellow, fragrant, about 1 inch wide** **2. In the absence of cross-pollination, the flowers are self-fertile.** **3. Blooming time: May-September**
FRUIT	**1. A berry enclosed by a very prickly calyx** **2. Each berry contains several dark brown or black, chunky seeds that are inedible.**
LEAVES	**Alternate leaves 1 to 3 ½ inches long, scattered short hairs on the upper surface and scattered spines along the lower leaf surface**
STEMS	**Light green with yellow, straight sharp spines up to . 39 inches long**
ROOTS	**The root system consists of a branching taproot that can run deep into the ground.**
RANGE	**Every state except Florida**
HABITAT	**Dry upland prairies, deserts, disturbed areas**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. Buffalo burr can poison horses, sheep, goats, and cattle.** **2. The common name "buffalo bur," alludes to the plant's tendency to grow abundantly around bison wallows.** **3. When mature, the main stem breaks near the ground and the plant rolls like a tumbleweed, scattering thousands of seeds.**
ADAPTATIONS	**1. Drought resistant** **2. Deer resistant**
WILDLIFE USAGE	**Flowers: bees; Leaves: leaf beetle, aphids**

CALIFORNIA POPPY (Eschscholzia california)
See Plant Plate 23

FAMILY	**Poppy**
OTHER NAMES	**Golden poppy**
TYPE OF PLANT	**Annual unless it is a mild winter where they can survive for several years, resprouting each fall.**
SIZE	**1 to 3 feet tall**
FLOWERS	**1. Orange, yellow, white, red, pink 1 to 2 inches in diameter cup shaped with four petals** **2. The petals close at night (or in cold, windy weather) and open again the following morning, although they may remain closed in cloudy weather.** **3. Blooming time: spring, early summer**
FRUIT	**1. Small black or dark brown seeds in a greenish brown to black narrow, ribbed capsule with a red-pink disc at the base** **2. When the seeds are ripe the seed pods suddenly split and fling the seeds far from the plant.**
LEAVES	**Greenish blue fern-like**
STEMS	**Long slender**

LIFE SPAN	**1. February through September in proper growing conditions** **2. They may survive a warm winter.**
RANGE	**Pacific states, Arizona, New Mexico, far west Texas**
HABITAT	**1. Deserts, grasslands, roadsides, open slopes** **2. It favors open sunny, sandy, well-drained soils**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. State flower of California. April 6th is known as California poppy day.** **2. The flower grew so abundantly that by the time Spanish sailors first glimpsed the coastline, they nicknamed it "the land of fire."** **3. Among the many varieties of poppies, only opium poppy is illegal to grow in the United States.**
ADAPTATIONS	**1. Deer resistant** **2. Drought tolerant**
WILDLIFE USAGE	**Sap: aphids, leafhopper; Leaves and flowers: lepidopteran larvae (butterfly); Pollen: bees**
HUMAN USAGE	**Plant with other herbs: helps treat depression, long-term mental and physical tiredness, nerve pain, various psychiatric conditions, blood vessel problems, insomnia, bed-wetting, bladder and liver, promotes relaxation**
NATIVE AMERICAN USAGE	**Flowers and leaves: treated toothaches, sores, kill lice, sedative for babies, headaches, physical and mental stress, muscle tensions, anxiety**

ERECT DAYFLOWER (Commelina erecta)

See Plant Plate 17

FAMILY	**Commelinaceae (spiderwort family)**
OTHER NAMES	**Slender dayflower, widow's tears, white-mouth dayflower, narrowleaf dayflower**
TYPE OF PLANT	**Perennial herb**
SIZE	**Six to 18 inches tall and then usually bends over to spread outwards up to 3 feet**
FLOWERS	**1. Three petals- two large bright blue side petal with one smaller petal below and three yellow stamens** **2. They last only one day unless the day is overcast** **3. Blooming time: May – October**
FRUIT	**Seeds**
LEAVES	**The principal leaves are linear to somewhat lance-shaped.**
STEMS	**1. Erect dayflower starts out erect, but then lies on the ground as it matures.** **2. The soft, jointed stems of this perennial grow upright only if supported by other plants.** **3. Usually they lie on the ground and grow up to 3 ft. long.**
RANGE	**Throughout the United States and in Africa and western Asia**
HABITAT	**Grasslands, sandhill, shrubland**
PROPAGATION	**Seeds, cuttings, spreading roots**
OTHER INFORMATION	**1. Another common name for this species is "white mouth dayflower" so named because the lower petal is white instead of blue. It also is greatly reduced in size.** **2. When the bract of this plant is squeezed it produces a drop of liquid, hence the name Widow's Tears.**
WILDLIFE USAGE	**Plant: white-tailed deer, cattle; Seeds: bobwhite quails, white-winged doves, mourning doves**
HUMAN USAGE	**Sap: salve; Leaves: tea for sore throat, salad; Tender shoots: food-raw or cooked; Flowers: eaten raw or cooked**

DESERT CHICORY (rafinesquia neomexicana)

See Plant Plate 19

FAMILY	**Asteraceae (dandelion family)**
OTHER NAMES	**New Mexico plumeseed, plumeseed**
TYPE OF PLANT	**Annual wildflower**
SIZE	**Between 6 and 20 inches**
FLOWERS	**1. Composite flower:** **Disk: overlapping florets, flattened and notched at the tip, becoming smaller towards the center, each with a whitish style at the base**

	Rays: about 2/3-inch-long Floret bases have a yellowish tint, while the undersides of the larger petals have light pink or purple bands. 2. Blooming time: March to May
FRUIT	Seed
LEAVES	Basal leaves are narrow, oblong, up to 8 inches long with thin lobes along the edge; while leaves further up the stem become fewer and smaller.
STEMS	1. Smooth, gray-green and grows 6 to 20 inches tall. 2. These zigzag stems are so weak that they may grow up through shrubs for support.
RANGE	South California, south Nevada, Arizona, far southwest Utah and southwest New Mexico, northwestern Mexico sandy or gravelly soils in creosote scrub
HABITAT	Gravel and sandy desert flats, often in the shade accompanying shrubs from 200 to 3,000 feet
PROPAGATION	Seeds
HUMAN USAGE	Roots: food, ground up used as a tea in many herbal teas; leaves: eaten; flowers: salad
NATIVE AMERICAN USAGE	Roots made into a tea to treat: colds, fevers, pain killer

DESERT MARIGOLD (Baileya multiradiata)
See Plant Plate 23

FAMILY	Asteraceae. (aster family)
TYPE OF PLANT	Annual or short-lived perennial wildflower
SIZE	They can grow to be 1-2 feet tall and 2 feet across.
FLOWERS	1. Composite flower: Ray flowers: golden Disk flowers: golden 2. Single, golden yellow, one- to two-inch wide flower heads grow on the end of stems up to 18 inches above the leaves. 3. Blooming time: from March through July Summer rains may cause the flowers to bloom again in October and November.
FRUIT	Pale tan seeds
LEAVES	Fuzzy, hairy gray-green basal leaves (occurring in a tight cluster or rosette at the base of the plant)
STEMS	Thick flower stems, up to 18 inches (50 cm) in height, usually carrying a single yellow flower
LIFE SPAN	The desert-marigold is an annual or short-lived perennial.
RANGE	Southern Arizona north into southern Nevada and southwestern Utah, south into Mexico, west to the Mojave Desert and east through the Chihuahuan Desert to Texas
HABITAT	Stony slopes and sandy or gravelly soils of plains, mesas, washes, pinyon-juniper regions, and most abundant on roadsides.
PROPAGATION	Seeds
OTHER INFORMATION	1. The plant can be poisonous to sheep and goats, but not to horses and cattle. 2. Their drought tolerance and long flowering season have made the desert-marigold a popular plant in the horticultural world. 3. Rain triggers additional rounds of flowering.
ADAPTATIONS	1. The leaves' hair increase light reflection, resulting in lower leaf temperatures, and they block ultraviolet light.
WILDLIFE USAGE	Seeds: sparrows, doves, finches, quail; Plant: rabbits, rodents; flowers: desert-marigold moths (Schinia miniana) lay their eggs on the flowers of the plant. When the larvae hatches, they seal up the flower with a cocoon like ball around it. This protects the larvae from predators and screens out some of the sunlight making the animal cooler and moister.
HUMAN USAGE	Researchers at Arizona State University have extracted several desert-marigold compounds, e.g., fastiglin, baileyolin, and radiatin, which might help in cancer therapy by inhibiting tumor formation
NATIVE AMERICAN USAGE	Plant: deodorant (Acoma, Laguna), adobe bricks and plaster when mixed with clay (Jemez Apache s); Flowers: infusions for healing, dye

WHITE EVENING PRIMROSE (Oenothera pallida)
See Plant Plate 17

FAMILY	Onagracea (evening primrose family)
TYPE OF PLANT	Perennial

SIZE	**Up to two feet**
FLOWERS	**1. White flowers open in the afternoon and turns pink as it wilts the next morning. 2. The flowers open within ½ hour with sudden visible jerks. 3. Blooming time: April to September and sometimes October**
FRUIT	**Narrow capsule from .5 to .7 inches long**
LEAVES	**Long, narrow, toothed , dark green**
STEMS	**Reddish, hairy**
LIFE SPAN	**Annual**
HABITAT	**Prairie, fields, meadows, and open woodlands, often in sandy soil.**
RANGE	**Pennsylvania west to Nebraska, south to Texas then eastward to Florida, Connecticut, New Mexico, Arizona, Utah, California, northern Mexico.**
PROPAGATION	**Rhizomes that may be more than 1 foot below the surface**
OTHER INFORMATION	**1. Overtime, a single plant can produce a clump of about 6 feet in diameter.**
WILDLIFE USAGE	**Nectar: moths**
HUMAN USAGE	**Seeds: ground for gravy, boiled for soup; Fruit: chewed; Young leaves: salads**
NATIVE AMERICAN USAGE	**Plant: poultice applied for throat problems; Roots: made into a lotion for: muscle strain, rheumatism**

FENDER'S BLADDER POD (Lesquerella fendleri)
See Plant Plate 18

FAMILY	**Brassicaceae (mustard family)**
TYPE OF PLANT	**Annual or short-lived perennial**
SIZE	**Up to 10 inches**
FLOWERS	**1. Flowers are formed of four yellow petals that grow intense, compact clusters at the tip of each stem. 2. Blooming time: as early as February and continue through April**
FRUIT	**Nearly spherical green pods that turn reddish when mature Each pod contains 10 to 26 seeds.**
LEAVES	**Narrow less than 2 inches long, upward pointed, grayish-green with dense star-like silver hairs**
STEMS	**Narrow, unbranched, erect, and covered with star-like silver hairs**
RANGE	**Arizona, Utah, Colorado, New Mexico, Texas**
HABITAT	**Limestone and gypsum soil, sandy soil, rocky Chihuahuan Desert**
PROPAGATION	**When the plant dies and dries, the taproot breaks off allowing the plant to blow about dispersing the seeds.**
OTHER INFORMATION	**1. It is one of the first flowers to bloom in the spring. 2. The name refers to the shape of the plant's bomb-shaped fruit. 3. Thirty percent of the oil in the bladderpod contains a unique fatty acid that can replace castor oil. Since castor oil contains a deadly toxin ricin, the use of it is restricted in the United States. Bladderpod is now being grown as a crop.**
WILDLIFE USAGE	**Plant: deer occasionally browse**
HUMAN USAGE	**Leaves and green seed pods: pepper flavoring; Seed coating: contains a gum that may be used for a thickening agent and the recovery of crude oil. Plant oil: replacement for castor oil**
NATIVE AMERICAN USAGE	**Leaves: a tea to wash spider bites (Navajo); Plant: crushed and mixed with salt to reduce swelling (Acoma, Laguna)**

FLEABANE (Erigeron strigosus)
See Plant Plate 19

FAMILY	**Asteraceae (aster family)**
OTHER NAMES	**Daisy fleabane**
TYPE OF PLANT	**Annual or biennial**
SIZE	**1 to 3 feet tall**
FLOWERS	**1. Compact flowers:**

	• Ray flowers: 40 or more tightly-packed white flowers, sometimes with pale pink undersides • Disk flowers: yellow flowers 2. Blooming time: June- October
FRUIT	Fluffy white
LEAVES	1. Alternate leaves are up to 4" long and 2/3" across, becoming smaller in size and sparser as they ascend the stems. 2. Some of the larger leaves have sparse coarse teeth along their outer margins. 3. The upper leaf surface is medium green and hairless (or nearly so), while the lower leaf surface is light-medium green and short-pubescent down along the central vein.
STEMS	1. The central stem is light green to purplish green and longitudinally grooved along its sides. This stem often has spreading white hairs toward its base, while above these hairs become shorter and more appressed. 2.The lateral stems are similar to the central stem above; except they are less grooved.
RANGE	Throughout the United States except Arizona and Nevada
HABITAT	Black soil prairies, gravel prairies, hill prairies, limestone glades, dry savannas, eroding clay banks, pastures, and abandoned fields
PROPAGATION	Seeds
OTHER INFORMATION	1. The plant's name originated from a belief that dried flowers could rid a dwelling of fleas
WILDLIFE USAGE	Plant: host for Insects, Northern crescent butterfly (larva and adults)
HUMAN USAGE	Plant: insect repellent when burned to release an oil (early settlers), landscaping
NATIVE AMERICAN USAGE	Plant: insect repellent when burned to release an oil, diuretic, induce sweating, cough (Navajo), fever (Navajo)

GLOBEMALLOW (Sphaeralcea Munroana)
See Plant Plate 17

FAMILY	Malvaceae (mallow family)
OTHER NAMES	Desert mallow, desert hollyhock, apricot mellow, sore-eye poppy (some people are allergic to it)
TYPE OF PLANT	Perennial
SIZE	1 to 3 ft. tall
FLOWERS	1. Orange five-petal cup-shaped flowers up to 1 ½ inches wide 2. Blooming time: May through October
FRUIT	Comma shaped seeds in brown capsule
LEAVES	Large, elongated, toothed, grayish-green and covered with fine, white hair
STEMS	Sometimes woody
RANGE	Southern CA, southern NV, AZ, NM, southern CO, TX, southwest OK, southern KS; south to southern
HABITAT	Sandy washes, rocky hillsides, deserts, semi-desert, often found with creosote
PROPAGATION	Seeds
ADAPTATIONS	1. Drought tolerant.
WILDLIFE USAGE	Nectar: bees and other insects; Plant: grazed on by bighorn sheep, our Bolson tortoises love the flowers
HUMAN USAGE	Leaves: salad, sooths internal and external irritation similar to aloe vera, sun tea, thickener for soup; Green fruit: pickled to taste like okra
NATIVE AMERICAN USAGE	Roots: treat diarrhea by Pima.

HARTWEG'S EVENING PRIMROSE (Calylophus hartwegii)
See Plant Plate 17

FAMILY	Onagraceae (evening primrose family)
OTHER NAMES	Hartweg's Sundrops
TYPE OF PLANT	Mounding woody perennial
SIZE	4 to 18 inches high, 2 feet wide

FLOWERS	**1. Four large (up to 2 inches), bright lemon-yellow petals, crinkly in appearance and widely obovate in shape, forming a tube at the base from which eight stamens arise** **2. These blossoms have a 24-hour life span, opening at night and fading to an orange pink by late afternoon.** **3. Blooming time: March – November (depending on rain)**
FRUIT	**Seeds**
LEAVES	**Leaves are held at around 90 degrees to the stem. They are narrowly lanceolate or oblong in shape, with undulate margins.**
STEMS	**Strong stems that grow up to 2 feet tall and have a light hair covering, most noticeable towards the top**
RANGE	**Arizona, Colorado, Kansas, New Mexico, Oklahoma, Texas**
HABITAT	**Prairies, meadows, plains, roadsides, sand, clay, pinon-juniper, limestone hillsides; 2,000 to 7,000 feet**
PROPAGATION	**Seeds, division**
ADAPTATIONS	**1. Heat tolerant** **2. Can grow in poor soil**
WILDLIFE USAGE	**Pollen: hawk moths, hummingbirds**
HUMAN USAGE	**1. They make a great rock garden**
NATIVE AMERICAN USAGE	**Navajo consider it to be one of their Life Medicines; Pods: cooked into food**

JIMSONWEED (Datura wrightii)

See Plant Plate 20

FAMILY	**Solonacea (nightshade family)**
OTHER NAMES	**Scared datura, spiny apple, Wright thorn apple**
TYPE OF PLANT	**Herbaceous Perennial**
SIZE	**Up to 2 feet**
FLOWER	**1. Four-inch-wide and six to eight-inch-long trumpet-shaped white flower that opens at the end of each day and withers by noon.** **2. The five fused flower lobes have a thin, narrow, tooth-like projection.** **3. The outer edge of the lobes have a pinkish tint.** **4. Buds are pinkish or dull purple.** **5. Blooms throughout the summer.**
FRUIT	**Green, musty smelling, and covered with spines turns into a walnut size, egg-shaped hard brown spiny pod filled with flat, glossy, black seeds**
LEAVES	**The plant produces a dense mass of large, up to 5 inch wide and 10 inches long, dark green ovate leaves with a very fine downy hair covering that exude a bad smell.**
RANGE	**From California to Texas**
HABITAT	**Canyons and washes, open plains; loose sandy, well-drained soil**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. This is a poisonous species.** **2. The flowers give off a narcotic-laced nectar which attract moths that will become discombobulated (falling to the ground and missing their target) after imbibing. The addictive nectar help keep the pollinator inside the flower for a longer time, which helps distribute the pollen to other plants.** **3. The name jimsonweed comes from an incident at Jamestown settlement that occurred when soldiers ate leaves in a salad and hallucinated.** **4. The leaves and seeds are the most poisonous parts of the plants.** **5. Poison symptoms: Hot, dry, and flushed skin, hallucinations, pupil dilation, headache, delirium, rapid and weak pulse, convulsions, and coma**
ADAPTATIONS	**1. The flowers attract pollinators by their odor.**
WILDLIFE USAGE	**Pollen: hawk moths, sphinx moths, bees, beetles, hummingbirds**
NATIVE AMERICAN USAGE	**Small doses used as a hallucinogen.** **Seeds :crushed to make an ointment to exterminate lice; Leaves: smoked to relieve asthma attacks, crushed and placed on boils (Acoma, Laguna); Infusion used: to wash cut of a castrated sheep**

	(Navajo), as an eyewash for blindness of horses (Navajo), cleanser of sores (Navajo); Roots: powdered to make an anesthetic used during painful procedures like stitching up wounds, Crushed and placed on boils (Acoma, Laguna)

MEXICAN HAT (Ratibida columnifera)
See Plant Plate 18

FAMILY	Asteraceae (sunflower family)
OTHER NAMES	Prairie coneflower, thimble-flower
TYPE OF PLANT	Perennial though a harsh winter will kill it
SIZE	15-24" tall, 18" wide.
FLOWERS	1. Composite flower: • Ray flowers: 3 to 7 drooping red, yellow, or red/yellow • Disk flowers: reddish brown to black spiky cone 2. Blooming time: May – November (with adequate rain)
FRU(IT	Seeds are very aromatic when crushed
LEAVES	Leaf blades are divided into as many as 9 segments
STEMS	Tall, leafless stalk that can reach 1.5-3 feet in height, ending in a single flower
RANGE	Most of the United States
HABITAT	Disturbed land along roads, prairies
PROPAGATION	Seeds- produces an abundance of seeds, which can become a problem in controlling it.
OTHER INFORMATION	1. It gets its name from its distinctive shape – a tall cone surrounded by drooping petals that looks something like a sombrero. 2. It has a strong odor.
ADAPTATIONS	1. Very drought tolerant 2. Heat tolerant
WILDLIFE USAGE	1. Unpalatable to livestock 2. Deer may browse plant sometimes. 3. Small mammals and birds may sometimes eat them.
HUMAN USAGE	Plant: landscaping, Land reclamation
NATIVE AMERICAN USAGE	Leaves: crushed and put on the breast of nursing mothers (Acoma, Laguna), beverage (Dakota); Flower head: treat wounds (Dakota), relieve chest pain (Dakota); Leaves and stem : made into tea treat snakebites, treat poison ivy rash; Plant: yellow and green dye

NEW MEXICO THISTLE (Cirsium neomexicanum)
See Plant Plate 20

FAMILY	Asteraceae (Aster family)
OTHER NAMES	New Mexico thistle, desert thistle, powderpuff thistle, lavender thistle
TYPE OF PLANT	Biennial, perennial herb/forb
SIZE	Up to 6 feet high
FLOWERS	1. Composite flower: Ray flowers: none Disk flowers: hundreds of narrow florets make up the lavender, pink, sometimes white flower heads that measure up to 2 inches in diameter. 2. The base (bract) of the flower is armed with spines. 3. Blooming time: April-May
FRUIT	The seeds are topped with long, silky bristles.
LEAVES	The 7-inch-long stiff, grayish-green hairy leaves have long, sharp, spine-tipped marginal teeth.
STEMS	Tough, fibrous stalk
LIFE SPAN	Will regrow from the tap root for two or more years
RANGE	California, Nevada, Arizona, Sonora, Utah, Colorado, New Mexico, Texas, northern Mexico
HABITAT	Sandy, well-drained soil, disturbed areas, grassland, pinon-juniper zones, desert uplands
PROPAGATION	Seeds
OTHER INFORMATION	The plant is classed as a noxious weed in some areas

WILDLIFE USAGE	**Nectar: beetles, butterflies, bees, birds ; mature flower heads: female Anna's hummingbirds for lining their nests; Leaves: in a tent-like structure home for Painted Lady caterpillar**

PALE DOCK (Rumex hymeosepalus)
See Plant Plate 21

FAMILY	**Polygonaceae (buckwheat family)**
OTHER NAMES	**Canaigre dock, desert dock, wild rhubarb, tanner's dock**
TYPE OF PLANT	**Perennial that grow in dense clusters**
SIZE	**1 to 4 feet tall**
FLOWERS	**1. Small greenish to pinkish flowers growing in whorl (5 to 20 petals that surround the stem) from 4 to 16 inches long** **2. Blooming time: Grows from February and will continue until it gets too hot**
FRUIT	**Showy pink/red/brown seed**
LEAVES	**1. Simple waxy, oblong or lance shape 6 to 24 inches long and .8 to 4.8 inches wide** **2. The ridged flat or wavy leaves allow water from light, misty rain to collect along a central vein and filter down to the taproot.**
STEMS	**Stout, fleshy smooth pink stalks**
ROOTS	**Taproot**
RANGE	**AZ , CA , CO , MT , NM , NV , OK , TX , UT , WY**
HABITAT	**Dry sandy areas, sandhills, scrubland, semi-desert**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. One of the first plants to grow and bloom in spring** **2. This plant is poisonous. Leaves and stems must be boiled several times before it can be eaten.** **3. The roots should never be eaten because they are high in Tannin.** **4. Properly treated it is a good substitute for rhubarb in pie.** **5. Native Americans allowed pale dock to grow among their gardens.** **6. At one time, a medicine made from the roots was sold to early settlers to treat skin diseases, syphilis and anemia.**
WILDLIFE USAGE	**Plant: ruddy copper larvae**
HUMAN USAGE	**Roots: contain tannin acid used in leather tanning; Plant: yellow, gray, or green dye; Dry powder: stop bleeding quickl; Dry slices: tea, washes, foot washes, gargles Stems: used like rhubarb, boiled down to make jam**
NATIVE AMERICAN USAGE	**Leaves: reduce rheumatic pain, poultice for wounds; Roots: dermatological aid, pieces put in mouth to help heal sore gums (Papago), ground to used burns, rashes, injuries (Zuni, Acoma, Laguna); Root boiled: eaten or made into poultice for stomach issue, dye for woolen rugs (Navajo) Seeds: ground to make porridge or bread; Pollen: sprinkled as a blessing on ceremonial objects (Navajo- who revered it as a Life Medicine)**

PEPPERGRASS (Lepidium montanum)
See Plant Plate 19

FAMILY	**Brassicaceae (mustard family)**
OTHER NAMES	**Mountain peppergrass, mountain pepper weed, poor man's pepper**
TYPE OF PLANT	**Annual**
SIZE	**Up to 16 inches**
FLOWERS	**1. Individual small, 4 petal white flowers that are arranged in an elongated compact cluster at the top of a stem** **2. Blooming time: March through June and sometimes after summer rains.**
FRUIT	**Flattish, oval, green 1/8-inch-long seed pods.**
LEAVES	**1. Linear, toothed, narrow, up to 3 inches long leaves produced at the end of profusely branched stems** **2. The leaves may be hairless or have a short hair covering.**
STEMS	**1. Plants produce one stem or several branching stems at the base that form a round shape plant.** **2. Stems may be hairless or have a short hair covering.**
RANGE	**Western North America from Oregon to Montana to northern Mexico.**
HABITAT	**Semi-deserts, dry plateaus, pinyon-juniper woodland, weedy areas, disturbed area, mesquite scrubs**

PROPAGATION	**Seeds**
OTHER INFORMATION	**1. The entire plant is edible.** **2. The leaves and seeds taste like pepper.** **3. The peppery leaves are probably not favored by mammalian herbivores.** **4. Roman naturalist, Pliny the Elder. wrote about peppergrass one thousand years before the Incas were cultivating this plant.**
WILDLIFE USAGE	**Flowers flies, bees, wasps, butterflies, moths; Leaves of the small plants in spring rabbits, groundhogs**
HUMAN USAGE	**Seeds: season soups and stews, a substitute for pepper; Young leaves: salads, cooked as greens** **Roots: crushed with added vinegar and salt to make a horseradish substitute**
NATIVE AMERICAN USAGE	**Leaves: chewed by Isleta Indians to soothe a headache; Seeds: used in salads Plant: digestive problems (Navajo), heart palpitations (Navajo), headache (Navajo), rubbed on a baby's face to make it sleepy (Navajo)**

DESERT PRICKLY POPPY (Argemone squarrosa)
See Plant Plate 20

FAMILY	**Papaveraceae (poppy family)**
OTHER NAMES	**Bluestem prickly poppy, Texas prickly poppy, cowboy fried egg**
TYPE OF PLANT	**Annual or biennial**
SIZE	**4 feet tall**
FLOWERS	**1. White flower that has many yellow and red stamens and wrinkled petals** **2. The flowers grow solitarily or in loose cymes at the top of the plant.** **3. Blooming time: March to July**
FRUIT	**1. The fruit of this plant is a spiny capsule opening by the terminal splits.** **2. The seeds are brownish black.**
LEAVES	**1. Greyish green, 2 to 10 inches long; prickly and lobed.** **2. The upper surface of the leaf is smooth although it has a few prickles along the midrib while the low er surface of the leaf is spiny along the midrib and main vein.**
STEMS	**Very branchy, erect, pale grayish-green covered with yellow prickles.**
ROOTS	**Deep-rooted**
RANGE	**CO , KS , NM , OK , TX Texas and the Great Plains states, westwards into Arizona and Utah**
HABITAT	**Sandy or gravelly soils and is often found along fences, roadsides, railroad tracks, on hills and slopes, and in overgrazed pastures. grassland, foothills, desert margins; 1,500 to 8,000 feet**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. This plant is usually avoided by cattle and many other animals.** **2. It is very prickly and has limited nutritional value.** **3 All parts of this plant contain alkaloids that are poisonous.**
WILDLIFE USAGE	**Seeds: quails, doves**
HUMAN USAGE	**The oil of the white prickly poppy was used as a fine lubricant during WWII because its oil content is similar to soybean; It is also used for decorative and ornamental purposes.**
NATIVE AMERICAN USAGE	**Yellow sap from plant: sacrificial rituals (Aztec priest), remove warts (Comanches), treat cold sores (Comanches), skin problems (Comanches); Flowers: congestion from cold or flu Seeds: emetic to induce vomiting, laxative, mild sedative Plant: bladder infections, prostate pain, throbbing migraine pain smoked during important ceremonies to induce a euphoric and mild sedating effect, a tea to heal sunburns or scraped skin**

PURPLE GROUNDCHERRY (Quincula lobata)
See Plant Plate 24

FAMILY	**Solanaceae (potato family)**
OTHER NAMES	**Chinese lantern, purple flower groundcherry**
TYPE OF PLANT	**Low growing perennial**
SIZE	**6 inches high**
FLOWERS	**1.Purple, flat, disk-like, 1-inch-wide flower that has 5 united petals that look like a star and purplish filaments and yellow anthers** **2. Blooming time: March -November**
FRUIT	**Small, yellow, edible berry surrounded by a papery husk**

LEAVES	**Gray-green, oblong, deeply lobed and beaded with tiny, white sticky hairs which can make it look messy when dirt sticks on them**
STEMS	**Spreading stems that are generally hairless but may have light covering of minute hairs**
RANGE	**AZ , CA , CO , KS , NM , NV , OK , TX , UT**
HABITAT	**Mesquite shrub land, disturbed areas , uplands, desert**
PROPAGATION	**Seeds**
HUMAN USAGE	**Berries: Can be eaten (but because it looks similar to other harmful plants, one must be careful to make sure it is the right plant before consuming it.), jam, fresh, pies, sauces, tarts**
NATIVE AMERICAN USAGE	**Berries: jelly (Kiowa), salsa, treat sore throat; Roots: poultice for wounds; Leaves: poultice for sore throat**

SAND PHLOX (Palafoxia sphacelata)

See Plant Plate 22

FAMILY	**Asteraceae (sunflower family)**
OTHER NAMES	**An annual forb/herb**
TYPE OF PLANT	**14 to 16 inches**
SIZE	**4 to 36 inches tall**
FLOWERS	**1. Composite flower: Ray flowers: pink Disk flowers: 5 small, spreading pink lobes with dark stamens 3. Blooming time: May-November**
FRUIT	**Narrow seeds**
LEAVES	**Hairy, narrow, lanced shape from 1 to 3 ½ inches long**
STEMS	**1. The top of the stems and the flowering branches are covered with glandular hairs. 2. Bristly-hairs cover the lower stems, which makes the plant feel sticky.**
RANGE	**CO, KS, OK, NE, NM, TX**
HABITAT	**Dry sand hills and dunes, roadsides, disturbed areas, grasslands and scrub, pinon-juniper woodlands**
PROPAGATION	**Seeds**
WILDLIFE USAGE	**Flowers: bees, butterflies, birds; Plant: larvae of some Lepidoptera**

SCORPION WEED (Phacelia integrifolia)

See Plant Plate 24

FAMILY	**Boraginaceae (borage or forget-me-not family)**
OTHER NAMES	**Wild heliotrope. Toothed-leaf scorpion weed, gyp phacelia**
TYPE OF PLANT	**Annual, biannual, perennial**
SIZE	**31 inches tall**
FLOWERS	**1. Bell-shaped, finely haired, ¼ inch wide, purplish, or bluish flowers with 5 rounded, united petals growing in a coiled cluster that resemble a scorpion's tail with protruding stamens 2. Bloom time: March-May**
FRUIT	**Somewhat rounded capsule containing 4 oblong, brown seeds**
LEAVES	**Oblong in shape with wavy or lobed edges and covered with bristle-like hairs**
STEMS	**Flower stems are erect, rather stout, unbranched, or sparingly branched, and densely covered with gland-tipped hairs.**
RANGE	**AZ , CO , KS , NM , OK , TX , UT, MEXICO**
HABITAT	**Desert, washes, slopes, roadsides, dry sandy soil**
PROPAGATION	**Seeds**
OTHER INFORMATION	**1. The plant is covered with stiff, glandular hairs that can cause a rash, like poison oak and poison ivy. 2. The plant is aromatic- can be rather stinky.**

SHAGGY STENANDRIUM (Stenandrium barbatum)
See Plant Plate 22

FAMILY	**Acanthaceae**
OTHER NAMES	**Shaggytuft**
TYPE OF PLANT	**Perennial**
SIZE	**low spreading, less than 2 inches high**
FLOWERS	**1. Five rose-pink lobes, streaked with white about ¾ inches wide** **2. One of the first spring flowers.** **3. Bloom time: March-June**
LEAVES	**Both sides of the dull gray-green leaves are covered with thick, white hairs and are up to 2 inches long.**
STEMS	**Short**
RANGE	**Southeast New Mexico and west Texas**
HABITAT	**Dry limestone soil, often with stands of Lechuguilla**

SPECTACLE POD (Dithyrea wislizenii)
See Plant Plate 19

FAMILY	**Brassicaceae (mustard family)**
OTHER NAMES	**Tourist plant**
TYPE OF PLANT	**Annual herb**
SIZE	**Up to 3 feet tall**
FLOWERS	**1. Four ½ inch long white petaled flowers that are borne in an elongated cluster at the top of the stems** **2. Blooming time: February to July (later depending on water and temperature)**
FRUIT	**1. Gray-green covered with fine hairs** **2. Two rounded flat nearly ½ inch wide lobes** **3. Each half of the fruit holds one seed.** **4. The seed pod resembles a pair of eyeglasses.**
LEAVES	**1. At base, leaves are up to 6 inch long, deeply pinnately lobed.** **2. Leaves on stems are shorter and less deeply indented.**
STEMS	**Hairy stems**
RANGE	**Deserts of California, Nevada, Arizona, New Mexico, far west Texas, northwestern Mexico**
HABITAT	**Open sandy soil in dry grasslands and deserts, sandstone-based desert shrub land, areas of pinyon-juniper and ponderosa pine**
PROPAGATION	**Seeds**
HUMAN USAGEUSAGE	**Plant made into tea: delirium, applied for swelling especially on the throat; Plant ground into powder: sprinkled on wounds**

COMMON SUNFLOWER (Helianthus annuus)
See Plant Plate 18

FAMILY	**Asteraceae (sunflower family)**
TYPE OF PLANT	**Annual**
SIZE	**Up to 9 feet tall**
FLOWERS	**1. Composite flowers:** **Ray flowers: golden yellow Disk flowers: large purple-brown about 2 inches across** **2. Blooming time: March-October**
FRUIT	**Long, dry, flat-oval, slightly angular one seed that must be split to release the seed**
LEAVES	**1. All leaves are rough and hairy.** **2. Two types of leaves:** • **Oppositely arranged heart-shaped lower leaves** • **Alternately arranged narrow upper leaves**
STEMS	**Erect, rough. and hairy**
RANGE	**Throughout the USA**
HABITAT	**Prairies, dry open areas**
PROPAGATION	**Seeds**

OTHER INFORMATION	**1. They follow the movement of the sun across the sky from east to west. This process is known as heliotropism.** **2. The state flower of Kansas** **3. Sunflowers are native to the Americas and were domesticated around 1000 B.C.** **4. Sunflower is the only flower with "flower" in its name.** **5. A single sunflower can have up to 2000 seeds.**
WILDLIFE USAGE	**Seeds: birds Flower heads and buds: ants, aphids, ladybugs; Nectar: monarch and bordered patch butterflies; Leaves: boarder patch larva chew**
HUMAN USAGE	**Seeds: vegetable oil for cooking and making margarine, bio-diesel, snack, wild bird food, mixed with rye flour, livestock forage; Plant: landscaping**
NATIVE AMERICAN USAGE	**Seeds: ground to make cakes and bread (Navajo), roasted and ground to extract oil (Navajo), given to nursing mothers to give strength to mother and child, eaten for strength when hunting and warring, purple and dark red dye from the shells, oil for softening leather, hair conditioner, wounds; Stems: pith made chewing gum (Pima, Maricopa), pith burned and placed on warts (Navajo), flute with 4 notes to mark the beat for grinding corn in the Enemy Way Ceremony (Navajo); Petals: dried and powder and mixed with yellow cornmeal as a face powder for the Basket Dance; Flower heads: yellow, orange, and green dyes; Plant: used as poultice for snakebites, an ointment for skin sores and inflammation, kidney ailments, tea used to treat: pulmonary problems, rheumatism, screwworm sores on horses, wart removal**

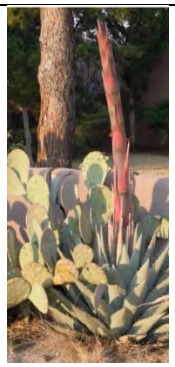
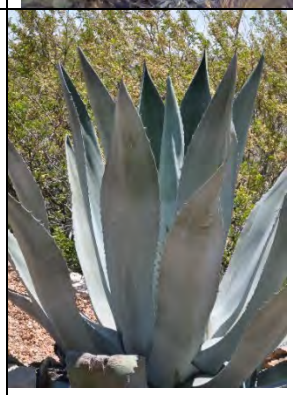
TAHOKA DAISY (Machaeranthera tanacetifolia)

See Plant Plate 22

FAMILY	**Asteraceae (aster family)**
OTHER NAMES	**Tansy-aster, Tansey-leaf-aster, wild aster**
TYPE OF PLANT	**Annual wildflower**
SIZE	**Low, spreading, 12 to 18 inches high**
FLOWERS	**1. Composite Flower: 2 inches wide** **Ray flowers: lavender-blue very narrow Disk flowers: golden yellow** **2. Blooming time: June-October**
FRUIT	**Fuzzy seeds**
LEAVES	**Dense compact fern-like, deeply divided into many narrow segments up to 4 ¾ inches long**
RANGE	**AZ , CA, CO , IL , KS , MT , NE , NM , NV , NY , OK , SD , TX , UT , WY**
HABITAT	**Sandy soil, gravelly soil disturbed grassland, chaparral, pinion-juniper zones**
PROPAGATION	**seeds**
ADAPTATIONS	**1. Drought tolerant**
WILDLIFE USAGE	**Flowers: bees**
HUMAN USAGE	**Plant: landscaping**
NATIVE AMERICAN USAGE	**Plant: tea to treat stomachache (Navajo)**

Desert Sand Verbena (verbena wrightii)
See Plant Plate 21

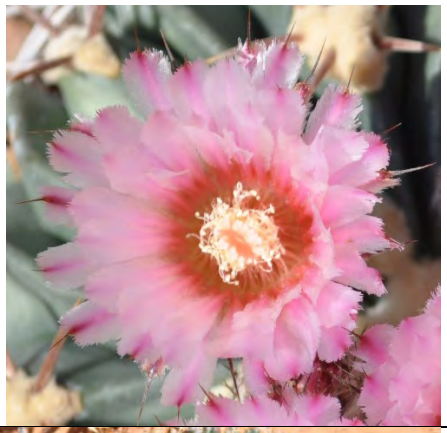
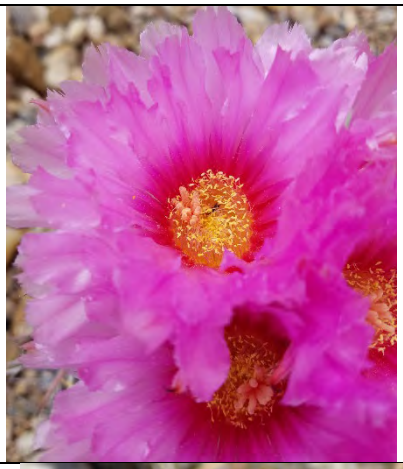
FAMILY	**Nyctaginaceae (four-o'clock family)**
OTHER NAMES	**Sand verbena**
TYPE OF PLANT	**Sweet fragrance annual wildflower**
SIZE	**Up to 6 inches high 20 inches wide**
FLOWERS	**1. Purple, lavender, or pink trumpet-shaped, 5-lobed, fragrant flowers, 2 to 3 inches wide** **2. Blooming time: February- May**
LEAVES	**Green, hairy, sticky**
STEMS	**Ground hugging**
RANGE	**Mojave and Sonoran deserts of southeastern California, southern Nevada, Arizona, New Mexico and northwest Mexico**
HABITAT	**Sandy areas in the deserts of the southwestern United States and northern Mexico, associated with creosote-bush and coastal-sage scrub habitats.**
PROPAGATION	**Seeds**
WILDLIFE USAGE	**Pollen: bees, moths**

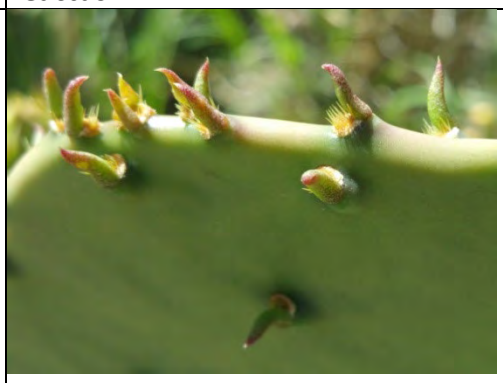
	Agave	Plant Plate 2
New Mexico Agave/ Century Plant **1. Plant/flower** **2. flower** **3. flower**		
Rapid Growth of Century Plant **1. April 12** **2. May 20**		
1. Young New Mexico Agave **2. American Agave**		
Lechuguilla **1. Plants spread by underground pups** **2. Flower**		

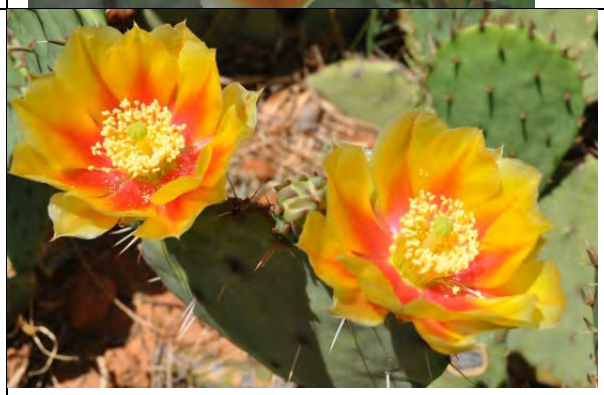
	Yucca		Plant Plate 2
Plant **1. Torry Yucca** **2. Soaptree Yucca** **3. Soapweed Yucca**		 	
<u>All the yucca flowers are white.</u> **1. Torry Yucca** **2. Soaptree Yucca** **3. Soapweed Yucca**			
<u>Fruit</u> **1. Torry yucca looks like bananas** **2. Soaptree yucca old pods** **3. Soapweed yucca**			

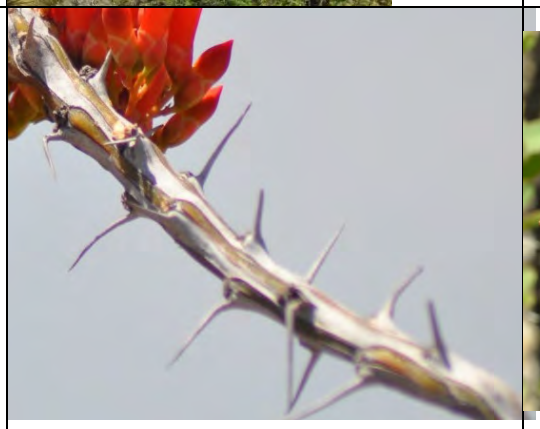
	Cactus	**Plant Plate 3**
Christmas Cholla **1. Plant with red fruit** **2. Fower**		
Pencil Cholla **1.Plant/Spines** **2. Flowers**		
Cane Cholla **1. Plant with flowers and yellow seed pods . The pods do not fall off until the next year.** **2. Flowers**		
Plant Green Pitaya **1. Cactus with buds and new growth on top** **2. Flower**		

		Plants 4 Cactus
Claret Cup Hedgehog **1.Plant** **2. Flower** **3. Plant**		
Strawberry Hedgehog **1. Plant** **2. Flower** **3. Plant**		
New Mexico Rainbow – Hedgehog **1. Plant** **2. Flower** **3. Seed Pod**		
Green Pitaya **1. Cactus with buds and new growth on top** **2. Flower**		

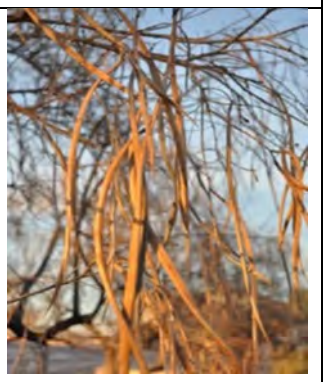
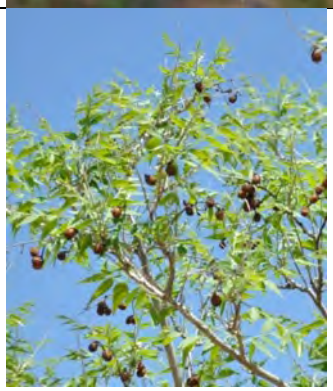
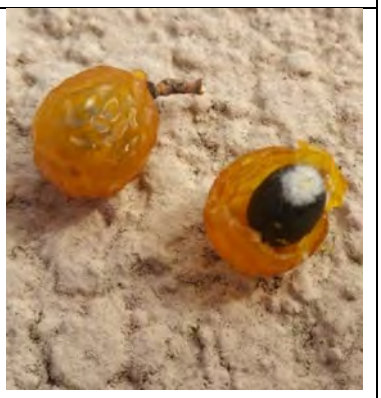
	Cactus	Plant Plate 5
Horse Crippler **1. Flower** **2. Fruit**		
Eagle's Claw **1. Plant** **2. Seed Pod**		
Flower Comparison **1. Horse Crippler** **2. Eagles Claw**		
Nipple Cactus **1. Plant with flowers** **2. Plant with buds**		

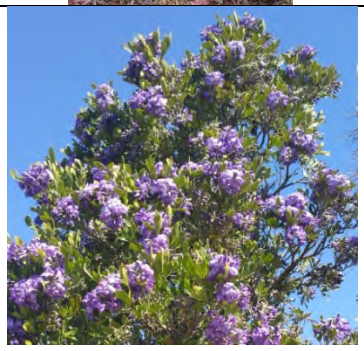
	Cactus	Plant Plate 6
Prickly Pear **1. New Growth Spines** **2. New Growth Fruit and Pods appear in Spring**		
Prickly Pear **1. Spines and glochids growing out of areoles** **2. Fruit called tunas**		
Prickly Pear **1.. Cows tongue/Opuntia englemannii** **2. Bunny ears/ polka -dot /Opuntia microdasys**		
Prickly Pear **1.Purple/ Opuntia macrocentra** **4. spineless /Opuntia ellisiana**		

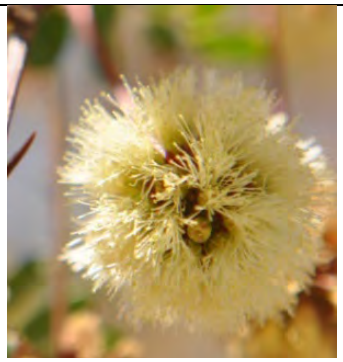
	Cactus	Plant Plate 7
Prickly Pear		
Prickly Pear		
Prickly Pear		
Prickly Pear		

	Grass/Sotol /Ocotillo	Plant Plate 8
Bear Grass **1. Plant with flower** **2. Flower**		
Sotol **1. Plant with flower** **2. Leaves** 3. **Flower with tarantula hawk**	 	
Ocotillo **1. Plant with flowers** **2. Flowers often bloom before leaves appear New primary leaves become spines on the new stem growth. Note the secondary leaves above the newly forming spines.**		
Ocotillo **1. Photosynthesis occurs in the stems when leaves are not present** **2. Flowers attract hummingbirds**		

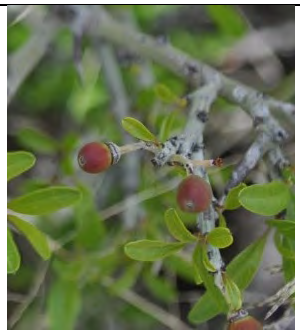
	Trees/ Shrubs	Plant Plate 9
Juniper **1.Tree** **2. unripe female berry** **3. mature berry**		 
Alligator Juniper **1. Tree** **2. Rough Trunk** **3. Berry Like-cone**		 
Pinon **1. Tree** **2. Cone**		
Shinnery Oak **1. Plant** **2. Leaves**		

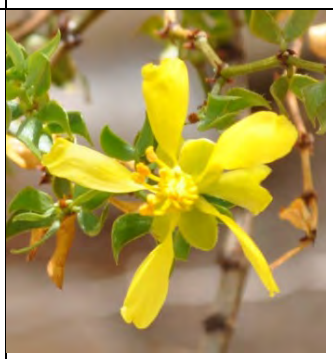
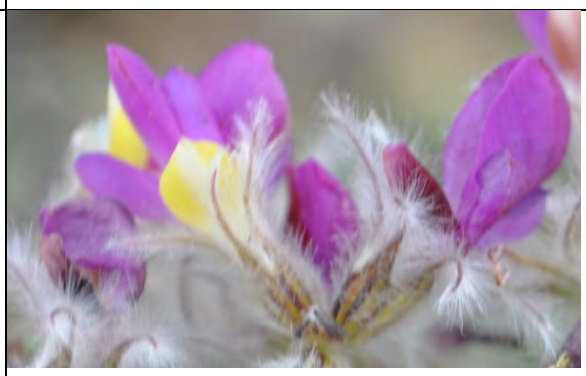
	Trees/Shrubs	Plant Plate 10
Desert Willow 1. Tree 2. Flower 3. Seed pod		 
Soap Berry 1. Tree 2. Seed pod 3. Seed		 
Cottonwood 1. Tree in spring 2. Tree in fall		
Texas Madrone 1. Tree 2. Pealing bark 3. Flowers		 

	Trees/Shrubs	Plant Plate 11
Honey Mesquite **1. Plant** **2. Flower** **3. Developing seed pod** **4. Ripe seed pod**		  
Goldenball Lead Tree **1. Plant** **2. Flower** **3. Seed pod** **Photo: Native Plant Society of Texas**		 
Mexican Buckeye **1. Plant** **2. Flower** **3 Seed pod**		 
Mescal Bean/ Texas Mountain Laurel **1. Plant** **2. Flower** **3. Seed Pod**		 

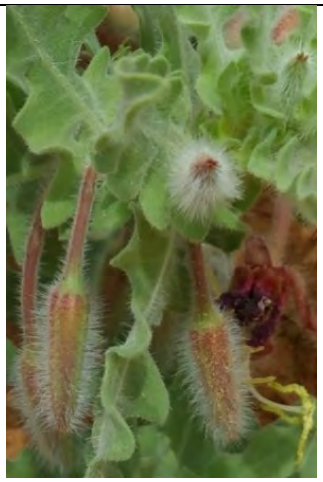
	Trees/Shrubs	Plant Plate 12
Romer Acacia **1. Plant** **2.Flower** **3. Seed pod**		 
White Thorn Acacia **1. Plant** **2.Flower** **3. White thorns**		 
Cat Claw Mimosa **1. Plant** **2.Flower** **3. Seed pod**		 
Plant Galls		

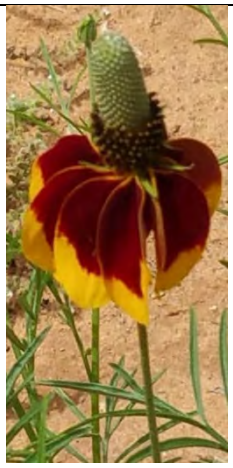
	Trees/Shrubs	Plant Plate 13
Little Leaf Sumac **1. Plant** **2. Flower** **3. Fruit**		 
Algerita **1. Plant** **2. Flower** **3. Fruit**		 
Apache Plume **1. Plant** **2. Flower** **3. Seeds at the base of the flower are attached to the pink styles that get carried away by the wind**		 
Fairy Duster **1. Plant** **2. Flower**		

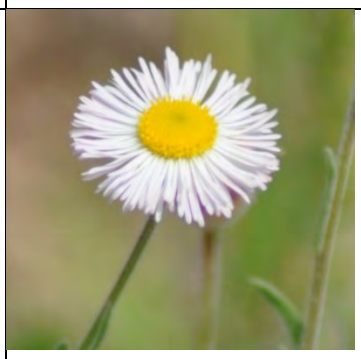
	Trees/Shrubs	Plant Plate 14
Four-winged Saltbush **1. Plant** **2. Salty leaf/ with flowers** **3. Seed pods**		 
Crucifixion Thorn/ Crown of Thorns **1. Plant** **2. Fruit/ thorns**		
Graythorn/ Lote Bush **1. Plant** **2. Fruit** **3. Thorns**		 
American Tar Buah **1. Plant** **Sandhill Sagebrush** **2. Plant**		

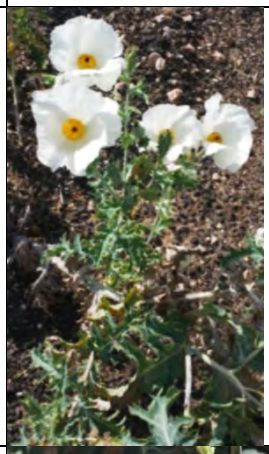
	Trees/Shrubs	Plant Plate 15
Mormon Tea **1. Plant** **2. Stems without leaves** **3. Flowers**	 	
Creosote **1. Plant with flowers** **2.Flower** **3. Seeds**		 
Feathered Dalea **1. Plant** **2. Flower**		
Mariola **1. Flowers** Whitebrush 2. Flowers		

	Trees/Shrubs	Plant Plate 16
Threadleaf groundsel **1. Plant** **2. Flower**		
Skeleton-leaf goldeneye **1. Plant** **2. Flower**		
Threadleaf Groundsel **1. Seeds** **Skeleton-leaf Groundsel** **2. Seeds**		
Broomweed/ Snakeweed **1. Plant** **2. Plant**		

	Wildflowers	Plant Plate 17
Hartweg's Evening Primrose **1. Plant** **2. Flower**		
<u>White Evening Primrose</u> **1. White flower fades to pink** **2. Hairy buds, stems, and leaves**		
<u>Erect Dayflower</u> **1. Plant** **2. Flower**		
<u>Globemallow</u> **1. Plant** **2. Flower**		

	Wildflowers	Plants Plate 18
Common Sunflower **1. Plant** **2. Flower** **Mexican Hat /Prairie Coneflower** **3. Flower**	 	
Blanket Flower **1. Plant** **2. Flower**		
Indian Blanket Flower **1. Plant/ flowers** **2. Flower**		
Bladder Pod **1. Plant with flowers and seed pods** **2. Plant**		

	Wildflowers	Plant Plate 19
Fleabane **1.Plant** **2. Flower**		
Desert Chicory **1. Plant** **2. flower**		
Peppergrass **1.Plant** **2. Flower/ seed pods**		
Spectacle Pod **1. Plant** **2. Flower** **3. Seed pod**	 	

	Wildflowers	Plant Plate 20
Buffalo Burr **1. Plant** **2. Flower/ burrs** **3. Burrs**		 
Prickly Poppy **1. Plant** **2. Flower**		
Jimson Weed **1. Plant** **2. Flower** **3. Seed pod**		 
Thistle **1. Plant** **2. Flower**		

	Wildflowers	Plant Plate 21
Globemallow **1. Plant** **2. Flower** **3. Plant**		
Beebalm **1. Plant/ Flower** **2. Flower**		
Desert Sand Verbena **1. Plant** **Verbena** **1. Plant**		
Wild Rhubarb/ Pale Dock **1. Flower** **2. Seeds**		

	Wildflowers	Plant Plants 22
Tahoka Daisy **1. Plant** **2. Flower**		
Blue Curls/ Fiddleneck **1. Plant with fuzzy leaves** **2. Flower**		
Sand Phlox **1. Plant** **2. Flower**		
Shaggy Stenandrium **1. Plant** **2. Flower**		

	Wildflowers	Plant Plate 23
Desert Marigold **1. Plant** **2. Flower**		
Angelita Daisy **1. Plant** **2. Flower**		
Poppy		

	Wildflowers	Plant Plate 24
Scorpionweed/ Gypphacelia **1. Plant** **2. . Flower**		
<u>Purple Ground Cherry</u> **1. Plant** **2. Flower**		
<u>Filaree</u> **3. Flower**		

SECTION 8

ANIMAL TAXONOMY

Taxonomy- Animals

Taxonomy is the science of classifying organisms in established categories. It is a useful (in some cases essential) tool for zoologists and other biologists. The word is derived from two Greek words: "taxis" meaning arrangement or order and "nomos" meaning law. Hence, taxonomy is the set of laws for arranging living things into categories. The seven most important categories (from largest to smallest) are kingdom, phylum, class, order, family, genus, and species. These are discussed below.

Most classical taxonomy is based on structural features of animals. Animals with major structural similarities (of bones, organs, body coverings etc.) are grouped together. It is the task of the taxonomist to determine which structures truly reflect evolutionary relationships and which structures reflect other factors. This study is called systematics.

Because new information about living things is always becoming available, taxonomists often change their minds or disagree. For example, some classifications of the mammals include seals, sea lions and walruses within the order Carnivora, while others present a separate order, the Pinnipedia, for these animals. It is unlikely that debate will ever rest concerning the lowly tree shrew. Some taxonomists call it a primate, while others refuse it admittance into that lofty group which includes people. There are even taxonomists who prefer placing all the birds and dinosaurs together in the class Dinosauria! We shall use the more traditional arrangement of Mammals, Birds, Reptiles and Amphibians in this manual.

Taxonomy remains a very active branch of science today and has matured into the science of systematics: the study of classification and of the evolutionary processes that give rise to new taxa.

Recently, other "tools" besides structures are being used to classify animals. Three of the most important are (a) similarities and differences of chromosomes and other genetic material, (b) behavioral similarities and differences, and (c) chemical similarities and differences. This additional information often helps the taxonomist sort out which structures are most important for indicating relationships.

Taxonomy is concerned with two things:
- **giving each kind of animal a species name.**
- **arranging species in appropriate families, orders, etc. so that the relationships between different animals are indicated in the classification.**

If a hitherto unknown animal is discovered, it must be:
1. **described in sufficient detail to enable other zoologists to recognize it when other specimens are found;**
2. **given a name (the specimen or specimens from which the new species was described then become "type specimens" of the species and are referred to in the future);**
3. **assigned to a genus, family, order, etc. to indicate its relationship to other animals and, if necessary, new families, orders, etc., have to be created, named and defined to accommodate it.**

Kingdom

There are five kingdoms currently recognized:
- **Animals (digest food within body and absorb it)**
- **Plants (make their food)**
- **Fungi (digest food outside the body and absorb it)**
- **Protista (single celled organisms with a nucleus)**
- **Monera (single celled organisms without a nucleus)**

The animal kingdom is divided into many phyla (plural of phylum).

Phylum

Zoo animals belong primarily to the phylum Chordata, animals which have an internal supporting structure. This structure is in the form of a continuous flexible rod (notochord) or a series of vertebrae which make up a backbone. Nearly all Chordata have a backbone and are called vertebrates. They belong to the subphylum Vertebrata.

Class

The subphylum Vertebrata is made up of a number of classes. For example, there are several classes of fish, collectively called Pisces, including:
- **Class Agnatha (jawless fish)**

- **Class Placodermi (extinct)**
- **Class Chondrichthyes (sharks and their relatives)**
- **Class Osteichthyes (bony fish)**

In addition, there are four classes of vertebrates collectively called Tetrapods: (tetra = 4 and pod = leg) including:

- **Class Amphibia (frogs, toads, and salamanders)**
- **Class Reptilia (lizards, snakes, turtles, and crocodilians)**
- **Class Aves (birds)**
- **Class Mammalia (mammals)**

Order

Each class is split into a number of orders.
There are three orders of living amphibians (plus several extinct orders):

- **Anura frogs and toads**
- **Urodela salamanders and newts**
- **Gymnophiona caecilians (worm-like, legless amphibians)**

There are four orders of living reptiles (plus several extinct orders):

- **Rhychocephalia the tuatara**
- **Crocodilia crocodiles, alligators, gavels, caimans**
- **Chelonia turtles and tortoises Squamata**
  Suborder: :Sauria lizards Suborder :Serpents snakes

The eighteen orders of living mammals are:

- **Monotremata (one hole) egg-laying mammals, platypus, spiny anteater**
- **Marsupialia (pouch) pouched animals --kangaroos, opossum, phalangers, koalas, wallabies**
- **Insectivora (insect eater) insect eating mammals, solenodons, shrews, moles, hedgehogs**
- **Dermoptera (skin wing) flying lemurs**
- **Chiroptera (hand wing) bats**
- **Primates (first) tree shrews, lemurs, tarsiers, monkeys, apes, man**
- **Edentata (without teeth) sloths, anteaters, armadillos**
- **Pholidota (clad in scales) pangolins**
- **Lagomorpha (hard) pikas, rabbits, hares**
- **Rodentia (gnaw or nibble) rodents -- rats, mice, beavers, squirrels, lemmings, porcupines**
- **Cetacea (monstrous) whales, dolphins, porpoises**
- **Carnivora (flesh eater) carnivores --cats, dogs, bears, weasels, otters, skunks, badgers**
- **Pinnipedia (fin foot) seals, sea lions, walruses**
- **Tubulidentata (tube teeth) aardvarks**
- **Proboscidea (snout) elephants**
- **Sirenia (sea nymph) manatees, dugongs**
- **Perissodactyla (odd-toed ungulates) horses, rhinos, tapirs**
- **Artiodactyla (even-toed ungulates) pigs, peccaries, and hippos as well as the ruminants, examples of which are: deer, cattle, antelopes, buffalo, giraffes, camels, sheep, goats**

The twenty-seven orders of living birds are:

- **Struthioniformes ostriches**
- **Rheiformes rheas**
- **Casuariiformes cassowaries, emus**
- **Apterygiformes kiwis**
- **Tinamiformes tinamous**
- **Sphenisciformes penguins**
- **Gaviiformes loons**
- **Podicipediformes grebes**
- **Procellariformes albatrosses, petrels**
- **Pelecaniformes pelicans, boobies, cormorants, snake birds, frigate birds**
- **Ciconiiformes herons, storks, flamingos, ibises**
- **Anseriformes ducks, geese, swans, screamers**
- **Falconiformes vultures, hawks, eagles**
- **Galliformes grouse, quails, turkeys**
- **Gruiformes cranes, rails, coots, bustards**

- **Charadriiformes auks, terns, gulls, stilts, sandpipers, plovers**
- **Pteroclidiformes sandgrouse**
- **Columbiformes pigeons**
- **Psittaciformes parrots, parakeets, cockatoos, lorries, lorikeets, macaws**
- **Cuculiformes touracos, cuckoos**
- **Strigiformes owls**
- **Caprimulgiformes frogmouths, night jars**
- **Apodiformes swifts, hummingbirds**
- **Trogoniformes trogons**
- **Coliiformes mousebirds**
- **Coraciiformes kingfishers, motmots, rollers, hoopoes, hornbills**
- **Piciformes barbets, honeyguides, toucans, woodpeckers**
- **Passeriformes perching birds -- flycatchers, larks, swallows, wrens, thrushes, warblers, sparrows, etc.**

Family

Every order of animals is divided into families. The family level of organization is often a very useful one because it is at this level that "common-sense" similarities and differences become apparent. For instance, it makes sense to differentiate between the dog-like carnivores and the cat-like carnivores. This distinction is implicit in the families Canidae and Felidae.

The scientific name: Genus and Species

The species is the smallest taxonomic level in the series. Since biblical times, people have recognized that there are different "kinds" of living things, and that at some level a group of living things is no longer divisible. But until a few hundred years ago, species were thought to be fixed and unchanging "kinds" of living things. Today we are aware that species do change over time, and so we use a more biological definition rather than depending upon structural features for identifying them. Today we say that species are groups of actually or potentially interbreeding natural populations reproductively isolated from other such groups.

Note that this definition says nothing about the ability of captive individuals to interbreed. Often, individuals of closely related species which do not interbreed in the wild because they occur in different places may successfully interbreed in zoos. In fact, such novelty cross-breeding of animals such as lions and tigers was at one time encouraged. Zoos today are more interested in maintaining the integrity of captive species, so we see fewer and fewer of these novelty offspring. Interestingly, natural populations generally sort themselves out quite well. For example, the closely related mallard and pintail ducks coexist over much of eastern North America without interbreeding despite the fact that captive mallards will mate with captive pintails.

The species name is used together with the genus name of an animal to form its scientific name. No two species ever have the same scientific name. The species name may be used more than once, particularly if it denotes a place such as in Bufo americanus (American toad) or a name such as in Saguinus geoffroyi (Geoffroy's tamarin). Because it is paired with a different genus name, no confusion results in using the same species name for different animals. There may be many americanus species, but only one Bufo americanus. The genus part of the scientific name is comparable to the given name. Scientific names are always underlined or italicized, and the genus part is always capitalized. Sometimes it may be abbreviated, as in B. americanus, if the name Bufo is understood.

One way to remember the order of the categories is to learn the saying below and use the first letter from each word.

Kings play chess on fine grain sand.

Kings Kingdom

Play Phylum

Chess Class

On Order

Fine Family

Grain Genus

Sand Species

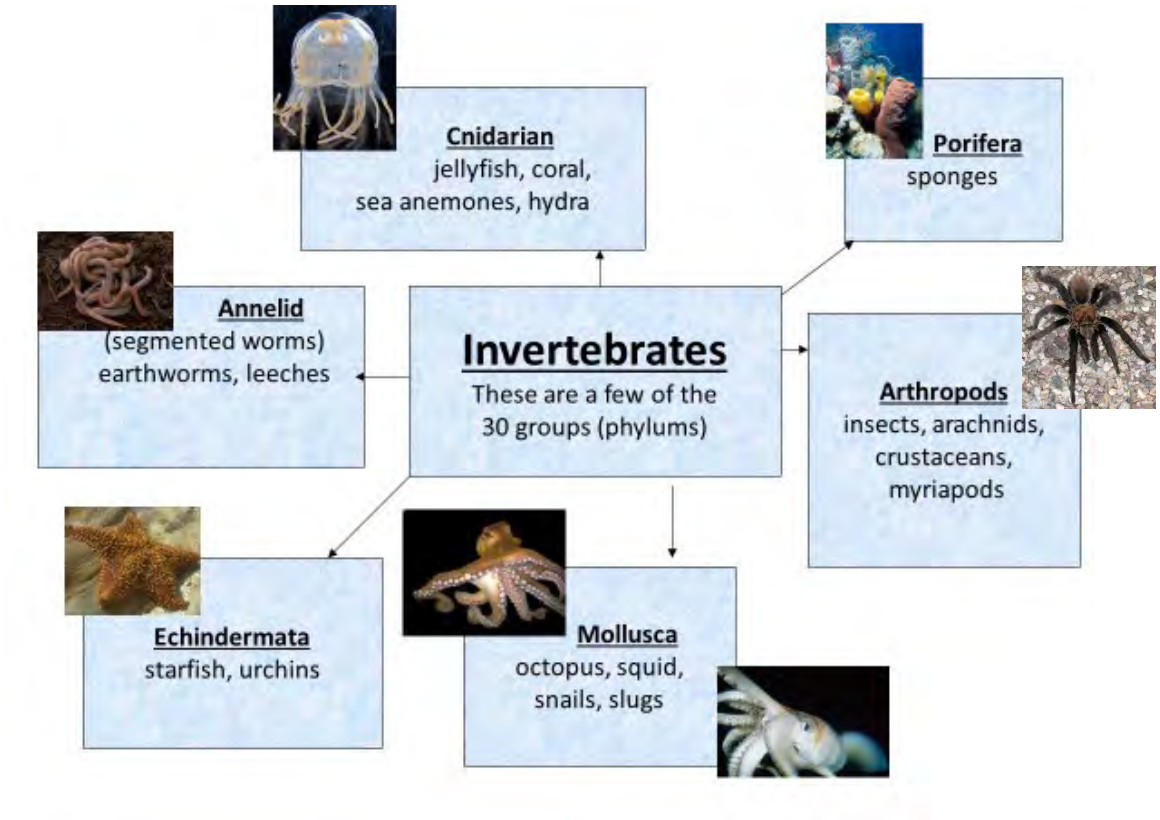
SECTION 9

INVERTEBRATES

Invertebrates

- **Invertebrates are all animals without backbones. This is the only common trait.**
- **About 95 to 98% of all animals identified to date are invertebrates.**
- **Invertebrates are classified into about 30 major groups, or phyla. These include tiny animals such as rotifers as well as all sponges, corals, jellyfish, starfish, worms, mollusks, and arthropods.**
- **Invertebrates have two basic body plans:**
  Radial Symmetry like starfish.
  Bilateral Symmetry where there is a definite front and back end and the right and left sides are mirror images.

Invertebrates range in size from the smallest rotifer at 0.001 mm or 0.00004 inches, to the giant squid which can measure over 60 feet and 4,000 pounds! These squids can reach this size because the water helps support them.



The following chart shows major differences between invertebrates and vertebrates.

Invertebrates	Vertebrates
Over 1,400,000 species- over 95% of all known animals.	Over 85,000 species- About 5% of all known animals
No backbones- they have external skeletons, no skeletal systems, or hydrostatic skeletons.	Have backbones- they have internal skeletons.
All are exothermic.	Birds and mammals are endothermic. Fish, reptiles and amphibians are exothermic.
Not well-developed brains.	Well-developed brains.
Most must shed their external skeleton in order to grow, which can prevent them from becoming very large.	The skeleton grows with the animal and allows them to become bigger than many invertebrates.
The hard external skeleton provides good protection.	The skeleton somewhat protects their organs.
The lack of muscles in some invertebrates prevents them from being very flexible.	Their skeletons and muscles allow them to be very flexible.

Arthropods

Arthropods (arthro = joint; pod = foot or leg) are invertebrates with segmented bodies, jointed legs, and a hard exoskeleton.

More than 85% of all living animal species are arthropods. In terms of sheer numbers and the variety of niches they fill, arthropods are the most successful animals on earth. Over one million arthropod species have been identified so far, but more are still being found.

Metamorphosis

Many animals go through changes in their body forms as they develop into adults. Metamorphosis is part of their life cycles.

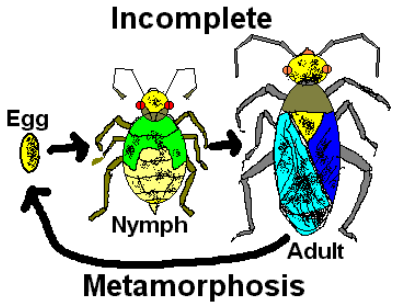
Some of the invertebrates that go through metamorphosis are:

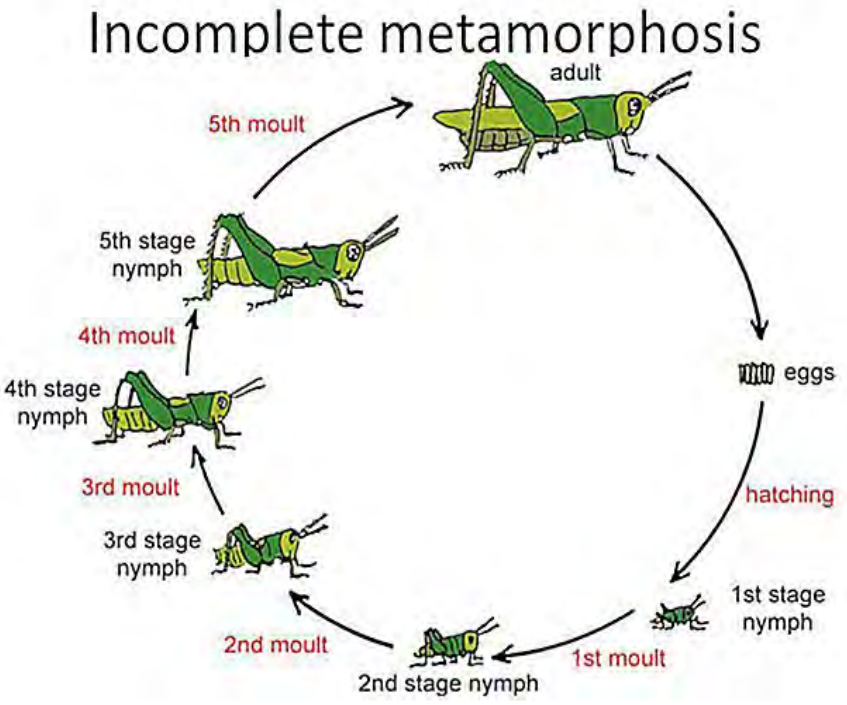
- **insects- dragonflies, butterflies, grasshoppers**
- **arachnids- tarantulas, black widows**
- **myriapods- centipedes, millipedes**
- **mollusks- octopus, squid, snails**
- **crustaceans- lobsters, crabs, shrimp**
- **cnidarians- jellyfish, coral**

There are 2 types of metamorphosis that insects go through are:

Incomplete Metamorphosis

Three stage changes (about 12% of insects go through incomplete metamorphosis)
1. Eggs- The eggs are usually covered by an egg case, which provides protection for them.
2. Nymph-An immature insect goes through 4 to 8 molts in which it sheds its exoskeleton (called instars). After each molting, the nymph looks like a small version of the adult, but lacks adult features such as wings. The size and morphological differences between nymphs in different instars are small, often just differences in body proportions and the number of segments. The nymph eats the same food as the adult.
3. Adult- Finally, after the last molt, the insect emerges in its adult form. It will continue to molt for growth purposes throughout its life.





Complete Metamorphosis

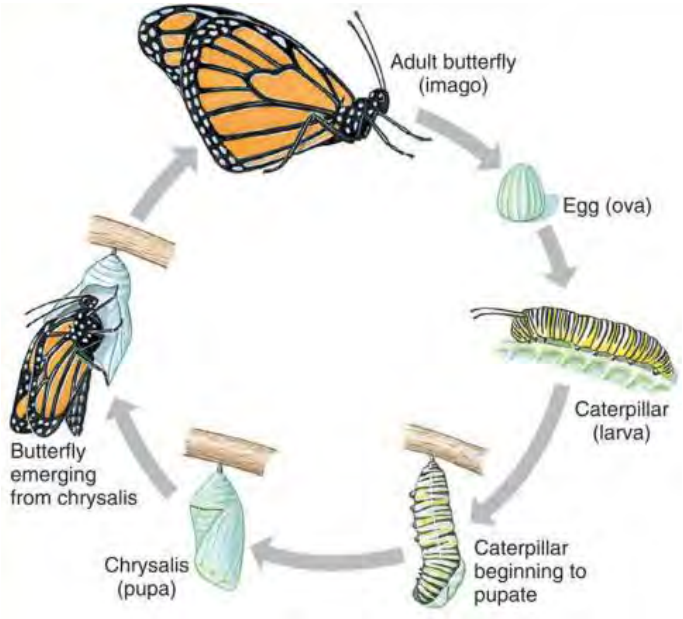
About 88% of all insects go through a four-stage metamorphosis. Insects with complete metamorphosis include beetles, bees, ants, butterflies, moths, fleas, and mosquitoes.

1. **Eggs-are laid in a tough case**

2. **Larvae- The larvae have a soft worm-like shape. They have huge appetites and can eat their own body weight every day. Scientists refer to these developmental changes as instars (shedding of the exoskeleton.) The number of instar stages can be different depending on the type of insect. Some larvae will add more body segments as they grow.**

3. **Pupa- (chrysalis for butterflies, cocoons for moths) At the end of the larval stage the insect will make a hard shell and inside it will become a pupa. At this stage the larva will stop eating and moving. The pupa appears lifeless, but one of Nature's most amazing transformations is happening. Inside the pupa, the larva's body will completely change into a fully grown adult.**

4. **Adult- Once the adult leaves the pupa it slowly stretches out and relaxes under the sun for a couple of hours while its exoskeleton dries out and hardens.**



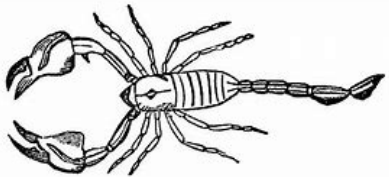
Similarities Between Complete and Incomplete Metamorphosis

- **Both complete and incomplete metamorphosis are types of growth of insects.**
- **Body form of the insect changes in both complete and incomplete metamorphosis.**
- **Both complete and incomplete metamorphosis extend from the egg stage to the adult stage.**
- **A series of molts occur in both complete and incomplete metamorphosis while growing into adult.**

ARTHROPOD CHEAT SHEET

CRUSTACEANS:

5 pairs of legs (at least)
2 pairs antennae



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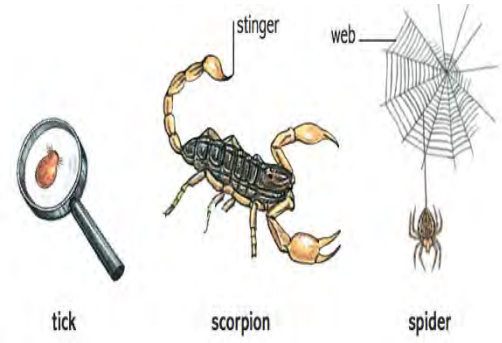
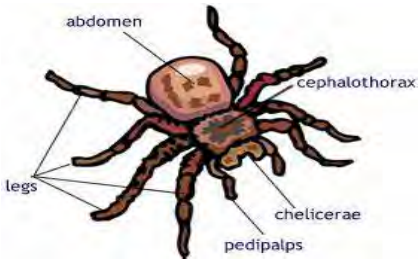


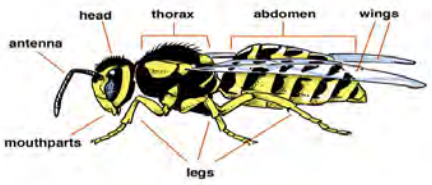
2 body regions: Cephalothorax(the fused head and thorax) and Abdomen
4 pairs legs
0 antennae
1 pair chelicerae (jaw like or fang-bearing appendages)
1 pair pedipalps between mouth and first pair of walking legs (often modified i.e. pincers in scorpions)

SPIDERS:



pedicel (stalk or waist between thin two body regions
spinnerets: (usually 6)

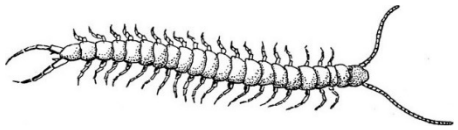
INSECTS:



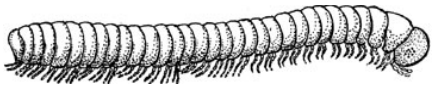
3 body regions: Head, Thorax, Abdomen
3 pairs legs
1 pair antenna
2 pairs wings (some have one pair or none)
2 sets of jaws
2 kinds of eyes: simple and compound

MYRIAPODS:

CENTIPEDES (Chilopoda):
2 body parts - Cephalothorax (the head and thorax are one section), body segments (trunk)
1 pair of legs per body segment (15-191 segments)
1 pair antenna (long) flattened
legs are to the side
carnivorous –poison fangs



MILLIPEDES (Diplopoda)
2 body parts -Head, Cephalothorax (the head and thorax are one section), body segments (trunk)
2 pairs legs per body segment (11-192 segments)
1 pair antenna (short)



INSECTS

ASSASSIN BUG (Reduviidae)

See Invertebrates Plate 1

PHYLUM	**Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes)**
CLASS	**Insecta**
OTHER NAMES	**Wheel bug, reduviid bug, kissing bug**
LIFE SPAN	**1 to 2 years**
SIZE and WEIGHT	**0.2 to 1.6 inches, weight up to 3.4 ounces**
TIME OF ACTIVITY	**Nocturnal. Active from spring through fall. Hibernates in winter.**
RANGE	**Once only found in tropical regions further south, climate change and global warming have since pushed them further north. Found across the bottom two-thirds of the United States, and predominantly in Arizona, California, Texas, and New Mexico.**
HABITAT	**Rainforests, deserts, rocky areas, inside animal nests, in woodpiles, gardens, chicken coops, and more**
SHELTER	**Peoples' homes** **They can share a shelter with nesting vertebrates from which they suck their blood.**
SOCIAL BEHAVIOR	**Social behavior depends heavily on the species, some are solitary, some live-in groups, and some congregate in hiding places. The same goes for reproduction, some species reproduce singly, while other congregate in large groups.**
COMMUNICATION	**Visual and chemical**
TYPE OF DIET	**Termites, aphids, caterpillar eggs, leafhoppers, lady bugs, and asparagus beetle eggs and larvae**
PREDATORS	**Birds, rodents, praying mantis, spiders, and other assassin bugs**
LIFE CYCLE	**Incomplete metamorphosis: Egg-Nymph-Adult**
SEXUAL MATURITY	**The nymph molts five times, and will hibernate just before the last molt to emerge in the summer season as a reproductive adult.**
MATING SEASON	**Spring**
MATING HABITS	**1. Mating occurs in the early summer with males approaching the females via ritualized behaviors that include jumping, antennae touching, and hesitant approaches to copulate.** **2. The males guard the females after copulation to protect the eggs.**
GESTATION	**2 weeks**
# OF OFFSPRING	**Up to 300 eggs are laid in rafts of 20 to 30.**
TIME WITH MOTHER	**None**
THREATS	**Assassin bugs can be a threat to the honey bee population.**
LEGS	**6 legs**
WINGS	**Adults have functioning wings.**
BODY PARTS	• **Head** • **Thorax** • **Abdomen** • **2 pair of wings** • **2 compound eyes and 2 simple eyes** • **1 pair of antennae** • **Proboscis -mouth part used to stab and kill prey** • **3 pairs of legs**
HUMAN USAGE	**These bugs attack many agricultural and horticultural pests.**
DEFENSE ADAPTATIONS	**1. They may lift the tip of the abdomen in the air when walking or resting.** **2. This posture mimics certain types of stinging insects when they are under threat and may be a defensive warning.**
HUNTING ADAPTATION	**1. They stab the victim and then inject a toxin that paralyzes it in a fraction of a second and begins liquefying it.** **2. Once the victim stops twitching, they can insert the maxillae even a little bit farther into the prey and start slurping up the contents.**

BROWN MARMORATED STINK BUG (Halyomorpha halys)

See Invertebrates Plate 1

PHYLUM	**Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes)**
CLASS	**Insecta**
ORDER	**Hemiptera (cicadas, aphids, planthoppers, leafhoppers, shield bug, etc.)**
FAMILY	**Pentatomidae (stink bugs)**
OTHER NAMES	**Stink bug, cat-facing insect**
LIFE SPAN	**6-8 months**
SIZE and WEIGHT	**Size – 5/8 inches weight – .004 ounces**
TIME OF ACTIVITY	**Diurnal, but can be somewhat active at night where they are drawn to light Most active from March through September Will hibernate in winter**
RANGE	**The stink bug is an Asian species that has spread worldwide.**
HABITAT	**They are now found all over the United States.**
SHELTER	**Houses and under debris When a suitable winter shelter is found, it secrets a chemical odor that attracts other stink bugs.**
SOCIAL BEHAVIOR	**They tend to be together in large groups.**
COMMUNICATION	**1. Vibration songs are generated by movements of the stink bugs' abdomen and are transferred to the plant leaves or other substrates on which the stink bug is sitting. 2. Releases chemicals that act as pheromones**
TYPE OF DIET	**1. Most are herbivores that feed on apples, peaches, berries, peppers, beans and pecans. They also feed on field crops like sorghum and cotton. 2. A few species do not feed on plants. They are predators of insects that eat plants. Because of this, most gardener consider the predatory stink bugs to be beneficial.**
PREDATORS	**Eggs: Samurai wasp, pill bugs, several spiders and the wheel bug Adults: spiders, wheel bugs, birds, and lizards**
MATING SEASON	**spring**
SEXUAL MATURITY	**About 2 weeks after their final molt**
MATING HABITS	**1. Both males and females rub their wings or legs against their bodies, which makes a noise to attract nearby stink bugs. (This is like how crickets make a chirping noise by rubbing their wings together.) 2. Stink bugs also emit an odor to attract mates. This odor is a pheromone, which is not the same odor released to deter predators. Both male and female stink bugs release pheromones. 3. After mating, a female stink bug lays her first egg mass on a plant leaf. Egg masses commonly contain barrel-shaped eggs, which are laid in several organized rows.**
GESTATION	**Eggs hatch within five days.**
OFFSPRING BORN	**They hatch as nymphs.**
# OF OFFSPRING	**20-150**
DEGREE OF INDEPENDENCE	**They are fully independent.**
TIME WITH MOTHER	**None**
LIFE CYCLE	**Incomplete metamorphosis: egg -nymph- adult. To grow larger, each nymph must shed its outer covering in order to make room for their larger body. They go through five instars (molts) before reaching adulthood.**
BODY PARTS	**• Head • Thorax • Abdomen • 2 pair wings • 3 pair of legs • 1 pair large eyes • 1 pair of antennae • Stink glands on underside of the thorax**
BREATHES THROUGH	**They breathe with a network of tiny tubes called tracheae. Air enters the tubes through a row of holes along an insect's abdomen.**

OTHER INFORMATIONS	**1. They use their mouth to pierce the skin of the fruit and injects a small amount of saliva into the fruit. The saliva is toxic to the cells of the fruit, so when the damaged fruit grows, it develops a scar. The scar causes the fruit to resemble the face of a cat. Because of this, some people call stink bugs "cat-facing insects."** **2. Stink bugs also feed on stems and leaves of plants.** **3. Besides making fruit unfit for sale, stink bug feeding then allows other insects to enter the fruit.** **4. The stink bug can also spread plant diseases.** **5. These plant-feeding stink bugs can become serious pests in farms, orchards and gardens.**
HUMAN USAGE	**The predatory species help to keep other pest populations down.**
DEFENSE ADAPTATIONS	**1. The glands that produce the defensive chemicals (the "stink") are located on the underside of the thorax, between the first and second pair of legs.** **2. The odor from the stink bug is due to two organic chemicals compounds: trans-2-decenal and trans- 2-octenal. The smell has been characterized as a "pungent odor that smells like cilantro." The stink bug's ability to emit an odor through holes in its abdomen is a defense mechanism meant to prevent it from being eaten by birds and lizards.**

BUTTERFLIES

See Invertebrates Plate 1

PHYLUM	**Arthropoda (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes)**
CLASS	**Insecta**
ORDER	**Lepidoptera (butterflies, moths)**
SUPER FAMILY	**Papilionoidea**
A GROUP IS CALLED	**Flight, flutter, rabble A group of caterpillars – army**
LIFE SPAN	**One month to one year depending on the species**
SIZE and WEIGHT	**Depending on species, anywhere from 1/8 to 12 inches and weight up to .07 to .1 ounce**
FLIGHT SPEED	**The top butterfly flight speed is 12 mph. Some moths can fly 25 mph.**
TIME OF ACTIVITY	**Mid-morning to late afternoon**
RANGE	**Different species can be found on every continent except Antarctica.**
HABITAT	**Found in every habitat from tropical rain forests to deserts**
SHELTER	**Trees (dead or alive), tall grasses, and even rock piles provide great places for butterflies to hide during bad weather** **Butterflies also use these shelters at night, when they rest.**
SOCIAL BEHAVIOR	**1. Most adult butterflies tend to be solitary.** **2. However, at sunset, many species of butterflies of the genus Heliconius bed down in gangs of about 4 to 15 individuals to help protect themselves from predators.**
COMMUNICATION	**1. Adult butterflies communicate with one another mostly through chemical clues.** **2. A few species communicate with sound. One species makes clacking sounds with its wings.**
TYPE OF DIET	**1. Most adult butterflies drink nectar from flowers through their tongues (proboscis), which function much like straws.** **2. A minority of butterflies eat tree sap, rotting animal matter, and other organic material.** **3. Butterfly caterpillars almost all eat plant matter.**
PREDATORS	**Wasps, ants, parasitic flies, birds, snakes, toads, rats, lizards, dragonflies, frogs, spiders and even monkeys**
MATING SEASON	**Monarch butterflies mate during February and March.**
SEXUAL MATURITY	**Adults emerge from the chrysalis and reach sexual maturity in four to five days.**
MATING HABITS	**1. Male butterflies find females by pheromones and sight.** **2. If the female accepts the male, they couple end to end and may go on a short courtship flight.** **3. The male passes a sperm packet called a spermatophore to the female. The sperm then fertilize each egg as it passes down the female's egg-laying tube.**
GESTATION	**The larva usually hatches out of the eggs in 2-3 weeks.**
OFFSPRING BORN	**Hatch as larva**

# OF OFFSPRING	**An average of 100 – 300 eggs are laid**
DEGREE OF INDEPENDENCE	**Totally independent**
THE YOUNG	**Only about 2% of eggs laid make it to the adult stage.**
TIME WITH MOTHER	**None**
THREATS	**Climate change, widespread pesticide use, and invasive species**
LIFE CYCLE	**Complete metamorphosis: (egg – larva (caterpillar) – pupa (chrysalis) - adult**
BODY PARTS	• **Head** • **Thorax** • **Abdomen** • **1 pair of antennae that act like our taste buds** • **1 pair of simple eyes that detect light** • **1 pair of compound eyes which is their main sight** • **2 pair wings that helps in heat regulation and are able to repel water**
BREATHES THROUGH	**They breathe through a series of tiny openings along the sides of their bodies, called "spiracles."**
OTHER INFORMATION	**1. Monarch butterflies journey from the Great Lakes to the Gulf of Mexico, a distance of about 2,000 miles, and return to the north again in the spring.** **2. Butterflies cannot fly if their body temperature is less than 86 degrees.**
WEATHER	**Some people say that when the black bands on the Woolybear caterpillar are wide, a cold winter is coming.**
VISION	**Butterflies can see red, green, and yellow colors.**
FEET AND CLAW ADAPTATIONS	**Many butterflies can taste with their feet to find out whether the leaf they sit on is good to lay eggs on to be their caterpillars' food.**
DEFENSE ADAPTATIONS	**Many butterflies use body markings and colors as camouflage to escape predators.**

CARPENTER BEE (Xylocopa)

See Invertebrate Plate 2

PHYLUM	**Arthropoda (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes)**
CLASS	**Insecta**
ORDER	**Humenoptera (wasps, hornets, ants)**
FAMILY	**Apodea (bees)**
OTHER NAMES	**None**
LIFE SPAN	**Males live about 1 year and usually die shortly after mating. Females will live a little longer but never live to the second summer.**
SIZE	**1 inch**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**A wide variety of habitats**
SHELTER	**They nest in bored holes in dead wood. Old nests are used year after year and offspring will often construct their nests alongside old nests. For this reason, a single nest one year will become two or three the following year.**
SOCIAL BEHAVIOR	**Solitary**
COMMUNICATION	**Buzzing sounds and pheromones**
TYPE OF DIET	**Nectar, pollen**
PREDATORS	**Woodpeckers and various other species of birds, such as bee-eaters as well as some mammals and predatory flies**
MATING SEASON	**Spring**
MATING HABITS	**1. Two very different mating systems appear to be common in carpenter bees, depending on the physical characteristics of the male bee.** **2. Males with large eyes search for females by patrolling, or by hovering and waiting for passing females, which they then pursue.** **3. Males with very small heads release pheromones to advertise their presence to females.** **4. Following mating, the female makes a nest by chewing a cavity by vibrating her body as she rasps her mandibles against the wood of a sotol, yucca, agave bloom stock, dead tree trunks and limbs, firewood or other wooden structures. Moving from one end of the cavity to the other, she puts one egg and pollen and/or nectar, in a cell that she sections off with wood debris and saliva. Here, the larvae mature, pupate, and emerge as adults.**
GESTATION	**About seven weeks from egg to adult**

OFFSPRING BORN	**Larva hatch from the eggs**
# OF OFFSPRING	**6-10 eggs. The female usually only lays eggs once in her lifetime.**
DEGREE OF INDEPENDENCE	**Totally independent.**
THE YOUNG	**Each new generation is hatched in the late summer, emerging from nests to grow and feed, pollinating flowers as they go before settling in for the winter and hibernating. Survivors emerge in April and May to mate.**
THREATS	**Pesticides**
LIFE CYCLE	**Complete metamorphosis: Egg – Larva – Pupa – Adult**
BODY PARTS	• **Head** • **Thorax** • **Shiny black hairless abdomen** • **Antennae** • **2 pair of wings** • **1 pair of large compound eyes** • **3 pairs of legs**
BREATHES THROUGH	**Breaths through small holes along the sides of the abdomen called spiracles**
OTHER INFORMATION	**1. The carpenter bee ranks as an important pollinator of the flowering plants.** **2. The damage done by carpenter bees to a wooden structure is usually quite superficial. However, given enough time and enough seasons, they can cause a lot of damage.**
HUMAN USAGE	**Pollinate crops**
WEATHER ADAPTATIONS	**Hibernates in winter**
DEFENWSE ADAPTATIONS	**1. The male carpenter bee can be aggressive, but are harmless because they do not have stingers.** **2. The female has a stinger and can inflict a painful wound.**

DRAGONFLIES

See Invertebrates Plate 1

PHYLUM	**Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)**
CLASS	**Insecta**
ORDER	**Odonata (dragonflies, damselflies)**
FAMILY	**Petaluridae (dragonflies)**
OTHER NAMES	**Darner, darning needle, dining needle, ear skewer, horse-stinger, mosquito fly, mosquito hawk, and needle**
LIFE SPAN	**With a lifespan of up to five years as nymphs and six months as adults, dragonflies have a relatively average lifespan when compared to many other insects.**
SIZE	**Depending on the species, from one inch to six inches**
WEIGHT	**Average is about 0.5 to 1 ounce.**
TIME OF ACTIVITY	**Diurnal**
RANGE	**Worldwide in all kinds of habitats if fresh water is present**
HABITAT	**Freshwater habitats, including lakes, bogs, seepages, rivers, springs, and sinkholes**
SHELTER	**Shallow water with a lot of vegetation and debris**
SOCIAL BEHAVIOR	**Solitary**
COMMUNICATION	**Adult dragonflies communicate visually much more than most other insects. Males fight aerial duels for territory, displaying their size and speed to each other. Mating pairs probably communicate by touch and possibly by chemically.**
TYPE OF DIET	**Adults- Mosquitos, midges, caddis flies, other flying insects** **Naiad (immature dragonflies)-insects, tadpoles, small fish**
PREDATORS	**Birds, especially the more acrobatic fliers such as flycatchers, swallows, kingfishers, falcons, and kites** **Spiders, praying mantis, robber flies, and bats**
SEXUAL MATURITY	**Shortly after emerging as an adult**
MATING HABITS	**1. The male finds and defends its pond area and then attracts a female.** **2. He transfers his sperm to a spot near his abdomen. The male then grasps the female by her head with the claspers at the end of his abdomen. They fly together, and usually perch on a twig or plant stem. The female curls her**

	abdomen downwards and forwards under her body to pick up the male's sperm. 3. Still joined together, the male and female dart over floating or waterside vegetation to find a suitable place to deposit eggs. 4. The female lays eggs by tapping the surface of the water repeatedly with her abdomen, by shaking the eggs out of her abdomen as she flies along, or by placing the eggs on vegetation.
MATING SEASON	April through October
GESTATION	Most dragonfly eggs hatch in one to three weeks, but some species can overwinter.
OFFSPRING BORN	The hatching larvae are aquatic nymphs.
# OF OFFSPRING	A clutch may have as many as 1500 eggs.
DEGREE OF INDEPENDENCE	Total independence
THE YOUNG	They hatch into aquatic nymphs or naiads which molt between six and 15 times depending on the species.
TIME WITH MOTHER	None
THREATS	Habitat destruction, pollution, and climate change (global warming).
LIFE CYCLE	Incomplete metamorphosis- egg – larva (called naiad) –adult
BODY PARTS	• Head • Thorax • Abdomen • 1 pair stubby little antennae • 1 pair compound eyes that provide an almost 360-degree vision • 2 pairs of wings
BREATHES THROUGH	Spiracles (tiny holes in the abdomen)
WINGS	1. Two pairs of long delicate, membranous wings that may vibrate as many as 1,600 times a minute 2. They can hover like a helicopter. They can shoot ahead like an arrow. They can also zoom upward, dive, and even fly backward while they search for food. 3. The flight of the dragonfly is so special that it has inspired engineers who dream of making robots that fly like dragonflies.
OTHER INFORMATIONS	1. Dragonflies do not have true teeth but they do have extremely large, strong jaws with sharply-pointed tooth-like serrations. 2. Dragonflies cannot hear and don't have much sense of smell.
HUMAN USAGE	1. Dragonflies, which eat insects as adults, are a great control on the mosquito population. A single dragonfly can eat 30 to hundreds of mosquitos per day. 2. They have also been used in traditional Chinese and Japanese medicine.
WEATHER ADAPTATIONS	Many dragonfly species will migrate in the winter.
HUNTING ADAPTATIONS	1. Dragonflies are expert hunters. They catch their insect prey by grabbing it with their feet. 2. They're so efficient in their hunting that, in one study, the dragonflies caught 90 to 95 percent of the prey released into their enclosure.

DUNG BEETLE

See Invertebrates Plate 2

PHYLUM	Arthropods: spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)
CLASS	Insecta
ORDER	Coleoptera (beetles, weevils)
FAMILY	Scarabaeidae (scarb beetles)
OTHER NAMES	Dung chafer, tumblebug
LIFE SPAN	Depending on species from 13 weeks to 12 years.
SIZE	1. Depending on species, size can be 0.02 to 7 inches 2. Weight of the heaviest one (Goliath beetle) is 3.5 ounces.
WEIGHT PUSHED	Can push 1,141 times its body weight making it the strongest living creature on earth. (That would be the same as a human lifting 180,000 pounds.)

TIME OF ACTIVITY	**Dark colored beetles are more nocturnal, and brightly colored beetles are more diurnal.**
RANGE	**Found in all areas of the world except Antarctica**
HABITAT	**A full range of habitats from tropics to deserts**
SHELTER	**In burrows inside their ball of dung**
SOCIAL BEHAVIOR	**Mostly solitary as other dung beetles will try to steal the dung ball from each other.**
COMMUNICATION	**Auditory through vibrations and chemical**
TYPE OF DIET	**1. They eat the dung of herbivores and omnivores.** **2. They do not necessarily have to eat or drink anything else, because the dung provides all the necessary nutrients.**
PREDATORS	**Crows, foxes and other vertebrates**
MATING SEASON	**Spring**
SEXUAL MATURITY	**Three weeks after emerging as an adult.**
MATING HABITS	**1. The male make a brood ball and begins rolling it. If a female likes what she sees, she may either help him push it or hop on the dung ball and go for a ride.** **2. While the male is pushing his prize to an ideal spot, he will have to fend off other males trying to steal his treasure.** **3. Once at a good spot, the pair will then bury the dung ball into soft soil (or, in some species, just leave it in a bed of vegetation), mate and lay eggs in the ball.** **4. After mating, some species do not leave, but remain to safeguard their offspring.**
GESTATION	**Depending on species a few days to several months**
OFFSPRING BORN	**Hatch as larvae**
# OF OFFSPRING	**Some large species of dung beetles may only produce one or two offspring, while other species may produce dozens in a year**
DEGREE OF INDEPENDENCE	**Depends upon species. In most cases the larvae are left on their own.**
TIME WITH MOTHER	**In some cases, females will stick around to look after their brood.**
THREATS	**Some species of scarab are threatened by habitat loss and collection by beetle hunters, but the scarab population is stable.**
LEGS	**6 legs**
WINGS	**They have wings but most species are poor fliers**
LIFE CYCLE	**Complete metamorphosis. Egg—Larvae—Pupa—Adult** **The larvae live in brood balls prepared by their parents. During the larval stage, the beetle feeds on the dung surrounding it.**
BODY PARTS	• **Head** • **Thorax** • **Abdomen** • **1 pair of Antennae** • **1 pair of compound eyes** • **3 pairs of legs** • **2 pair of wings- the outer leathery protective wings are called elytra and when those spread apart the 2 flight wings unfold and are extended**
BREATHES THROUGH	**They do not breathe; instead, they have holes called spiracles in the sides of their bodies which lead to trachea, which act like lungs.**
OTHER INFORMATIONS	**1. After making a dung ball, the beetle follows a straight line despite all obstacles.** **2. Dung beetles can navigate when only the Milky Way or clusters of bright stars are visible, making them the only insects known to orient themselves by the Milky Way.** **3. Sometimes, dung beetles try to steal the dung ball from another beetle, so the dung beetles have to move rapidly away from a dung pile once they have rolled their ball to prevent it from being stolen.** **4. The ancient Egyptians thought the dung beetle (scarab) was an incarnation of the sun god Khepri. They had observed the young beetles emerged from their dung balls and thought they looked like the spherical sun. They believed that when the sun set in the west the scarab pushed it through the**

	night to the east and then over the edge of the earth at sunrise.
HUMAN USAGE	1. Dung beetles play a role in agriculture by burying and consuming dung, they improve nutrient recycling and soil structure. 2. They can protect livestock, such as cattle, by removing the dung which, if left, could provide habitat for pests such as flies and spread diseases.

PRAYING MANTIS (Mantis religiosa)
See Invertebrates Plate 1

PHYLUM	Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)
CLASS	Insect
FAMILY	Mantidae (mantis)
OTHER NAMES	God-horse
LIFE SPAN	The praying mantis lives from the spring into the fall. They only live about 6 months as adults.
SIZE and WEIGHT	The largest females are about 10 inches with an average weight of 1.4 to 1.7 ounces. Males are usually a little smaller.
TIME OF ACTIVITY	Most are diurnal although some species can be nocturnal.
RANGE	Throughout the world
HABITAT	Many different habitats from tropical to deserts.
SHELTER	During bad weather, mantids seek shelter in plants, bushes, and other woody places. When it is very hot, they seek shade to keep from dehydrating.
SOCIAL BEHAVIOR	Mostly solitary
COMMUNICATION	Visual, chemical, and mechanical (males call out loudly to females)
TYPE OF DIET	While the praying mantis prefers cockroaches and flies, it may attack any number of other insects as well as spiders, salamanders, frogs, mice and hummingbirds.
PREDATORS	Spiders, snakes, birds and the bats
SEXUAL MATURITY	They are sexually mature once they reach the adult stage of life.
MATING HABITS	1. In some species, the male and female engage in a ritualistic courtship dance, stroking each other fondly with their antennae before they finally mate. 2. The female will eat the male unless he is able to fly away to safety. 3. In the fall, the female makes her egg sack, carefully places her eggs in the sack, and then covers it with a froth that dries and hardens like plaster. 4. She leaves the sack attached to the twig or a trunk of a tree to await the spring hatch. 5. She will die within a few weeks.
MATING SEASON	Spring
GESTATION	3 to 10 weeks
OFFSPRING BORN	Hatch as nymphs
# OF OFFSPRING	Up to 300 eggs are laid. Only about one fifth will survive to adulthood.
DEGREE OF INDEPENDENCE	Totally independent
THE YOUNG	Nymphs undergo between 7 to 15 molts before becoming adults.
TIME WITH MOTHER	None
THREATS	Habitat destruction and deforestation
LIFE CYCLE	Incomplete metamorphosis Egg – Nymph – Adult
BODY PARTS	• Head has a distinctively triangular shape • Thorax • Abdomen • 1 pair of long antennae • 1 pair large compound eyes and 3 simple eyes between them • 3 pair of legs- the front larger ones catch prey, the last 2 are for walking • 2 pair of wings-(female don't fly) males outer wings are used to protect the inner flying wings
BREATHES THROUGH	Spiracles (holes in the sides of the abdomen exchange gases)
OTHER INFORMATIONS	1. They can swivel their heads from side to side in a 180-degree rotation (the only insects in the world able to do this). 2. They have only one ear, which it uses to alert it to potential predators,

	especially its worst enemy, bats.
HUMAN USAGE	Some people keep them as pets. They are also used to get rid of garden pests, not realizing mantis do not distinguish between harmful and useful insects (like bees) and will eat both.
DEFENCE ADAPTATIONS	If threatened, its mouth emits a molasses-colored, evil-smelling, foul liquid that creates a gooey and perhaps fatal mess.
HUNTING ADAPTATIONS	1. The praying mantis is a master at camouflage and can hunt throughout the day. 2. It may either ambush or stalk its prey. 3. It uses its "prayerful" front legs to quickly snatch up an unsuspecting victim, locks it tightly in a barbed nutcracker-like clinch and devours it alive. 4. Given the opportunity, it may hold one victim with one front leg and snatch another with the other. 5. If another praying mantis wanders too near, the two may join in a savage fight to the death, with the winner eating the loser.

TARANTULA WASP

See Invertebrates Plate 1

PHYLUM	Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)
CLASS	Insecta
ORDER	Hymenoptera (sawflies, wasps, bees, ants)
FAMILY	Pompilidae (spider wasps, spider hunting wasps) 5,000 species that prey solely on spiders
LIFE SPAN	Adult males live a few weeks or so Females can live four to five months
SIZE	Up to 2 to 3 inches with a wingspan up to 4 inches) Females are larger than males.
TIME OF ACTIVITY	1. Diurnal, but they avoid the hottest part of a summer day 2. Nocturnal when hunting tarantulas
RANGE	The Americas, India, southeast Asia, Africa, Australia
HABITAT	15 species in the United States, with 9 species in the desert
SHELTER	Burrows, natural cavities, or burrows of other insects or animals
SOCIAL BEHAVIOR	Solitary
COMMUNICATION	The bright colors tell the predator "See me. I am bright, bold, and dangerous; if you attack me you will suffer."
TYPE OF DIET	Nectivorous: (nectar and pollen) milkweeds, soapberry trees, mesquite trees, etc. The consumption of fermented fruit sometimes intoxicates them to the point that flight becomes difficult.
PREDATORS	Roadrunners (sometimes)
MATING HABITS	1. The males emerge from their underground cell to seek flowers and begin their mating behavior. They will go to hilltops or other higher places (hill topping) to establish their mating territory (leks), so they can watch for a passing female that is ready to reproduce. The males will fight other males to keep their territories. 2. The females emerge from their cells to seek nectar and go to find a mate. 3. They mate briefly and only once in their life. 4. Using her scents of smell, the female finds a tarantula in its burrow. She enters the burrow and brings the spider out and stings it. It takes only seconds for the tarantula to become paralyzed. The hawk grasps one leg in her mandibles and walking backwards drags the spider back to its burrow. She lays 1 egg and then tears down the burrow's walls and using her abdomen, she packs down the entrance before she leaves.
THE YOUNG	1. The larva hatches in 3 to 5 days and spends the next 35 days feeding on the still living spider. 2. The larva saves the vital organs, such as the heart and central nervous system, for last. By waiting until the final larval instar, it ensures the spider will not decompose before the larva has fully developed. 3. Once the tissue of the spider has been consumed, the larva spins a cocoon in which it pupates. 4. It will over-winter in the cocoon chamber and emerge in spring as an adult.
OFFSPRING BORN	1. If the stung tarantula is small, the female wasp will lay an unfertilized egg,

	which will result in a male being born. 2. If the stung tarantula is large, the female lays a fertilized egg, which will result in a female being born.
LIFE CYCLE	1. Complete metamorphism Egg- Larva- Pupa-Adult
BODY PARTS	• Head • Thorax • Abdomen • 3 pair of legs with hooked claws for dragging the tarantula • 2 pair of wings • 1 pair of compound eyes • Stinger • 2 antennae
OTHER INFORMATIONS	2. They have the most painful sting of any insect in the United States. 2. They have a very painful sting that rates high in the Schmidt sting pain index. Schmidt described the sting as, "blinding, fierce, shockingly electric." 3. The sting is not deadly to humans, but it is worse than a bee, wasp, or ant. 4. They are not aggressive- a person would have to be handling it to be stung. 5. The state insect of New Mexico
DEFENCE ADAPTATIONS.	1.Their metallic blue-black bodies with orangish wings (known as anosmatic coloring) warns predators that they are deadly and should be left alone. 2. They make jerky movements while on the ground and flick their wings, so the predators will be sure to notice them with their colors. 3. They will buzz their wings to give an audible warning. 4. The wasp's hard, slippery, body is too tough to be smashed fast enough by beaks and jaws to avoid a sting to the mouth or tongue. 5. As a last resort, they will produce a powerful odor.

VELVET ANT (Dasymutilla klugii)

See Invertebrates Plate 2

PHYLUM	Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)
CLASS	Insecta
ORDER	Hyenoptera (sawflies, wasp, bees, ants)
FAMILY	Mutillidae (wasp whose wingless females resemble large hairy ants)
OTHER NAMES	Mutillid wasp, cow killer, mule killer (The velvet ant is actually not an ant, it is a wasp.)
LIFE SPAN	Under 1 year
SIZE	1/8 to 1 inch
RUNNING SPEED	0.3 miles per hour. This is usually fast enough to outrun predators.
TIME OF ACTIVITY	Diurnal Most active April through November
HABITAT	Throughout the United States and can be found in all Chihuahuan desert environments
SHELTER	They will burrow under debris or climb into plants for shelter.
SOCIAL BEHAVIOR	Mostly solitary although they have been known to gather in large groups during mating season.
COMMUNICATION	They can make a high-pitched squeak when threatened. They can also produce a "warning signal" pheromone to ward off predators.
TYPE OF DIET	They primarily feed on nectar but they will also eat larvae and adult insects such as flies, beetles, bees, and other wasps. The larva feed on the larva of the insects where the mother has laid her eggs.
PREDATORS	They are only preyed upon by predators that normally eat the ants they look like. They have multiple defenses that keep them safe from most predators.
MATING SEASON	Towards the end of spring for a period of 12 days
SEXUAL MATURITY	When they reach the adult stage of the life cycle
MATING HABITS	The whole pairing interaction, lasting around two hours, includes several behavioral phases. During copulation (lasting around two minutes), the male moves his antennae rhythmically, hitting the back of the female's head with the scape (a tooth-like projection on the second section of the abdomen against a ridged structure on the third section, the "file"). During the whole pairing act, females are held by the males' mandibles.

DEGREE OF INDEPENDENCE	**Totally independent**
THE YOUNG	**After the larva is hatched, it feeds on the pupa it was laid next to and then uses the empty pupa case to build its own pupa case in.**
THREATS	**Pesticides and human encroachment on habitats**
LIFE CYCLE	**Complete metamorphosis Egg – Larva – Pupa - Adult**
BODY PARTS	• **Head** • **Thorax** • **Abdomen** • **3 pair of legs** • **2 pair of wings (males only)** • **Stinger** • **1 pair of antennae** • **1 pair of compound eyes, 3 small simple eyes called ocelli**
BREATHES THROUGH	**Spiracles (holes along the sides of the abdomen that lead into trachea, they do not have lungs.)**
OTHER INFORMATIONS	**1. They have "hair" covering their backs which gives them their velvety appearance.** **2. Their sting is one of the most painful, but their venom is very mild.** **3. Like all wasps, they can sting multiple times.** **4. The males are rather plain-looking. The females are bright and furry.**
HUMAN USAGE	**Help to keep down populations of ground dwelling wasps and bees.**
BODY ADAPTATIONS	**1. Different species of velvet ants mimic each other in appearances.** **2. By resembling other velvet ant species from their neighborhood, these solitary creatures have found strength in numbers.**
DEFENCE ADAPTATIONS	**1. Their powerful exoskeleton with smooth edges prevents them from being crushed in the mouths of predators or under a human foot.** **2. They can make squeaking sounds to warn off predators.** **3. They can release unpalatable chemicals, causing predators to spit them out due to the bad taste.**

CRUSTACEANS

PILL BUG

See Invertebrates Plate 1

PHYLUM	**Arthropods (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes. etc.)**
CLASS	**Malacostraca (crustaceans which includes crabs, shrimps, lobsters, isopods, and amphipods)**
ORDER	**Isopoda (aquatic and terrestrial malacostracan crustaceans)**
FAMILY	**Armadillidiidae (wood lice)**
OTHER NAMES	**Sow bug, wood lice, potato bug, armadillo bug, roly-poly (called roly-poly because they roll up into a compact ball)**
LIFE SPAN	**Up to 2 years**
SIZE	**½ to ¾ inch long**
ACTIVITY	**Nocturnal**
RANGE	**Throughout the world**
HABITAT	**Moist environment- rotting wood, under rocks and leaves, etc.**
SHELTER	**They often take shelter beneath rotting logs or rocks, moist cracks and crevices where plant debris builds up**
SOCIAL BEHAVIOR	**1. They aren't particularly social, but some are apparently attracted to the smell of their own kind.**
COMMUNICATION	**1. They have poor vision and probably communicate chemically.** **2. They also sense vibrations.** **3. Another form of communication is tapping another pill bug with its antennae.**
TYPE OF DIET	**They eat rotting vegetation and help nutrients in getting returned to the soil for plants to feed on, so they're not pests.**
PREDATORS	**Centipedes, spiders, ants, birds, amphibians, anything that eats invertebrates**
SEXUAL MATURITY	**After their fifth molt at about one year.**
MATING HABITS	**1. In spring they become active and mating may occur with the male guarding the female from the attention of other males.** **2. Females will produce a number of eggs that are carried in a pouch on her**

	abdomen.
MATING SEASON	Late spring to early summer
GESTATION	Two months
OFFSPRING BORN	Up to 50
# OF OFFSPRING	30 to 50 eggs in a brood pouch which is filled with fluid
DEGREE OF INDEPENDENCE	Dependent on mother until they can forage on their own
THE YOUNG	Look like small adults
TIME WITH MOTHER	1. After hatching, the young will remain in the pouch for a period of time before leaving to be on their own. 2. They are totally independent once they leave the brood pouch.
THREATS	None
LIFE CYCLE	Simple metamorphosis egg- manta (which has two sub-stages)- juvenile (which has several sub-stages)- adult There is no nauplius stage, which most crustaceans have. Instead, embryos hatch as immaturely developed adults.
BODY PARTS	• Head • 2 pairs of antennae, one pair which you can't see • 1 set of very simple eyes (too tiny to see without a microscope) • Thorax having seven segments and a pair of legs attached to each segment. • Abdomen has five segmented plates with two hairy uropods on the end which can sense wind, temperature, and humidity
BREATHES THROUGH	1. Pill bugs use gill-like structures to exchange gases that are on appendages on the abdomen. 2. They require moist environments to breathe but cannot survive being submerged in water (they will drown).
OTHER INFORMATIONS	1. Though they're often associated with insects and are referred to as "bugs," however, pill bugs belong to the subphylum Crustacea. 2. Like crabs and other crustaceans, pill bugs tote their eggs around with them. 3. Overlapping thoracic plates form a special pouch, on the pill bug's underside. 4. When poked, a pill bug will roll up into a tight ball. 6. Pill bugs represent the only crustacean that has widely colonized the land, however, they need a moist environment to survive.
HUMAN USAGE	Pill bugs are important for ridding the soil of heavy metal ions by taking in copper, zinc, lead, arsenic, and cadmium, which they crystallize in their midgut. Thus, they can survive in contaminated soil where other species can't.
WEATHER ADAPTATIONS	If the humidity gets really high in the atmosphere, above 87 percent, pill bugs can absorb moisture from the air to stay hydrated or improve their hydration.
DEFENCE ADAPTATIONS	Their hard body plates protect them from predators when they roll up into a tight ball.

ARACHNIDS

VINEGARROON

See Invertebrates Plate 2

PHYLUM	Arthropoda (spiders, scorpions, insects, shrimp, lobster, millipedes, centipedes, etc.)
CLASS	Arachnida (spiders, mites, ticks, scorpions, harvestmen)
FAMILY	Thelyphonidae (vinegarroon)
OTHER NAMES	Whipscorpion
LIFE SPAN	1. They mature slowly, molting 4 times (once a year) before becoming adults. 2. Adults live up to another 4 years. Once they reach adulthood they do not molt.
SIZE and WEIGHT	1 – 3.3 inches, weight up to 4.4 ounces
TIME OF ACTIVITY	Nocturnal
RANGE	They are found in more arid regions of New Mexico and Arizona, Oklahoma, Texas, and Mexico.
HABITAT	Found mostly in desert areas but they have also been reported in grassland, scrub, pine forests, and mountains

SHELTER	**Burrows** **They can often be found under logs, boards, rotting wood, rocks, and other natural dark places.**
SOCIAL BEHAVIOR	**1. Adults are solitary and aggressive.** **2. If they encounter another vinegarroon, they will fight with each other which may result in serious injury or death.**
COMMUNICATION	**None**
TYPE OF DIET	**Insects, millipedes, scorpions, and terrestrial isopod, but sometimes on worms and slugs and sometimes prey on small vertebrates.**
PREDATORS	**Raccoons, coatimundi, weasels, skunks, roadrunners, lizards, tarantulas and scorpions**
LIFE CYCLE	**Incomplete metamorphosis Egg-Nymph-Adult**
SEXUAL MATURITY	**4 years**
MATING HABITS	**1. A complex mating ritual that lasts 8 to 12 hours.** **2. The male secretes and transfers a sperm sac (spermatophore) into the female.** **3. She carries the eggs internally for several months and then lays 30 to 40 eggs in a fluid filled sac held under her abdomen.**
MATING SEASON	**Fall**
GESTATION	**1. The female remains in her burrow holding the egg sac off the ground for an additional two months.** **2. She does not eat until the eggs hatch.**
OFFSPRING BORN	**The white young that hatch from the eggs climb onto their mother's back and attach themselves there with special suckers.**
# OF OFFSPRING	**30-40**
DEGREE OF INDEPENDENCE	**Dependent on mother until their first molt**
THE YOUNG	**After the first molt, they look like miniature adults.**
TIME WITH MOTHER	**Until the first molt at which time they leave the burrow**
THREATS	**None**
LEGS/ APPENDAGES	**4 pairs of legs.** **Long whip-like tail is a sensory organ, but is not a stinger**
BODY PARTS	• **Cephalothorax -fused head and thorax** • **Abdomen** • **Pedipalps (large scorpion-like pinchers)** • **1 pair of eyes in front and 3 pairs on each side** • **8 legs** • **Front legs used as antennae like sensory organs** • **Other 4 legs are used for walking**
OTHER INFORMATIONS	**1. Vinegarroons excavate their own burrows using their pincers to dig and carry the dirt out. A burrow can be used for several months at a time.** **2. They use their antenniform legs to detect chemical and tactile stimuli, such as vibrations, water, and finding prey and mates.** **3. The antenniform are carried off the ground. Additionally, the flagellum (tail appendage) and pincers are used to obtain sensory information.** **4. Molting happens once a year, and may take months to complete.** **5. During molting, the vinegarroons will not eat and, they retreat to a burrow until the process is finished.** **6. After the molt, the vinegarroons are white for a couple of days, and then they will continue to darken and harden for up to 4 more weeks.** **7. One very distinct and curious feature of whip scorpions is its long thin tail appendage, which is directly related to their common name "whip-scorpion." It is used as a sensory organ and for defense.**
HUMAN USAGE	**Pet trade**
VISION AND HEARING ADAPTATIONS	**1. They have one pair of eyes at the front of the cephalothorax and three on each side of the head, a pattern also found in scorpions.** **2. They have very poor eyesight.** **3. They rely on their tails, and first two sets of legs, which they use as antennae, to sense movement and vibrations made by predators or prey.**
DEFENCE ADAPTATIONS	**1. Hard exoskeleton** **2. Two organs near the tail produce a vinegar-like mist which is emitted when it is irritated**

HUNTING ADAPTATIONS	**Uses its powerful pinchers to catch its prey**

BLACK WIDOW SPIDERS (Latrodectus mactans)

See Invertebrates Plate 3

CLASS	**Arachnida (spiders, scorpions, ticks, mites, harvestmen, vinegaroon)**
ORDER	**Araneae (all spiders)**
FAMILY	**Theridiidae (tangle-web spiders, cobweb spiders, comb-footed spiders) over 3,000 species**
DESCRIPTION	**Females** • **Size: about .5-inch-long, to about 1.5 inches long when the legs are spread.** • **Color: usually have a reddish hourglass shape on the underside of their abdomens. In some species the females have a series of red spots and two crosswise bars on the underbelly.** • **Life Span: about 1 to 1 ½ years. Some can live up to 3 years.** **Males** • **Size: about ½ the size of the female with smaller bodies and longer legs** • **Color: Male black widows are generally a tan, brown, or grayish color and frequently have yellow and red bands and spots over their backs, as do both sexes of black widows in their immature stages.** • **Life span: 3 to 4 months** **Both females and males have shiny, globular abdomens.**
BABIES ARE CALLED	**Spiderlings**
TIME OF ACTIVITY	**Nocturnal**
RANGE	**1. Black widow spiders inhabit most of the warmer regions of the world to a latitude of about 45 degrees north and south.** **2. They occur throughout all four deserts of the American Southwest.**
HABITAT	**Common around man-made structures such as garages, barns, lawn furniture, and woodpiles, under ledges, rocks, and plants**
SOCIAL BEHAVIOR	**Solitary**
TYPE OF DIET	**Carnivores: cockroaches, beetles, flies, ants, grasshoppers, moths, small spiders, pretty much anything that is caught in the web**
PREDATORS	**Mud-dauber wasps, praying mantis, some birds**
WEB	**1. They are erratic in appearance and lack shape and form.** **2. The silk is stronger than almost all other arachnids.** **3. The webs are rough and sticky.** **4. The female hangs upside down in her web.** **5. The female may rush out and bite when her web is disturbed.** **6. The webs are built on the underside of ledges, rocks, plants and debris, wherever a web can be strung.** **7. They use their webs to catch prey and lay an egg sac in them.**
SEXUAL MATURITY	**Male: 70 days Female: 30 days**
MATING SEASON	**Spring-summer**
MATING HABITS	**1 After maturing, the male will spin a small "sperm web." He deposits some semen into the web and coats his palps —two appendages near the mouth, which resemble tiny claws or thick antennae — with sperm.** **2. The male wanders off to find a female using chemical scent cues from the female that he can smell 200 feet away.** **3. He performs a vibratory song and dance on the female's web by plucking the strands as he walks around.** **4. He cautiously makes his way to the female, and then starts tapping her body.** **5. Eventually, the male will insert his palps into the female's reproductive opening on her abdomen.** **6. Females may occasionally kill and eat a male after mating but this is more the exception than the rule.** **7. Female mates only once in her lifetime, but retains sperm for future egg-laying.**
GESTATION	**14 to 30 days**
# OF OFFSPRING	**1. Three hundred to 750 eggs are encased in a round, cream-colored egg sac made of silk and suspended in a web.** **2.The female will lay 4 to 9 egg sacs in one summer**
THE YOUNG	**1. Young black widow spiders are typically an orange and white color when they**

	first hatch. 2. The spiderlings are cannibalistic and only a few will survive. 3. The spiderlings disperse by means of "ballooning" by producing a strand of silk which is picked up by the wind and carried to new locations.
LIFE CYCLE	1. Incomplete metamorphosis Egg- Nymph-Adult 2. The female will molt 6 to 8 times and mature in about 90 days. 3. Males molt 3 to 6 times and mature in about 70 days.
BODY PARTS	• Cephalothoraxes (the head is fused with the thorax) • Abdomen • 2 jointed pedipalps (front limbs used for feeling) • Instead of jaws, they have a pair of chelicerae with fangs that are able to inject venom. • 4 pairs of 7 segmented legs • 8 simple eyes located in the front of the head, arranged in 2 rows
OTHER INFORMATIONS	1. Only the adult female black widow has venom, and is thought to be the most venomous spider in North America. 2. The venom of the black widow is neurotoxic (affects the nerves) and at least 15 times more potent than a rattlesnake's venom, which is hemotoxic (affects the blood). Luckily, because of the size of the spider the amount of venom injected is much less. There is a less than 1% mortality rate for humans bitten by a female black widow. 3. The males and juveniles are harmless. 4. Black widows are comb-footed spiders, which means they have bristles on their hind legs that they use to cover their prey with silk once it has been trapped.
WEATHER ADAPTATIONS	1. Black widow spiders go into a state known as overwintering in cold locations. It's similar to a bear hibernating. The spider's metabolic rate slows to conserve energy. 2. In early adulthood, they overwinter in protected areas in nature or in buildings, such as barns and storage sheds. They may enter homes and other inhabited buildings in winter in locations where the weather turns cold.
DEFENCE ADAPTATIONS	1. Females have venom.
HUNTING ADAPTATIONS	1. After ensnaring its prey in the web, the black widow uses its "comb" feet to wrap the pray in silk. This row of strong, curved bristles is located upon the hind pair of legs and is used to pitch silk over captured prey. Then it uses its fangs to make small punctures in the victim's body and injects venom into the prey. 3. The spider often leaves the prey for about 10 minutes to allow it to die. 4. She returns to inject digestive enzymes that will liquefy the prey's body so she can suck up the liquid.

BROWN RECLUSE SPIDER (Loxosceles reclusa)

See Invertebrates Plate 3

CLASS	**Arachnida (spiders, scorpions, ticks, mites, harvestmen, vinegarroon)**
ORDER	**Araneae (all spiders)**
FAMILY	**Sicariidae -six eyed necrosis venomous spider which includes the brown recluse and six-eyed sand spiders**
OTHER NAMES	**Violin spider, fiddleback spider, recluse spider** **Named because of the violin shaped mark on their backs** **Called recluse because it prefers dark undisturbed places near or on the ground.**
LIFE SPAN	**1 to 2 years**
SIZE	**Body length: ½ inches** **4 inches long when the legs are extended**
RANGE	**South from southeastern Nebraska through southern Iowa, Illinois, and Indiana to southwestern Ohio** **In the southern states, it is native from central Texas to western Georgia and north to Kentucky.**
HABITAT/SHELTER	**Outdoors: dry places under logs, rock, debris like piles of leaves, packrat nests, piles of rocks, window sills, cracks in foundation, cracks, and soil**

	Indoors: in boxes, tires, bedding, toys and clothing on the floor, shoes, behind furniture, closets, and storage areas
WEB	**Built in dark, undisturbed places near or on the ground** **Used for nesting not for getting food**
SOCIAL BEHAVIOR	**They live in dense clusters.**
TYPE OF DIET	**Insectivores: moths, flies, spiders, crickets, cockroaches, moths** **Sometimes they can be scavengers.** **Recluses can go without food or water for 6 months.**
PREDATORS	**Birds such as blue jays** **Praying mantis**
MATING HABITS	**1. The male looks for the female and must impress her by first preforming a dance. If that doesn't work, he will bring food to her.** **2. If she accepts the food, they will mate.** **3. Usually between May and July, the female deposits her eggs in off-white silken cases in sheltered, dark areas.** **4. She may deposit several egg sacs during those 3 months.**
GESTATION	**24-36 days (depending on weather and food conditions.)**
# OF OFFSPRING	**40 to 50**
THE YOUNG	**They resemble parents but are lighter in coloration. They will molt several times before reaching adulthood at 10 to 12 months.**
LIFE CYCLE	**Incomplete metamorphosis Egg- Nymph-Adult** **Lighter colored spiderlings will molt several times before becoming a light tan to dark brown adult.**
BODY PARTS	• **Cephalothoraxes (the head is actually fused with the thorax)** • **Abdomen** • **2 jointed pedipalps (front limbs by the mouth used to help grab and position food)** • **Instead of jaws, they have a pair of chelicerae with fangs that are able to inject venom.** • **3 pair of simple eyes** • **4 pair of hairless 7 jointed legs**
OTHER INFORMATIONS	**1. Frequently, the bite to a human is not initially felt and may not be immediately painful, but within 2 to 8 hours symptoms may include nausea, vomiting, fever, rashes, and muscle and joint pain. Between 12 to 36 hours the hemotoxic destruction of blood cells and tissues develop.** **2. The hemotoxin can cause an ulcer that leads to soft issue destruction that may take months or even years to heal, leaving deep scars.** **3. The venom can cause organ damage and even death.** **4. They are typically light to medium brown, but they can range in color from whitish to dark brown or blackish gray. The cephalothorax and abdomen are not necessarily the same color. They can be recognized by the violin-shaped marking on the top of their cephalothorax.**
WEATHER ADAPTATIONS	**They are good at surviving in people's homes during cold winters.**
DEFENCE ADAPTATIONS	**1. The brown recluse spider is a non-aggressive spider and will only bite when disturbed (example: when they are caught in clothing or touched when sleeping)** **2. It usually flees.** **3. It will make quick horizontal rotation movements to try to avoid contact.** **3. It will stand motionless with its pedipalps raised.** **4. If they get their leg caught in something, such as a crack or a predator's mouth, they can drop the leg. The spider can still walk around with only four legs, as long as there is still one leg on each side.**
HUNTING ADAPTATIONS	**1. They are night ambush hunters.** **2. It slowly creeps toward the prey until it is close enough to pounce and sink its venomous fangs into the prey. It leaves the prey to die and return later to eat it.** **3. Their longs legs allow them to chase down their prey.** **4. On occasion, they may catch prey in their webs.**

SCORPIONS

See Invertebrates Plate 2

CLASS	**Arachnida (spiders, mites, ticks, vinegarroon, harvestmen, scorpions)**
ORDER	**Scorpiones (over 1,500 species, with over 70 species in the United States)**
LIFE SPAN	**Scorpion lifespans range from three to five years, though some species are thought to live 10-15 years. Some live up to 25 years.**
SIZE	**1. Most species of scorpions reach between 2 and 3 inches.** **2.The longest scorpion in the world is probably the African scorpion, which grows to over 8 inches in length.** **3. In the U.S., the giant desert hairy scorpions are probably the largest, growing to a length of about 5 inches.**
RANGE	**1. Scorpions are found on all major land masses except Antarctica and New Zealand.** **2. Most of the scorpions in the U.S. are found in the southwest, preferring the warm, dry climates found in Arizona, California, and New Mexico.**
HABITAT	**Deserts, rain forests, prairies, grasslands, forest mountains, caves, ponds**
SHELTER	**1. Under rocks, in crevices, logs, in cracks** **2. They will dig and hide in burrows.**
SOCIAL BEHAVIOR	**Most are solitary. Some will live in family groups and share burrows and food.**
TYPE OF DIET	**1. Insects like beetles, crickets, flies and wasps, insect eggs, termites, centipedes, spiders, other scorpions, small lizards, young snakes, rodents** **2. Their metabolism can slow down so they do not need a lot of food. Most Scorpions can survive without food for a year if necessary.**
PREDATORS	**Bats, lizards, snakes, other scorpions, mice, birds-especially owls, tarantulas, centipedes**
MATING HABITS	**Scorpions often perform a wrestling "nuptial dance" before mating. The actual process of mating is equally curious. The male secretes a substance to form a rod-like structure glued to the ground. The upper tip contains sperm. The male then guides the female over the structure until the sperm is directed into her body. Once the courtship is over, the male must quickly exit, or be eaten by his mate.**
GESTATION	**Scorpion gestation periods vary from several months to a year and a half, depending on the species.**
# OF OFFSPRING	**24-35 that develop in the mother**
TIME WITH MOTHER	**1. The babies are hatched inside the mother's body and are about the size of a pinhead when they are born. The female scorpion carries her young on her back for a week or two until they shed their first exoskeleton.** **2.Newborn scorpions lack sense organs and functional mouth parts, but they do have the ability to sting. The female recognizes her young by their odor, and those without the right smell are eaten!**
LIFE CYCLE	**Incomplete metamorphosis – Egg- Nymph- Adult** **1. They usually go through 5 to 6 molts over the 2 to 6 years for them to reach maturity.** **2. They will grow larger and get a deeper color with each molt.**
BODY PARTS	• **Cephalothorax (head, pedipalps, legs)** • **Telson (stinger with venom gland)** • **4 pairs of 7 jointed legs that have sensory hair used for detecting vibrations from about a 1 foot away** • **2 large median eyes and 2 to 5 pair of lateral eyes near front-They don't see well, so they depend on their senses of touch and hearing.** • **Chelicerae (mouth part to tear and chew food and grooming)** • **2 pedipalps (specializes in hunting, defense, sensory functions, reproduction)** • **Chelae (claws)**
HAIRS	**1. Tiny sensory hairs protrude from the exoskeleton that detect touch, temperature changes, and other information.** **2. Comb-like sensors on the bottom of the body also gives information about the environment.**
OTHER INFORMATIONS	**1. About 25 species can kill people, but most just deliver an irritating sting. For humans, a scorpion sting is like that of a bee or wasp.** **2. Although there are many dangerous scorpions in the world, the local ones are**

	not a serious threat. Even the largest local species, the giant hairy scorpion, has a mild venom. 2. The symptoms of a sting are pain, tingling, burning, or a numbing sensation at the site of the sting and can last from 4 to 6 hours. 3. The local scorpions has a mild venom. The Centauroids, which occurs in western New Mexico, has caused fatalities in young children on rare occasions, but seldom with healthy adults. 4.. Under an ultra-violet light, scorpions glow bright green, blue, or yellow. The fluorescent pigment in their exoskeleton may help to protect them from the harmful effects of the sun's ultraviolet rays. 5. On a moonless night, scorpions can be seen at distances of (33 feet) with ultraviolet light.
WEATHER ADAPTATIONS	1. They have a thick outer covering to reduce moisture loss. 2. They are nocturnal, so they can avoid the heat of the day by staying in burrows, under rocks, and in crevices. 3. Because they have slow metabolism and minimal activity, they can survive by eating just one insect in a year! This allows scorpions to thrive in an extremely harsh environment as.
DEFENCE ADAPTATIONS	1. Hard exoskeleton helps protect them from prey. 2. Can use their venom to subdue their prey.
HUNTING ADAPTATIONS	1. They hunt at night. 2.They are opportunistic feeders that wait for their food to come to them rather than wasting energy actively hunting. 3. They locate their prey by detecting vibrations through small sensory organs in the tips of their legs and fine sensory hairs on their pedipalps. 4. When a vibration is detected the scorpion lies in wait until the prey is close enough for it to grab with its pincers or pedipalps. 5. They sting their prey multiple times with venom from their tail stinger. 6. They use their large pedipalps to crush and draw their food toward their mouths. 7. Scorpions can go several months without consuming food. Some scorpions which inhabit arid regions have survived without food for up to 12 months. 8. Scorpions must have water that they can drink or get from the food they eat.

TARANTULAS

See Invertebrates Plate 5

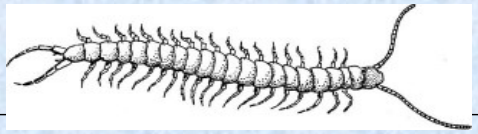
CLASS	**Arachnida (spiders, scorpions, ticks, mites, vinegaroons, harvestmen)**
ORDER	**Araneae (all spiders)**
FAMILY	**Theraposidae (all tarantulas)**
BABIES ARE CALLED	**Spiderlings**
LIFE SPAN	**Most live only a year or so after maturity. Some species can live up to 30 years. Females live longer than males.**
SIZE	**The size depends on the species, but the range from front right leg to rear left leg is 4.5 to 11 inches.**
WEIGHT	**1 to 3 ounces**
RUNNNING SPEED	**Most don't run, but some can run up to 10 mph**
TIME OF ACTIVITY	**Nocturnal**
RANGE	**Warm areas in South America, southern North America, southern Europe, Africa, southern Asia, and Australia**
HABITAT	**Deserts, mountain foothills, forested foothills**
SHELTER	**1. Burrows -some that live in places with dry soil, line their burrows with silk to help keep sand and dirt out. 2. Some live under rocks or logs.**
SOCIAL BEHAVIOR	**Solitary**
COMMUNICATION	**Many produce a hissing sound by rubbing their jaws, front legs, or palps against each other.**
TYPE OF DIET	**Grasshoppers, beetles, butterflies, cockroaches, small frogs, and toads, small spiders Larger tarantulas from the tropics can eat: lizards, mice, birds.**
PREDATORS	**Lizards, snakes, insect eating birds, skunks, coyotes, hawks, owls Female tarantula wasps- will sting the spider, drag the stunned tarantula to its**

	burrow, and lay an egg on it. When the wasp hatches, it eats on the live, but paralyzed tarantula.
SEXUAL MATURITY	**1 to 9 years**
MATING HABITS	**1. Before he can mate, the male spins a "small special web" and sprays it with sperm. Afterward, he rubs himself on the web, loading his pedipalps with it.** **2. He then searches for a female's burrow, using the pheromones she gives off as a guide. When a male tarantula finds a female burrow, he "taps his foot to alert the female to his presence."** **3. If she is receptive, she will emerge from her burrow, and the male will begin a series of courtship displays, including lowering the front of his body, raising his abdomen, shaking his pedipalps, and moving back and forth. If she is not interested, she will either "attack him or pay no attention to him."** **4. He then mates with the female, holding her fangs back with his legs. When he is finished, he "makes a quick getaway since females will often try to eat the males after mating."**
MATING SEASON	**Fall**
GESTATION	**6 to 9 weeks in an egg sac that the mother keeps under her**
# OF OFFSPRING	**500 to 1,400**
THE YOUNG	**Will go through several molts before they become adults.**
TIME WITH MOTHER	**Most do not care for them.** **Some may stay while they go through a few moltings.**
THREATS	**Loss of habitat**
LIFE CYCLE	**Incomplete metamorphous Egg- Nymph- Adult**
BODY PARTS	• **Cephalothoraxes (the head is fused with the thorax)** • **Abdomen** • **2 jointed pedipalps (front limbs used for feeling)** • **1 pair of chelicerae with fangs that can inject venom** • **4 pair of 7 segment hairy legs that have 2 to 3 retractable claws used for gripping** • **8 simple eyes that do not see well, but they do have an excellent ability to feel vibrations**
OTHER INFORMATIONS	**1. They are the largest of the spiders.** **2. Tarantulas from North America are harmless to humans, but their venom can cause a lot of discomfort for several days.** **3. If you come in contact with the urticating hairs that they can brush off on a predator, remove the hairs with tape.** **4. No person has ever died of a tarantula bite** **5. Their powerful jaws help to kill prey.** **6. A tarantula's fangs move up and down; all other spiders' fangs move horizontally.** **7. Tarantulas periodically molt, shedding their exoskeletons to grow and they can also replace internal organs. They can even regrow lost legs or pedipalps (short sensory appendages).** **8. Tarantulas are sometimes called "gentle giants of the night."**
HUMAN USAGE	**1. Considered to be a delicacy of indigenous peoples of the Amazon and people in Cambodia.** **2. Pets**
WEATHER ADAPTATIONS	**4. They hibernate in their burrows during the winter.**
DEFENCE ADAPTATIONS	**1. Have a hard exoskeleton to protect it.** **2. They will first try to run away.** **3. Most American tarantulas have barbed "urticating" hairs on their abdomens, and they use their legs to cast the hairs into the faces of threatening animals, inflicting irritation of soft tissues and eyes. The hair will not grow back, but they do get new hair when they shed.** **4. Their sense of touch (through vibrations) is very important for their hunting prey and avoiding predators.** **5. Sometimes, tarantulas spin a line of silk near the entrance to a burrow, which acts as a trip wire, alerting the spider to prey that is nearing its home.**
HUNTING ADAPTATIONS	**1. The tarantula does not use a web to catches its prey.** **2. When prey comes close, tarantulas ambush it, seize it with their legs, paralyze it with venom, and then kill it with their fangs. They can also crush**

	prey with their strong jaws. 3. After the prey is dead, tarantulas inject digestive enzymes into the prey to liquefy the body and suck it up through their straw- like mouths. 4. Left over parts of the prey are rolled up in a ball and thrown away by the tarantula.

MYRIAPODS

See Invertebrates Plate 3



Centipedes

- Has a flattened body
- Has 1 pair of legs on each segment
- Its legs are larger and stick out from the side of the body
- Can be about 3 to 6 inches long
- Like to live in moist places - under rocks
- Eat insects and spiders by killing them with its powerful fangs and injected venom
- They are active at night (nocturnal)
- The mother cares for her eggs and for a few days after they hatch.

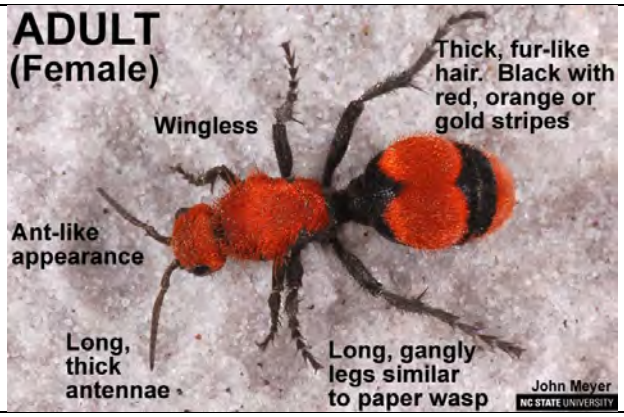
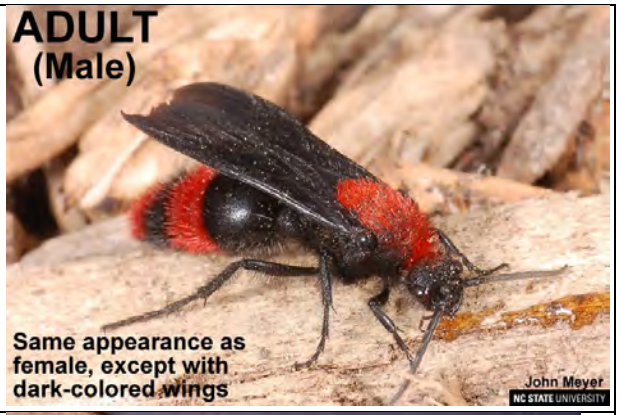
Millipedes

- Has a round body
- Has 2 pair of legs on each segment
- Its legs are shorter and are under the body
- Can be 1 to 5 inches long
- Like to live in moist places - under rocks
- Eat decomposed plants
- When frightened, they will curl up and release a foul -tasting chemical from its repugnatorial glands located along, the sides of its body
- They are active at night (nocturnal)
- They can live up to 10 years.
- The mother does not care for her eggs.

Invertebrates Plate 1

1. <u>Black swallowtail butterfly</u> **2. <u>Stink bug</u> Photo by Department of Agriculture**		
1. <u>Dragonflies</u> Photo by J.N. Stuart Creative Commons **2. <u>Praying Mantis</u> Photo from Amazing .Zone**		
<u>1. Dung Beetle</u> Photo from Londolozi Blog **2. <u>Assassin bug</u> Photo from Wikipedia**		
1. <u>Pill bug</u> Photo from Rapid Pest Solutions **2. <u>Tarantula Hawk</u>**		

Invertebrates Plates 2

1. & 2. Velvet Ant from NC State University		
1. Carpenter Bee **Photo by Shep Eubankspho to** **2.Wood bored by a Carpenter Bee Photo by bugwood. org**		
1. Chihuahuan slender tailed scorpion **2. Mother scorpion with babies Photo from Texas Parks & Wildlife**		
1. Vinegarroon **2. Harvestmen**		

Invertebrates Plate 3

1. Centipede
Photo from Animal Wildlife

2. Millipede

1. Carlsbad Green Tarantula
Photo from Pets on Mom

2. Tarantula eyes
photo by Gable Rhoads

1. Female Black Widow
Photo from Getty Images

2. Black Widow
Photo from Daily Star, UK

1. Brown Recluse
Photo by Rosa Pineda

2. Brown Recluse eyes (note fiddle pattern on back)
photo from extension : Oklahoma State University

SECTION 10

REPTILES

Reptiles: Class Reptilia

Characteristics of Reptiles

1. They have a backbone (vertebrate).
2. There their rough, dry, scaly skin is made of keratin (what fingernails are made of) that protects them from drying out.
3. They are ectothermic. They use their environment to warm and cool their bodies. If they are cold, they must lay in the sun to raise their body temperature. If they get too hot, they must find shade to cool off. Many reptiles are active at night, so they can avoid becoming too hot and having their skin dry out.

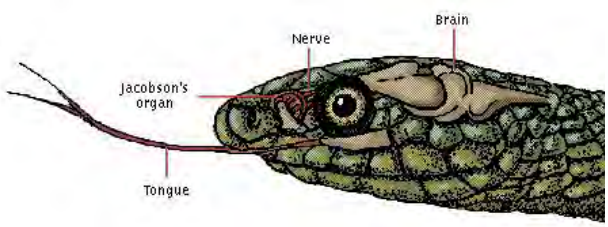
The following is a comparison of an ectothermic group (reptiles) and an endothermic group (mammals) listing the survival advantages of ectothermic. As these examples illustrate, reptiles have a structure and physiology based upon a low energy approach to survival. Ectotherms are not necessarily better or worse at adapting, just different.

Reptiles	Mammals
Reptiles need to eat far less often than mammals of equal weight.	Mammals must eat enough food (fuel) to get the heat necessary to maintain their body temperature.
Many reptile predators can afford to sit and wait for their prey.	Many mammalian predators must search for their prey in order to find sufficient food for their energy needs.
Reptiles can frequent habitats with limited or seasonal food, water, and oxygen supplies.	Mammals must either frequent only those habitats with constantly available resources or they must opt to forage great distances, migrate, or hibernate.
Aquatic reptiles can remain submerged for long periods (from 30 minutes to several hours, depending upon the species) before surfacing to take a breath.	Aquatic mammals are faced with an oxygen shortage after a shorter period of submerged time than aquatic reptiles of equal size.
Reptiles can take advantage of small body sizes not possible for endotherms (8% of lizard species characteristically weigh less than 1 gram as adults.)	A mammal smaller than 3.5 grams cannot satisfy the energy requirements to sustain life, even by eating continuously. This size seems to be the lower of limit of weight in mammals.
Reptiles can take advantage of a long thin body not possible for endotherms.	A mammal with any more than a moderately elongate body form would lose its body heat at too fast a rate to survive.

Senses and Behavior

Smelling and Tasting

Lizards and snakes have Jacobson's organs (ducts). They use their forked tongues to gather the dissolved odor particles in the air. When they pull their tongues back into their mouths, they put the tips of their tongues into the openings of the Jacobson's organs. Then the odors are analyzed by the brain to determine if the nearby creature is prey, predator, or a mate. This smelling adaptation of accounts for the- "tongue flicking" behavior in lizards and snakes.



Heat Sensitivity

There is an adaptive advantage to heat sensitivity if the snake is hunting warm-blooded prey, and many reptiles have some ability to sense warmth. This ability is most developed, however, in the pit vipers. (See Rattlesnake section.)

Another adaptive advantage to heat sensitivity involves the regulation of body temperature. Many reptiles respond to changes in the environment by changing color, the change being accomplished by the migration of

pigments in the skin cells. Because dark colors absorb more heat than light colors, a reptile that senses a drop in the temperature around it will turn darker. As its body temperature increases, the animal turns lighter. Not all reptiles can change color.

Vision

The eye structure is quite variable among reptiles with respect to visual acuity, color vision, and night vision. Some burrowing reptiles have lost the function of their eyes.

Hearing

The ear structure in reptiles varies as well. Some lizards and all snakes lack external ear drums and for some time it was thought that these reptiles could not hear airborne sounds. Recent experiments indicate that airborne sounds of particular frequencies are indeed heard by snakes.

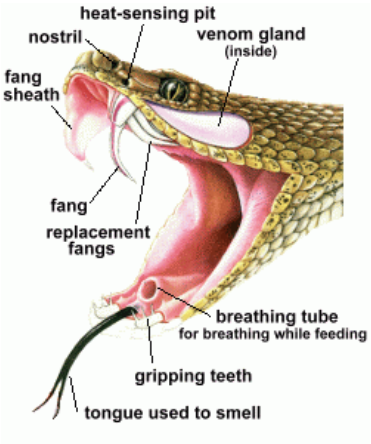
sound waves -→ air → skin → muscles→ bones→ ear bone →inner ear → brain

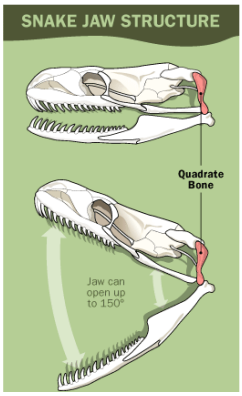
Eating

Many reptiles utilize the basic "catch and gulp" method of seizing and swallowing food whole, but certain reptiles are herbivorous or omnivorous and these habits require the ability to chew. In addition to closing the mouth, reptiles can generate pressure between the closed jaws, something amphibians cannot do.

Except for turtles, reptiles possess teeth which are shed and replaced throughout the animal's life. The teeth are basically the same shape; they are not differentiated into molars, canines, etc. as in mammals. In some species the teeth are restricted to the bones along the edge of the mouth; in others, the bones of the roof of the mouth also bear teeth.

Snakes and some lizards can increase the size of the food items they can swallow by expanding the size of the mouth. This is accomplished by having a skull divided into several moving parts. In the iguanid lizards, some of which are herbivorous, the upper jaw is movable and can manipulate food by moving relative to the lower jaw. In snakes, a much wider variety of relative motions is possible because the right and left sides of the head can move independently allowing the jaw to open up to 150 degrees.





The snake jaws move forward over the food, the right side alternating with the left side. This process may take some time, so the snake's glottis (airway) can be protruded from the mouth in order to keep the air passage clear while large prey is being swallowed. Swallowing is facilitated by starting at the head end of the prey, and snakes will normally approach food so that it can be swallowed head first.

In addition to the catch and gulp method of seizing and simply swallowing the prey, some snakes kill their prey first by squeezing or constricting it. The constricting snakes seize the prey in the mouth and may throw two or three loops of their body around the prey. The constriction process prevents the prey from breathing and suffocates rather than crushes it.

Once the prey has been caught and eaten by a reptile, digestion is slow. In snakes especially, the prey item forms a noticeable bulge in the body and would greatly hinder the reptile trying to escape an enemy or defend itself. If a snake is disturbed during digestion, it will usually regurgitate. This is probably a defense adaptation. Once digested, the food is either utilized or stored. Many reptiles, lizards in particular, can store food in their tails.

Many reptiles occasionally eat eggs, and some snakes utilize eggs as a high percentage of their diet. After the egg is swallowed, the shell is broken and the contents digested. Some species pass the shell fragments through the gut, whereas others regurgitate the shell.

Reproduction

Breeding is not necessarily seasonal in tropical reptiles, but outside of the tropics the changing length of day usually triggers breeding during a season that will provide the best chance of survival for the offspring. Some species of reptiles can store sperm in the reproduction tract until the appropriate time for fertilization. Because of this ability, mating can take place when it is convenient or safe and the timing of egg-laying can still take advantage of the most appropriate season. Male marine turtles wait on the beach for the females to finish laying their eggs and then intercept the females on their way back out to sea. The females then store the sperm from this mating until the proper time for fertilization.

In many species the reptile male establishes a territory during the breeding season. The courting male usually goes through a series of ritualized movements and tactile stimulations of the female. These rituals function as a form of species recognition as well as providing a stimulus to the female. The courtship of many lizards and snakes ends when the male grasps the female's neck in his jaws and brings the base of his tail close to hers so that the cloacas are adjacent.

Reproduction in reptiles involves eggs, but sometimes the eggs are not seen. Some lizards and snakes retain their eggs inside their bodies prior to hatching and these species have dispensed with the eggshell to varying degrees. They are casually called “live bearers,” which is a correct but misleading term. The live birth of reptiles results from an egg hatching inside the female, and is quite different from live birth of mammals where the embryo is nourished by the mother via the placenta. All reptiles still maintain a large yolk as the source of nourishment for the embryo. Live bearers include boas, rattlesnakes, water moccasins, copperheads, and garter snakes.

In general, reptiles produce more eggs per individual adult female than do birds or mammals, but the degree of parental care is minimal or non-existent in reptiles compared to birds and mammals. Many of the eggs and young fall victim to predation, weather, etc. Turtles generally dig a hole in the ground as deep as their hind legs. The female may take the precaution of digging more than one nest hole, leaving some empty or distributing her eggs among them all. These nest holes are then covered by the female after which she leaves the nest for good.

Many lizards and snakes lay their eggs in rotting logs or natural depressions. Once hatched, the young reptiles are miniature replicas of adults, fully equipped for life on their own. Their teeth and sense organs are fully formed and they are completely mobile. All venomous reptiles have fully formed teeth complete with venom when they hatch.

Locomotion

There is considerable variation in the locomotor habits of reptiles: some burrow, swim, climb or glide as well as walk and crawl. Many turtles also have a sprawling gait.

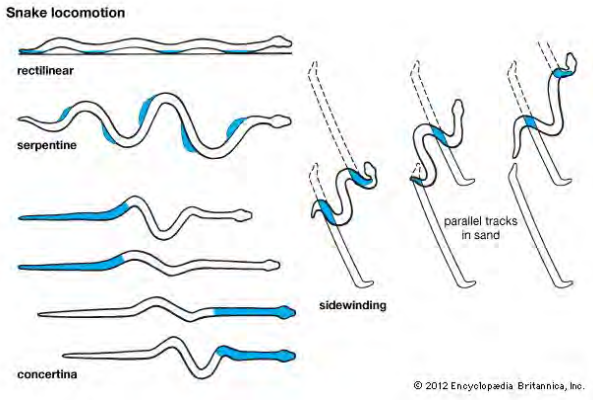
Some reptiles have the elbow rotated backward and the knee forward, bringing the limbs closer to the body.

Limbless locomotion is a specialization some lizards and all snakes have.

There are several different methods of limbless locomotion. The common method, called serpentine, is sometimes supplemented by a concertina crawl. In both serpentine and concertina locomotion, the snake requires a rough surface with something to push against as it moves forward. The belly scale crawl, also called rectilinear locomotion, is used when the snake is in a confined area or on a smooth surface, or it is used by large snakes with great bulk. The ventral scales are used like feet in a caterpillar style of movement. This is a much slower mode of travel than serpentine or concertina movements.

A few snakes living in sandy habitats (sidewinder rattlesnake) need a locomotory mode that will accommodate a shifting substrate. These snakes have developed a mode called sidewinding. The snake's body is nearly at right angles to the direction in which it is traveling, and the snake moves forward by throwing a loop of its body forward and then pulling the rest of the body up to that spot.

Except for turtles, reptiles use serpentine locomotion when they swim. The long tail of the lizard operates like a fin, while the arms and legs are held close to the body in order to reduce drag. In marine lizards and sea snakes, the tail is more laterally compressed to resemble a fin, while in terrestrial forms the tail is generally more rounded or ovoid in cross section.



Defense

Reptiles are generally peaceable, secretive animals preferring to avoid confrontations with other species, including humans. They are preyed upon by many animals and most are camouflaged as a protection against predation. This same camouflage strategy also prevents prey animals from noticing the predatory reptiles which sit and wait for their prey. Many arboreal snakes and lizards are green (Cooke's tree boa, green iguana), whereas the ground dwelling species are dark in color or irregularly marked to blend in with their surroundings.

The main line of defense for some reptiles is armor. The turtle can withdraw into its shell. Snakes will thrash their tails, and can produce a foul-smelling mush from the cloaca if they are annoyed. The tail of the rattlesnake is a specialized warning device, probably used to discourage predators. The rattle is made of keratin, like the scales. It begins as a single button at the end of a newly hatched snake's tail and grows through the addition of a segment with each shedding. Since a snake may shed more than once a year or may lose a segment of the rattle during the wear and tear of everyday life, the rattle is not a reliable guide to the snake's age.

Many reptiles assume a threat posture when provoked, and several species are equipped with devices which make them look bigger when they are displayed. Large size frequently discourages predators. The horned lizard expands to a much larger size when threatened.

Finally, some reptiles hiss when they are aroused. The sudden noise is startling and may cause a predator to pull back just long enough for a retreat. The hognose snake gets first prize for defense mechanisms, however. First it will raise its head and hiss. Next it will spread the skin on its neck to mimic a poisonous cobra. If these methods fail, the hognose rolls over on its back and plays dead with the tongue hanging out of its open mouth. Many animals will not eat food unless they have caught and killed it themselves, and feigning death is an effective defense against these predators. A hognose snake feigning death will continue to flop belly up even when it is placed right side up repeatedly.

Reptiles do not congregate for defense purposes. They tend to be solitary creatures, and it is rare to find more than one at a given place. Snakes hibernating in the same den are probably the result of several individuals taking advantage of the same environmental opportunity at the same time rather than any inclination to seek company.

LIZARDS

DESERT SPINY LIZARD and SOUTHWESTERN FENCE LIZARD

See Reptiles Plate 3

CLASS	**Reptilia (snakes, lizards, turtles, alligators)**
FAMILY	**Phyrnosomatidae (spiny lizard, honed lizards, fence lizards)**
OTHER NAMES	**Southwestern fence lizard is also known as Cowles' prairie lizard, White Sands prairie lizard and White Sands swift**
LIFE SPAN	**8-30 years**
SIZE and WEIGHT	**Both species are 3-5 inches long and weigh about 1-2 ounces**

TIME OF ACTIVITY	**1 Spring-diurnal Summer-crepuscular Winter-hibernate**
RANGE	**Colorado River Basin, Arizona, Chihuahuan Desert, northern Mexico**
HABITAT	**Semi-desert, grasslands, dense stands of mesquite, creosote, or tarbush, along arroyos or playa edges**
SHELTER	**1. Will use middens of packrats or white-throated woodrats. 2. In the sand**
SOCIAL BEHAVIOR	**The spiny lizards are very territorial and are usually found in male and female pairs.**
COMMUNICATION	**Spiny lizards will display ventral collars and push-up displays at rival males and may bite.**
TYPE OF DIET	**Ants, caterpillars, beetles, occasionally lizards of other species, and bird's eggs and nestlings**
PREDATORS	**Snakes, other lizards, birds of prey, coyotes, raccoons, foxes, domestic and feral cats**
SEXUAL MATURITY	**Spring of second year**
MATING HABITS	**Spiny lizards are often found in male and female pairs.**
MATING SEASON	**April through August, eggs laid 2-4 weeks after mating**
GESTATION	**Spiny Lizard - spring and summer with one or two clutches laid Fence lizard – spring and summer with up to four clutches laid**
OFFSPRING BORN	**Offspring are hatched about 2 months later**
# OF OFFSPRING	**2-12**
THE YOUNG	**Look like small adults**
TIME WITH MOTHER	**None**
THREATS	**Human encroachment on territories**
TYPE OF FEET	**Four feet with 5 clawed toes on each foot. The three middle toes are longer than the two outside toes.**
OTHER INFORMATIONS	**1. They will bask on the branches of trees, on rocks, or on other sunlit perches. 2. The fence lizards have a bacteria in their gut that kills the Lyme disease bacteria, so ticks that feed on them no longer carry the disease.**
HUMAN USAGE	**Fence lizards are used as pets**
DEFENCE ADAPTATIONS	**1. Their coloration helps them blend in with their surroundings. The spiny lizard can change from a lighter color in summer to a darker color in winter. Fence lizards living in White Sands National Park have a white color on their heads and backs, while those living a short distance away on lava flows are black. 2. When encountered, they are often heard before being seen as they scratch and claw the bark while on route to the opposite side of the trunk or branch. 3. They flee down into the inner tangles of pack rat nests, rock crevices, or burrows when threatened. 4. The spiny lizard has strong jaws and often bites when captured. 5. As a last resort against predators, lizards can drop their tail. The predator concentrates on the still moving tail and the lizard slips away. They can regrow their tails, but the tails store a lot of fat, which is their food reserve.**

TEXAS BANDED GECKO
See Reptiles Plate 3

CLASS	**Reptilia**
FAMILY	**Eublepharid**
OTHER NAMES	**None**
LIFE SPAN	**10-20 years**
SIZE and WEIGHT	**4-5 inches (half of which is tail) Weight 1-2 ounces**
TIME OF ACTIVITY	**Nocturnal**
RANGE	**West Texas, southeastern New Mexico, and northern Mexico**
HABITAT	**Dry rocky areas, canyons, and crevices**
SHELTER	**Under rocks and fallen yuccas, burrows in winter and in the heat of the summer**
SOCIAL BEHAVIOR	**Mostly solitary**
COMMUNICATION	**The only lizard with a voice they make squeaking and clicking sounds (like a mouse) when frightened, breeding or announcing territorial claims.**
TYPE OF DIET	**Small arthropods and will eat their shed skin.**
PREDATORS	**Birds, bigger lizards, snakes, and many mammal species**

SEXUAL MATURITY	**1 year of age**
MATING SEASON	**March and April**
GESTATION	**1. 42 days** **2. 2 to 3 clutches a year** **3. As the eggs are forming (the eggs are very large compared to the body size of the female) the female uses fat stored in her tail to increase the size of the egg yolk. The extra energy the egg receives helps ensure that the hatchlings develop properly and grow quickly.**
# OF OFFSPRING	**1-2**
THE YOUNG	**They look like small adults with more defined bands which become more blurred as they mature.**
TIME WITH MOTHER	**None**
THREATS	**Human encroachment**
TYPE OF FEET	**They have four feet with five toes each. They do not have the sticky pads and hairs on their feet like other species of geckos, so they are not great climbers.**
OTHER INFORMATIONS	**1. They have large eyes with vertical slits and eyelids.** **2. The tongue is used to collect molecules to smell.** **3. Fat is stored in the tail so they can go up to 9 months without eating.** **4. Like many lizards, they can lose their tails when attacked and will regrow them.** **5.They use hunting moves that look very much like those of cats.** **6. They can mimic scorpions by standing on their legs and lifting their tails above their heads to discourage predators.**
HUMAN USAGE	**Pet trade**

GILA MONSTER
See Reptiles Plate 3

CLASS	**Reptilia**
FAMILY	**Helpdermatidae**
OTHER NAMES	**None**
LIFE SPAN	**20-30 Years**
SIZE	**18 to 24 inches**
WEIGHT	**3-5 pounds**
TIME OF ACTIVITY	**Crepuscular or diurnal activity mainly in the spring when they eat many eggs and small animals and also mate**
RANGE	**Home range is about 1 mile. Mojave, Sonoran and Chihuahuan deserts**
HABITAT	**Dry and arid regions**
SHELTER	**Burrows**
SOCIAL BEHAVIOR	**Mostly solitary. They form groups called lounges in the spring for mating.**
COMMUNICATION	**Can make a hissing sound when threatened.**
TYPE OF DIET	**Eggs, baby birds, insects, reptiles, and small mammals**
PREDATORS	**Coyotes, birds of prey**
SEXUAL MATURITY	**Babies are mature by the next year following their hatching.**
MATING HABITS	**Males wrestle with each other for the right to mate.**
MATING SEASON	**April through June**
GESTATION	**About 10 months They are the only reptile to have eggs incubate in winter.**
OFFSPRING BORN	**Hatch in spring**
# OF OFFSPRING	**2-12**
THE YOUNG	**About 6 inches long and look like the adults**
TIME WITH MOTHER	**None**
THREATS	**Humans capture them to sell and destroy their habitats.**
TYPE OF FEET	**Large feet with 5 toes and long, strong, curved claws**
OTHER INFORMATIONS	**1. One of only two venomous lizards.** **2. The tip of the Gila Monster's snout is completely black, allowing the animal to remain unseen while peering from the burrow.** **3. Their striking skin color with its pink to orange and black appearance helps warn other animals that they should stay away from them.** **4. This venomous lizard doesn't have fangs. Its venom flows from the venom glands into grooves within its teeth. When they bite, they usually hold onto the prey.**

	5. The bumpy looking scales on the head, back, and tail are actually little pearl-shaped bones (osteoderms).
HUMAN USAGE	**A molecule from the venom is now synthesized to treat diabetes.**
WEATHER ADAPTATIONS	**Its skin is very "leaky" so it spends 95-98% of its time in burrows to avoid dehydration.**
ADAPTATIONS	**1. They only need to eat 3-4 large meals (about 1/3 of their body weight) a year.** **2. Fat is stored in their tails for use when needed.** **3. Their venom is not injected but flows down grooves in their teeth, so they need to chew on their victims to deliver it.** **4. In order for a human to get bitten he has to be handling them.** **5. Although the bite can hurt, it doesn't kill a person.**

WHIPTAIL LIZARDS
See Reptiles Plate 3

CLASS	**Reptilia (snakes, lizards, turtles, alligators)**
FAMILY	**Teiidae (whiptails, tegus)**
COMMON NAMES	**Common Checkered Whiptail and Little Striped Whiptail. (There are many other species of whiptails but these are the two most seen in the Chihuahuan Desert.)**
LIFE SPAN	**Up to 50 years**
SIZE	**Both species are approximately 6.5-9.5 inches.** **The tail is anywhere from 2 to 3 times longer than the body.**
WEIGHT	**Both species weigh about 2 ½ to 3 ½ ounces.**
TIME OF ACTIVITY	**They become active in early spring. Thet are mostly crepuscular. They are ectothermic so they will be most active when external temperatures are not too hot or cold.**
RANGE	**Colorado, Texas, New Mexico ,and northern Mexico**
HABITAT	**Grasslands, forests, scrub and deserts**
SHELTER	**Burrows in winter. During times of activity, they will hide in grasses, under rocks and under cacti.**
SOCIAL BEHAVIOR	**Live in small isolated groups**
COMMUNICATION	**They display gaping, lunging, chasing, biting, inflation of the body or throat, head bobs, and push-ups, as well as subtler shudders of the body. Some of these actions will be used only between males, while others facilitate courtship.**
TYPE OF DIET	**Insectivores eating mostly termites, spiders, crickets, beetles and grasshoppers.**
PREDATORS	**Other lizards, snakes, birds of prey, coyotes, foxes, raccoons, domestic and feral cats**
SEXUAL MATURITY	**18 months to 7 years**
MATING SEASON	**Early spring with eggs laid in midsummer**
MATING HABITS	**1. The female striped whiptail undergoes copulation with a male who attracts her with different postures.** **2. The checkered whiptail is parthenogenic (female produces eggs without mating). The females will undergo mating behaviors with each other. This is thought to release the hormones necessary for egg formation.** **3. Despite no external fertilization, the offspring of these lizards are not actually perfect clones of one another, because the offspring do have genetically diverse chromosomes.**
GESTATION	**6-8 weeks**
# OF OFFSPRING	**2-8**
THE YOUNG	**Look like small adults**
TIME WITH MOTHER	**None**
THREATS	**Predators, human encroachment on territory**
TYPE OF FEET	**Four feet with 5 toes on each foot**
OTHER INFORMATIONS	**1. When they grow, they shed their skin in pieces, unlike snakes that shed their skin in one large shed.** **2. They lack an external ear. They have a circular opening in which the tympanic membrane can be seen.** **3. Unlike snakes, their eyes do have eyelids.**
HUMAN USAGE	**Pet trade**

DEFENCE ADAPTATIONS	**1. They run very fast and will try to outrun predators.** **2. If unsuccessful, they will puff up to appear larger.** **3. They will hide under a cactus to discourage a predator.** **4. As a last resort their tail can detach. The tail keeps moving for a short time which detracts the predator and allows the lizard to escape. A new tail will be regrown, but by losing their tail, they lose a lot of fat storage and it takes a lot of energy to regrow a new one. The new tail is shorter and wider than the original tail.**

TEXAS HORNED LIZARD
See Reptiles Plate 3

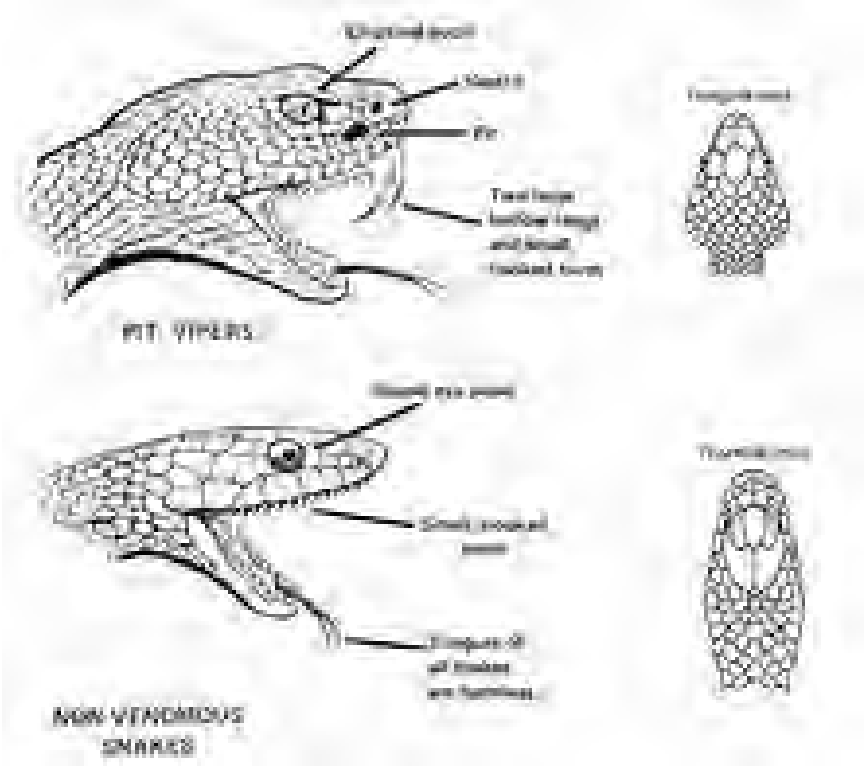
CLASS	**Reptilia**
FAMILY	**Phrynosomatida**
OTHER NAMES	**Texas horned toad, horned lizard, horn toad, horny toad**
LIFE SPAN	**5-8 years**
SIZE	**2 ½ to 6 inches and weight 1-3 ounces**
TIME OF ACTIVITY	**Diurnal**
RANGE	**New Mexico, Oklahoma, Texas, Kansas, northern Mexico**
HABITAT	**They live in a variety of arid and semi-arid environments from oak-pine woodland to thorn scrub deserts.**
SHELTER	**1. In the hot afternoon sunshine, they take shelter under rocks, in rodent burrows, under woody vegetation, or in crevasses to avoid predation and overheating.** **2. At night, they lie flat on the ground and will burrow up to 4 inches below the surface sand. This helps them keep them warm until the sun comes out the next morning.** **3. They hibernate from October until late March by burying themselves under soil, litterfall and foliage. Their burrows average a depth of 5 ½ inches and tend to face the south or south-west, where sunlight exposure is highest during the winter.**
SOCIAL BEHAVIOR	**Mostly solitary**
COMMUNICATION	**Head bobbing**
TYPE OF DIET	**Insectivores: harvester ants make up most of their diet, but they will also eat spiders, ticks, butterflies, moths, etc.** **They will eat food wherever they find it even if they have already eaten enough.**
PREDATORS	**Wolves, coyotes, bobcats, hawks, roadrunners, snakes, ground squirrels, cats, dogs**
SEXUAL MATURITY	**Two years after hatching**
MATING HABITS	**1. Males will perform their species-specific display of quickly bobbing their heads up and down.** **2. Females may reject males by simply moving away or by waving their tails.**
MATING SEASON	**Mid-April through June**
GESTATION	**1. Females produce one clutch of around 15 to 40 eggs per mating season.** **2. Females deposit their eggs 44 days after copulation in a burrow, where the eggs will incubate for 40 to 61 days.**
OFFSPRING BORN	**15-40**
# OF OFFSPRING	**Usually only 2-5 survive to adulthood**
THE YOUNG	**Look like small adults, they spend no time with their mother.**
THREATS	**Human encroachment, use of pesticides to kill ants**
TYPE OF FEET	**Four feet with front feet having four toes and back feet having five toe** **The middle toes are longer than the outside ones.**
OTHER INFORMATIONS	**1. They have sticky tongues to catch ants.** **2. They are camouflaged so they look like a rock.** **3. They play dead (do not move) for a long time, so they will not be easily seen.** **4. They can inflate their bodies, which make their spiny scales stick out, making them hard to swallow.** **5. They make loud hissing noises to frighten predators.** **6. They rotate their head so they can jab with their horns if picked up.** **7. They squirt bad tasting blood from their eyes as far as 3 feet to keep**

	predators away. 8. They hibernate in the winter which lowers their metabolism, so they do not need food at that time. 9. They use their noses and spiny horns to dig a shelter in the sand. 10. Snakes have a hard time eating them because of their wide, thorny bodies.
HUMAN USAGE	**Pet trade**

SNAKES
The Constrictor Snakes
See Reptiles Plate 1

CLASS	**Reptilia**
FAMILY	**Colubridae (not venomous snakes)**
COMMON NAMES OF SPECIES	**Bull-snake, Coachwhip, Corn Snake, Desert Kingsnake, Gopher Snake, Great Plains Rat Snake, Hognose Snake, Trans-Pecos Rat Snake**
LIFE SPAN	**10-15 years, average can live over 20 years**
SIZE and WEIGHT	**Bullsnake - 4-6' can be up to 8' 2-3 pounds can be up to 9 lbs.** **Coachwhip - most reach over 6' 3-5 pounds** **Corn Snake - 2-4' can be up to 6' 1-2 pounds** **Desert Kingsnake – 3-4' but can grow up to 7' 3-5 pounds** **Gopher Snake - 2½-7' 2-4 pounds** **Great Plains Rat Snake - 2-3' up to 5', 2-4 pounds** **Hognose Snake – 1-3' 5-10 ounces** **Trans-Pecos Rat Snake – 3-5' 7-12 ounces**
TIME OF ACTIVITY	**1. They are ectothermic, so they are most active when temperatures are not too hot or too cold.** **2. In the spring and fall they are mostly crepuscular (active in the early mornings or just before sunset.** **3. In the hot summer, they are most active at night when the desert cools off.** **4. In the winter they can be found on top of warm rocks and will be more active during the day or they will hibernate in burrows or caves.**
RANGE	**Varies with species but can be found throughout the Southwest.**
HABITAT	**Deserts, grassy plains, forests, rocky areas, and along the coast.**
SHELTER	**Tree cavities, rocks, crevices, burrows and often found in barns** **In cold climates they will hibernate in caves, crevices, etc.**
SOCIAL BEHAVIOR	**Mostly solitary except during mating season.** **In winter, many can be found hibernating together in the same caves , but they still exhibit solitary behavior.**
COMMUNICATION	**Hissing**
TYPE OF DIET	**Small rodents, frogs, lizards, birds, and bird eggs** **King snakes are called that because they eat other snakes.**
PREDATORS	**Eagles, hawks, roadrunners, coyotes, bobcats, foxes, kingsnakes.** **Kingsnakes are immune to rattlesnake venom and will eat other snakes both venomous and non-venomous.**
SEXUAL MATURITY	**Can be up to three years**
MATING HABITS	**Males attract females with pheromones.** **They sometimes fight each other for the same female.**
MATING SEASON	**Early spring** **Eggs laid about 5 weeks after mating**
GESTATION	**Varies with species, but the young usually hatch in late summer.**
OFFSPRING BORN	**Hatch from eggs laid by the female in a hidden spot.**
# OF OFFSPRING	**2-20**
THE YOUNG	**The hatchlings look like small adults.**
TIME WITH MOTHER	**None**
THREATS	**1. Predators and loss of habitat** **2. Humans will sometimes kill them because they will mistake them for rattlesnakes.**
OTHER INFORMATION	**1. All snakes are carnivores, and can swim, climb, bite, and drink water.** **2. When threatened, the first thing they usually do is freeze.** **3. If playing dead does not work, then they will puff up to appear larger.** **4. They will vibrate their tail and coil to mimic a rattlesnake.** **5. They also can emit a foul-smelling odor which discourages most predators.**

	6. King in the name of any snake means that its preferred food of other snakes. **7. A kingsnake will grasp a rattlesnake behind its head, throw 4 or 5 coils around its body and begin to swallow it almost immediately, pulling it through its coils as it does so.**
HUMAN USAGE	**Farmers like to have them in their barns to keep down the rodent population.**
VISION AND HEARING ADAPTATIONS	**1. The tongue picks up molecules from the environment which when inserted into the Jacobson's organ at the roof of the mouth. It senses the smell and taste of the molecule helping the snake to detect prey.** **2. The eyes do not have lids. They have a clear membrane over their eyes that protect them from dirt and foreign objects.** **3. Most of their "hearing" is actually the feeling of vibrations in the ground.**
JAW ADAPTATIONS	**The snake's jaw unhinges and the prey is swallowed whole starting with the head.**
BODY ADAPTATIONS	**Special scales on the underneath of the snakes help them to gain traction so they can move.**



RATTLESNAKES

A sensory specialization in the nasal area found in pit vipers helps them know exactly where its warm-blooded prey is located. The pit is a special heat receptor located on either side of the head between the nostrils and the eyes. Nerves leading from the pit organ carry information to the snake's brain. The brain produces an infrared image so the snake will know exactly where to strike its prey. These pits can detect temperature changes in the environment as slight as one tenth of a degree at one foot.

Rather than seizing the prey, a venomous snake strikes at the prey, embedding the fangs and injecting venom, then withdraws to wait until the prey is immobilized. The fangs are specialized teeth that connect to a venom gland above the mouth. Fangs operate in the same manner as a hypodermic needle. They can be located at the front or at the rear of the mouth, depending upon the species, and they are shed periodically as are the rest of the teeth.

See Reptiles Plate 2

CLASS	**Reptilia (snakes, turtles, lizards, alligator)**
FAMILY	**Viperidea (venomous snakes)**
COMMON SPECIES	**Banded rock rattlesnake, black-tailed rattlesnake, desert massasauga, and western diamond-backed rattlesnake**
LIFE SPAN	**Up to 25 years in captivity**
SIZE	**Banded rock rattlesnake: 3-27 inches Black-tailed rattlesnake: 25-35 inches can reach up to 50 inches Desert massasauga: 18-30 inches Western diamond-backed rattlesnake: 36-48 inches can rarely be 6-7 feet long.**
WEIGHT	**Banded rock rattlesnake: 2-4 pounds Black-tailed rattlesnake: 3-5 pounds Desert massasauga: 2-4 pounds Western diamond backed rattlesnake: 3-6 pound but can reach up to 15 pounds**
TIME OF ACTIVITY	**1. They are ectothermic, so they are most active when temperatures are not too hot or too cold. 2. In the summer they are mostly crepuscular. 3. During the hottest part of summer, they may be nocturnal. 4. In the winter they may be found on top of warm rocks or they will hibernate in burrows or caves.**
RANGE	**Varies with species but can be found throughout the Southwest.**
HABITAT	**Deserts, grassy plains, forests, rocky areas**
SHELTER	**1. Underneath rock outcroppings 2. In winter , they stay in burrows or caves.**
SOCIAL BEHAVIOR	**1. Mostly solitary except during mating season 2. In winter, many can be found hibernating together in the same caves ,but they still exhibit solitary behavior.**
COMMUNICATION	**They use their rattles and hiss when they are threatened.**
TYPE OF DIET	**1. Small birds and mammals, lizards, insects 2. Snakes do not have a sense of taste, so they eat to stay alive. 3.To kill their prey, they must inject venom in it, and once the prey is dead, the snake's jaw dislocates and begins to "walk" its lower jaw over the prey. It uses its backward-curving teeth to grip the animal. One side of the jaw pulls the prey in while the other side moves forward for the next bite. The snake drenches the prey with saliva and eventually pulls it into the esophagus. From there, it uses its muscles to crush the food and push it deeper into the digestive tract, where it is broken down for nutrients.**
PREDATORS	**Eagles, hawks, roadrunners, kingsnakes, coyotes, bobcats, foxes**
SEXUAL MATURITY	**Can take up to 3 years before reaching maturity**
MATING HABITS	**In many species, ritualized male combat has been observed.**
MATING SEASON	**Varies with species, but usually in the spring**
GESTATION	**Varies with species, but it can take up to one year after copulation.**
OFFSPRING BORN	**The fertilized eggs stay inside the female until hatched.**
# OF OFFSPRING	**Varies with species but can be anywhere from 2 to 20**
THE YOUNG	**Looks like small adults**
TIME WITH MOTHER	**The mother snake will protect her young from predators and will usually ensure that the baby snakes stay with her for at least their first week of life, until their first shed.**
THREATS	**Humans- loss of habitat**
OTHER INFORMATIONS	**1. All snakes can swim and climb. 2. Rattlesnakes are venomous and will bite if they feel threatened. 3. Fangs are hollow and venom is injected through them. 4. If a fang breaks off, a new one is ready to replace it. 5. The buttons (rattles) are added to the tail each time the snake sheds. 6. The age of the snake cannot be determined by the number of rattles because a snake can shed multiple times in one year and rattles can be broken off. 7. The venom of the desert massasauga is more potent than other species.**
HUMAN USAGE	**Rattlesnake roundups, pet trade, and skins for belts, etc.**
ADAPTATIONS	**1. Heat-sensing pits located behind each nostril can detect the heat of a mammal, which helps them find their prey.**

	2. The tongue picks up molecules from the environment which, when inserted into the Jacobson's organ at the roof of the mouth senses the smell and taste of that animal, helping the predator to detect prey. **3. Snakes do not blink because they do not have eyelids, but they do have skin over their eyes to protect them from dirt. When they shed their skin, that clear covering comes off and is replaced by the new skin.** **4. Snakes do not have outer ears; however, they can hear in a different way than we can hear.**

TORTOISES & TURTLES

Turtles do not have teeth on the edge of the mouth. Instead, there is a sharp, horny beak made of keratin that fits over a bony core. Herbivorous turtles use the sharp edges of the beak as a cutting edge for cropping vegetation. Others use the beak for slicing.

BOLSON TORTOISE
See Reptiles Plate 4

CLASS	**Reptilia (snakes, turtles, lizards, alligators)**
FAMILY	**Testudinidae (land dwelling turtles)**
OTHER NAMES	**Mexican giant tortoise, or yellow giant tortoise**
LIFE SPAN	**80-100 years This is an estimate, since scientist have not had time to study them because they have only been rediscovered in 1959.**
SIZE	**Carapace 9-18 inches long Height 4-6 inches**
WEIGHT	**Up to 30 pounds. It is the largest tortoise in North America.**
TIME OF ACTIVITY	**Crepuscular during warmer months** **In winter, they become dormant. Sometimes they will come out of their burrows on a warmer day.**
RANGE	**Chihuahuan desert from north eastern Mexico to south eastern New Mexico**
HABITAT	**Low grassland slopes with fine soil**
SHELTER	**1. The Bolson tortoise digs burrows up to 34 feet in length at depths of up to 5 feet.** **2. Because of aggressive behavior among males, burrows are located fairly far apart.** **3. Only one individual inhabits a burrow.** **4. In the summer, they dig shallow burrows because they move around a lot looking for food.** **5. In the winter, their body temperatures drop to about 40 to 60 degrees, and their hearts and breathing rates and other bodily functions slow down.**
SOCIAL BEHAVIOR	**1. They live in communities of up to 100.**
COMMUNICATION	**1. Vocalizing, posturing, and bumping their shells.** **2. Because they are mostly found in communities. They use fecal and secretions to mark their burrows and home ranges.**
TYPE OF DIET	**The principal food is low bushes and thick plants, grasses.** **The preferred food is the tender shoots or flowers.**
PREDATORS	**The eggs and young are easy prey for: ravens, hawks, roadrunners, coyotes, badgers, skunks, Gila monsters, kit foxes, some snakes.** **Only about 3% of hatchlings born in the wild will survive.** **Adults are prey to: kit foxes, badgers, bobcats, coyotes, golden eagles** **Coyotes and kit foxes can dig tortoises out of their burrows to eat. They can eat the tortoises without breaking open their shells.**
SEXUAL MATURITY	**15-20 years**
MATING HABITS	**1. It is possible that mating does not occur at all in dry years.** **2. Eggs are laid in a hole and covered up and are left on their own.**
MATING SEASON	**May through October**
GESTATION	**Hatching occurs about 2 months after incubation.**
#OF OFFSPRING	**12-15 however, only a few make it to maturity.** **A female can lay up to 3 clutches a year.**

THE YOUNG	**Look like small adults**
THREATS	**They are classified as endangered due to agriculture and human encroachment of their habitat. Some people in northern Mexico use them as a food source.**
TYPE OF FEET	**Four feet with five toes on each foot**
OTHER INFORMATIONS	**In 1973, four Bolson tortoises were brought from Durango, Mexico, to an Arizona rancher, who raised and researched them until her death. In the fall of 2006, Mrs. Applegate's heirs gave her 28 tortoises to the "Turner Endangered Species Fund." Twenty-four of them were taken to the Armendaris Ranch near Truth or Consequences, NM. the other 4 Bolson Tortoises were taken to the Living Desert Zoo and Gardens State Park in Carlsbad, NM.**
HUMAN USAGE	**Pet trade, food source** **Until 1959, scientist thought they were extinct, until some biologist saw some farmers in Mexico using the shells as animal feeders.**
VISION AND HEARING	**They perceive the world through visual, auditory, chemical and tactile senses.**

DESERT TORTOISE

See Reptiles Plate 4

CLASS	**Reptilia (snakes, turtles, lizards, alligators)**
FAMILY	**Testudinidae (land dwelling turtles)**
OTHER NAMES	**None**
LIFE SPAN	**80-100 years**
SIZE	**9-14 inches long and 4-6 inches tall**
WEIGHT	**8-15 pounds**
TIME OF ACTIVITY	**Although desert tortoises can survive body temperatures from below freezing to over 104 °F, most activity occurs at temperatures from 79 to 93 °F.** **Crepuscular – during summer** **Diurnal- late morning during spring and fall, and sometimes on warm winter afternoons**
RANGE	**Mohave, Sonoran and Chihuahuan deserts**
HABITAT	**Sandy flats, rocky foothills, canyons**
SHELTER	**1. Burrows at the base of a creosote bush** **2. Their burrows keep them safe from predators.** **3. They burrow underground to keep cool in the summer and warm in the winter. They spend at least 95% of their lives underground.** **4. They can live in places where the ground temperature is over 140 degrees because they live in burrows.**
SOCIAL BEHAVIOR	**Solitary**
TYPE OF DIET	**They are herbivores eating mostly grasses, wildflowers, and cacti.**
PREDATORS	**Ravens, coyotes, kit foxes, golden eagles, roadrunners, Gila monsters, fire ants**
SEXUAL MATURITY	**15-20 years**
MATING HABITS	**Male circles around the female, biting her shell in the process.**
MATING SEASON	**Mating occurs in spring and autumn. The female may produce 3 clutches a year depending on climate.**
GESTATION	**90-135 days Some eggs may overwinter and hatch the following spring.**
OFFSPRING BORN	**1. Temperature influences hatching rates and hatchling gender.** **2. Incubation from 81 to 88 °F resulted in a higher hatching rate.** **3. Incubation at 77 °F results in a lower hatching rate.** **4. Incubation temperatures less than 88 °F result in all-male clutches.**
# OF OFFSPRING	**4-8 eggs per clutch. Out of every 100 eggs, only 2 to 3 reach adulthood.**
THE YOUNG	**Look like small adults**
TIME WITH MOTHER	**None**
THREATS	**The most significant threats to tortoises include urbanization, disease, habitat destruction and fragmentation, illegal collection and vandalism by humans, and habitat conversion from invasive plant species**
TYPE OF FEET	**Four feet with 5 toes of the same length on each foot**
OTHER INFORMATIONS	**1. They only go to water to drink or bathe.** **2. They are not designed to swim.** **3. They will dig depressions in the ground so they can collect water.**

	4. They get most of their moisture from the foods they eat. 5. Storing water is also necessary for the survival of the desert tortoise. They have two water saving cabins under their shells that hold water they get from the cacti they eat. 6. Adults can live up to one year without drinking water because they store water in their bladders, where it can be reabsorbed back into the body. 7. When it is hot and water has dried up, they will only come out of their burrows a few times a week or once every two to three weeks. 8. They become dormant (torpor) in the winter to avoid the cold weather. 9. They cool off by resting in the shade of a bush or at the entrance of their burrows.
FEET AND CLAW ADAPTATIONS	Their strong legs and claws allow them to be good diggers.

SPINY SOFTSHELL TURTLE

See Reptiles Plate 4

CLASS	Reptilia (snakes, turtles, lizards, alligators)
FAMILY	Trionychidae
OTHER NAMES	None
LIFE SPAN	25 to 50 years
SIZE and WEIGHT	Females up to 21 inches Males are much smaller up to 8 inches Females can weigh up to 25 pounds
TIME OF ACTIVITY	1. Diurnal. They spend most of their days basking in the sun and foraging for food. 2. They are active all year but activity increases with warmer weather.
RANGE	They are found throughout the United States and Canada. The western border of the range of the spiny softshell extends into river systems from eastern Wyoming, Colorado, and New Mexico, including areas in the Missouri River drainage of Montana.
HABITAT	1. They prefer shallow (about 3 ½ feet deep) slow moving waters with sandy bottoms as well as clean, sandy banks. 2. Freshwater including ponds, lakes, rivers, tributaries, and streams. 3. Sandy environments are important for nesting sites, proper juvenile growth and development, and camouflage. 4.They will migrate short distances to find the best area depending on the temperature.
SHELTER	They spend most of their time buried under the sand or mud in a river or a lake bottom with their heads above the shallow water.
SOCIAL BEHAVIOR	Mostly solitary
COMMUNICATION	They have no vocal cords but can make a hissing sound.
TYPE OF DIET	1. They are mostly carnivorous and will consume insects, non-insect arthropods, crayfish, fish, some plant material, and mussels. 2. They will either actively hunt prey or bury themselves in the sand and wait to ambush prey.
PREDATORS	1. Turtle eggs and the young are often preyed upon by raccoons, skunks, and foxes. 2. The only thing that preys on the adults are humans.
SEXUAL MATURITY	8-10 years
MATING HABITS	1. The male will nudge the female's head while swimming, and if she chooses to mate, the male will swim above the female without clasping her with his claws (unlike other turtles). 2. A few months later, the female turtle quickly lays her eggs along a sunny sandbar or gravel bank in a flask-shaped cavity she has dug close to the water. 3. They can lay more than one clutch a season.
MATING SEASON	Mid to late spring in deep waters
GESTATION	Eggs are laid July through September
OFFSPRING BORN	Hatch in late spring the following year
# OF OFFSPRING	9-38
THE YOUNG	Look like small adults. They are particularly vulnerable to predators.
TIME WITH MOTHER	None
THREATS	1. A chemical (Rotenone) that is used to kill unwanted fish also kills them.

	2. Habitat fragmentation and shoreline development continues to threaten nesting sites. 3, They are hunted or shot for "fun" and human consumption. 4. Eggs, hatchlings, and juveniles are threatened by various human activities. 5. They are listed as endangered in Canada, but not in the USA.
TYPE OF FEET	Four webbed feet with three claws
OTHER INFORMATIONS	1. Their long necks and noses allow them to stretch up to the water surface to breathe without having to leave their hiding places. 2. One of their most distinguishing features is the presence of a leathery, moderately flexible carapace. This is caused by loss of keratinized scutes and some bony tissue loss. The shell has no scutes, but it does have spines on the edges of the carapace.
HUMAN USAGE	Food
ADAPTATIONS	1. They are bimodal breathers, meaning that they can perform oxygen and carbon dioxide exchange by breathing air or while breathing underwater. 2. They can absorb oxygen through their skin. 3. They are more dependent on underwater breathing than other aquatic species.

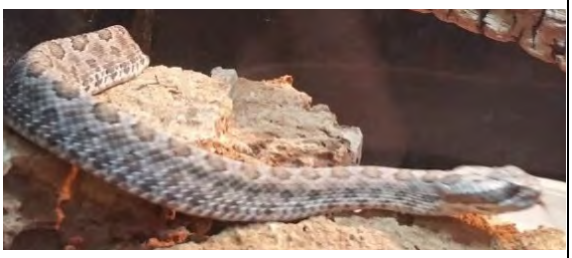
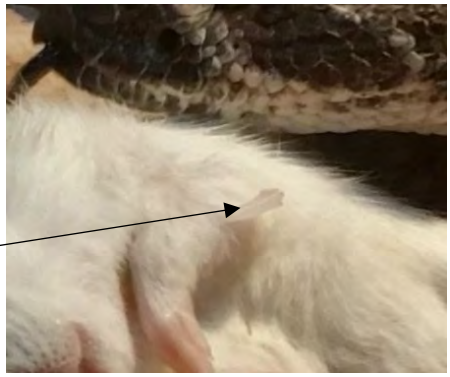
WESTERN BOX TURTLE

See Reptiles Plate 4

CLASS	Reptilia (snakes, turtles, lizards, alligators)
FAMILY	Emydidae (North American box turtles)
OTHER NAMES	None
LIFE SPAN	40-60 years, but some can live up to 100 years or more
SIZE AND WEIGHT	Size - 5-7 inches Weight – 7-19 ounces
TIME OF ACTIVITY	Crepuscular, being most active after a rain.
RANGE	Northern Chihuahuan and Sonoran deserts
HABITAT	Sandy lower drainages, open plains of the arid scrublands, and they may also be found in the lower forested slopes of area mountain ranges
SHELTER	1. They may either dig their own burrows or appropriate rodent burrows, or simply seek shade for shelter from excessive heat. 2. They spend about 85% of their time in burrows.
SOCIAL BEHAVIOR	1. Mostly solitary. 2. A turtle removed from its territory and released will try to get back to its home territory.
COMMUNICATION	Motions observed during mating (see Mating Habits below.)
TYPE OF DIET	1. Omnivores: reptiles, crayfish, insects, spiders, worms, eggs, carrion, berries, and succulent plants (including prickly pear cactus pads and fruit) They may even consume mushrooms that would poison a human. 2. Scavengers: They may dig with their clawed front legs through the dung of the larger grazing animals. 3. While it will drink (and even swim) if the it is near water, the turtle meets most of its liquid needs from its diet.
PREDATORS	The turtles, especially when young and vulnerable, may fall prey to herons, crows, weasels, ravens, foxes, gulls, raccoons, and skunks.
SEXUAL MATURITY	5 years for males 8 years for females
MATING HABITS	1. The male does such courtship behaviors as staring at the female, following her around, and rubbing up against her. He may also nudge and bump her shell. 2. The female often runs from the male, leaving him behind to chase her or to fight with other males who want to mate. 3. Chasing the female lasts about half an hour, and then the female will mate with the winning male.
MATING SEASON	April through October
GESTATION	1. The eggs incubate for about 50 days, though they can develop faster at warmer temperatures. 2. The sex of the young is also determined by the surrounding temperature. Eggs that develop at or above 84°F will usually become females. Eggs that develop below 82°F usually become males. 3. Females can retain sperm for up to 4 years.
OFFSPRING BORN	1. 2-8 eggs are laid and most hatch

	2. The female will lay 1 to 2 clutches per year.
# OF OFFSPRING	**2-8**
THE YOUNG	**Most do not survive to adulthood due to predators and human encroachment.**
TIME WITH MOTHER	**None**
THREATS	**1. Automobiles cause the death of many western box turtles.** **2. Humans have also been turning these turtles' habitat into houses, buildings, and farm land.** **3. Since they spend most of their lives in burrows, western box turtles are easily preyed upon by predators.** **4. They can be killed by farming equipment and lawn mowers.**
TYPE OF FEET	**Four feet with five toes each**
OTHER INFORMATION	**1. The female Western Box Turtle may lay several hundred eggs during her lifetime, but, usually, only a handful will survive to adulthood.** **2. The turtles produce a growth ring each year on each of the scutes of its carapace, so its age can be estimated by counting the rings.** **3. The Western Box Turtle appears on The Convention of International Trade in Endangered Species (CITES) list threatened species.** **4. To protect themselves, they have a hinged plastron that allow them to close their shell completely when they feel threatened.** **5. Western Box Turtles may also fight back, or walk away. Most of the time though, they freeze and wait for the predator to leave.** **6. They may also go into their burrows or go into water.**
HUMAN USAGE	**None**

1. Corn Snake **Photo by Nathan Shepard** **2.Corn snake** Photo by Alamy		
King Snake **2nd photo by HGHjim**		
1. Hognose with mouse **2. Trans-Pecos Rat Snake Photo by Gary Nafis**		
1. Gopher snake **2. Coach-whip**		

1.**Banded Rock Rattlesnake** **2. Note the shape of the head and eye.**		
1. Desert Massasauga Rattlesnake **2. Blacktail Rattlesnake**		
1. Western Diamondback eating a mouse. Note how wide the mouth is opened. **2. Western Diamondback's fang lost in the mouse**		

Western Diamond rattlesnake on the path at Living Desert Park.

1. Gila Monster **2. Desert Spiny Lizard**		
1. Texas Banded Gecko **Photo: unknown** **2. Fence lizard**		
1. Trans-Pecos striped whiptail **2.Whiptail**		
1. Texas horned lizard **Photo by Rick Reed** **2. Round-tail horned lizard** **Photo by Rick Reed**		

Turtles and Tortoises

Reptiles Plate 4

1. Shiny Softshell Turtle **2. Western Box Turtle**		
1. Bolson Tortoise **2. Bolson Tortoise Hatchling** **Photo by Mary Streng**		
1. Desert Tortoise		

SECTION 11

AMPHIBIANS

Amphibians: Class Amphibia

Amphibians are vertebrates that live on land, though they still depend on water to reproduce. Amphibians lay their eggs in water and undergo metamorphosis. This word comes from the Greek : META – Change and MORPH – Form. In Zoology, the definition is a change or successive changes of form during the growth of an animal by which it is adapted to a new or special environment or way of living

Animals that undergo metamorphosis often live in very different habitats at different stages of their life and also may eat completely different types of food, so the larval form does not directly compete with the adult form for space or resources. However, this also means that they can be more vulnerable to population declines due to habitat loss since they depend on two different habitats for their survival. Amphibians are also very vulnerable to toxins in the environment because their skin is thin and permeable(absorbs oxygen through the skin). For these reasons, many amphibians worldwide are now threatened with extinction. They are the proverbial "canaries in the coal mine."

The table below outlines some of the main differences between amphibians and reptiles.

	Amphibians	Reptiles
Skin	Thin and permeable	Dry and scaly body
Body Temperature	Exothermic	Exothermic
Skeleton	Vertebrate	Vertebrate
Eggs	Laid in jelly-like substance in water	Tough and leathery or hard shelled on land
Newborn	Undergoes metamorphosis	Looks like little adult
Feet	Don't have claws	Have claws

DESERT AMPHIBIANS AFTER DARK

Since amphibians never stray far from water where they lay their eggs, the desert seems an unlikely place for frogs, toads, and salamanders. Most are active during the hours of darkness when moisture levels are highest and the risk of desiccation is lowest. Some have adapted uniquely to cope with the scarcity of water.

BARRED TIGER SALAMANDER
See Amphibian- Plate 1

CLASS	Amphibian (frogs, toads, salamanders, caecilian)
FAMILY	Ambystomatidae (salamanders)
OTHER NAMES	Western tiger salamander. Larva are also called water dogs and mud puppies
LIFE SPAN	10-16 years up to 25 years in captivity
SIZE	Size – 3-6 inches up to 13 inches and weight – 2-5 ounces
TIME OF ACTIVITY	Nocturnal
RANGE	Southwestern Canada in British Columbia, Alberta, Saskatchewan, and Manitoba, south through the western United States to Arizona, New Mexico, Texas, and northern Mexico
HABITAT	Forests, fields, meadows, grasslands, and deserts near water
SHELTER	1. Adult Tiger Salamanders live underground for most of the year and usually dig their own burrows (near ponds, lakes, or slow-moving streams), unlike other species that use burrows of other animals. 2. They have been found over 2 feet below the surface. This allows them to escape the temperature extremes on the surface and may explain why they have such a wide array of habitat types.
SOCIAL BEHAVIOR	1. Larvae group together in a pond. 2. Juveniles and adults den together in times of drought to conserve body water. 3. Adults are usually solitary, but some have been seen sharing burrows.
COMMUNICATION	1. Salamanders ccommunicate during mating season. 2. During mating season, some species can make quiet ticking or popping noises, perhaps by opening and closing of valves in the nose.
TYPE OF DIET	They are carnivores that eat insects, earthworms, snails, slugs, small mice, other amphibians, and tadpoles.

PREDATORS	**Snakes, turtles and fish**
SEXUAL MATURITY	**Four years**
MATING HABITS	**Males compete for females. They also produce pheromones.**
MATING SEASON	**1. December- March after a heavy rain** **2. The females attach the eggs to plants along water's edge and then has nothing more to do with them. They prefer to lay their eggs in temporary pools of water because there are not any fish to eat the eggs.**
GESTATION	**They hatch in 3-5 weeks.**
OFFSPRING BORN	**When they hatch depends on the temperature of the water.**
# OF OFFSPRING	**Females lay up to 1,000 eggs.**
THE YOUNG	**1. After several weeks, the eggs hatch into larva (juveniles) with external gills.** **2. That summer or the following summer the larva goes through Metamorphosis.** **3. By August, they are fully grown.** **4. They will stay where they were born until a hard rain comes. Then they instinctively know to migrate to look for a good dry land place to spend the winter.** **5. Some of the larva might not complete metamorphosis. These will keep their gills and live in the water as adults.**
TIME WITH MOTHER	**None**
THREATS	**Salamanders are often hit by cars, polluting of their ponds and habitats, degradation, and fragmentation of habitat through human activities and encroachment of invasive species.**
TYPE OF FEET	**Four feet with four toes on the front feet and five toes in the back**
OTHER INFORMATIONS	**1. A tiger salamander only has a 50% chance of breeding more than once in its lifetime.** **2. Some populations may not metamorphose at all, and become sexually mature while in their larval form. These are the neotenes, and are particularly common where terrestrial conditions are bad.** **3. Most species of salamander have small teeth in both their upper and lower jaws. Unlike frogs, even the larvae of salamanders possess these teeth.** **4. Like other amphibians, they are closer to being truly cold-blooded than reptiles. Although they possess lungs, most breathing is through the skin.** **5. They are capable of regenerating lost limbs, as well as other damaged parts of their bodies. Researchers hope to reverse engineer the remarkable regenerative processes for potential human medical applications, such as brain and spinal cord injury treatment or preventing harmful scarring during heart surgery recovery.**
HUMAN USAGE	**Large larvae are usually known as waterdogs, and are used extensively in the fishing bait and pet trade.**

COUCH'S SPADEFOOT TOAD

See Amphibian Plate 1

CLASS	**Amphibian (frogs, toads, salamanders, caecilian)**
FAMILY	**Scaphiopoidae (North American spade foot toads)**
OTHER NAMES	**Spadefoot toad, Mexican Spadefoot Toad, Western Spadefoot Toad**
LIFE SPAN	**7 - 10 years can live up to 13**
SIZE	**1 ½ to 3 ½ inches**
TIME OF ACTIVITY	**1. Nocturnal but when the tadpoles are changing into adults, they are often active during the day.** **2. They are most active in the spring and summer during the monsoon season.**
RANGE	**Found primarily in Sonoran and Chihuahuan deserts**
HABITAT	**This is the most desert-adapted species of toads and can be encountered in any of the arid western desert valleys capable of supported rain pools that last at least 7-8 days.**
SHELTER	**1. Burrows under creosote and mesquite bushes.** **2. They remain buried in the soil for 8-10 months or longer during droughts and then emerge at the onset of the summer monsoons.**
SOCIAL BEHAVIOR	**Solitary**

COMMUNICATION	**The call, given by males as they float in the breeding pond, is a plaintive "wah! wah!" suggestive of a bleating sheep. It carries well on humid summer evenings and is a sure sign that the often-long-awaited summer monsoon has finally begun.**
TYPE OF DIET	**Couch's spadefoot adults will eat anything that moves and fits into their mouths. Winged termites, which are high in fat content, also emerge with the first monsoon storms, and often make up a high percentage of the spadefoot's diet. They also eat beetles, grasshoppers, katydids, ants, and spiders. They can consume enough food in one meal (up to 55% of their body weight) to last an entire year.** **Tadpoles will eat a variety of foods, such as small insects near the pool and algae, which they scrape off rocks. They also filter microorganisms from the water as it is passed over their gills. They will gather in wriggling masses, stir up the muck on the bottom of the pool, and filter out the organic nutrients. Spadefoot tadpoles are omnivores. They also eat dead insects and tadpoles, as well as fairy shrimp.**
PREDATORS	**Eggs: larval water scavenging beetles, larval tiger salamanders, yellow mud turtles, grackles, and skunks**
SEXUAL MATURITY	**15 to 19 months**
MATING HABIT	**1. Water is necessary for the fertilization of spadefoot eggs, and once the eggs hatch, water also provides a place for tadpoles to mature to the adult stage.** **2. After the first significant summer storm, Couch's spadefoots move to rain-filled temporary pools for a night or two of frantic breeding and foraging.** **3. The call, given by males as they float in the breeding pond, is a plaintive "wah! wah!"** **4. During reproduction, the male mounts the female and releases sperm to fertilize the eggs, which are deposited in the pools of water in the form of a floating mass.** **5. Eggs are usually laid the first night that ponds fill and hatch within 36 hours.** **6. Tadpoles can metamorphose in as little as 7-9 days. Drying of a pond stimulates rapid metamorphosis and smaller toads.**
MATING SEASON	**1. April through August** **2. They emerge from their burrows when they feel the vibrations from thunderstorms that signal the start of the rainy season.**
GESTATION	**1-2 days to emerge as tadpoles and about 7-9 days to complete metamorphosis.**
OFFSPRING BORN	**The female can lay up to 300 eggs.**
# OF OFFSPRING	**Many are not able to complete metamorphosis due to predation and the drying up of the water ponds or puddles they are in.**
THE YOUNG	**Undergo rapid metamorphosis. They must then eat enough food so they can survive during the winter estivation.**
TIME WITH MOTHER	**None**
THREATS	**Because of their thin, permeable skin and the underground dwelling, they are especially sensitive to environmental factors. Such environmental problems may include acid rain, increasing ultraviolet irradiation, changes in land and water, and other factors.**
TYPE OF FEET	**Four feet with three webbed toes The hind feet have a spade-like appendage with which they dig their burrows.**
OTHER INFORMATIONS	**1. They give off a peanut smell if they are injured or mishandled.** **2. They live in a state of estivation (a dormant period in which body function slow way down.)** **3. They can live two or more years in their burrows waiting for a soaking thunderstorm to bring enough moisture to cause them to return to the surface.** **4. The adults eat enough food to sustain them when they go underground.** **5. This species has benefited from construction of berms, cattle tanks, and other ground disturbance that promotes collection of rainwater.** **6. They expel musky secretions that are irritating to predators' mucous glands if consumed. Spadefoot toads also have pectoral glands above their bellies that contain poison.**
HUMAN USAGE	**None**

RED SPOTTED TOAD
See Amphibian Plate 1

CLASS	**Amphibian (frogs, toads, salamanders, caecilians)**
FAMILY	**Bufonidae (true toads)**
OTHER NAMES	**None**
LIFE SPAN	**Up to 11 years**
SIZE	**1.5 to 3 inches**
TIME OF ACTIVITY	**Nocturnal but may be diurnal during breeding. They hibernate in burrows during the dry season.**
RANGE	**This toad is native to the southwestern United States and northwestern Mexico including the Sonoran and Chihuahuan deserts.**
HABITAT	**They occur primarily along rocky streams and riverbeds, often in arid or semi-arid regions. They are very localized on the coastal slope, but widespread in the deserts. In dry areas They need seasonal pools or even temporary rain puddles to use for breeding.**
SHELTER	**Crevices in rocks and burrows in the dry season.**
SOCIAL BEHAVIOR	**1. Males defend calling territories at breeding sites. 2. Males engage in wrestling like bouts during territorial disputes.**
COMMUNICATION	**The most common call is a high-pitched trill, made by males, and lasting 4-10 seconds.**
TYPE OF DIET	**They are carnivores that feed primarily on insects, including ants, bees, bugs and beetles. They occasionally feed on smaller amphibians. Large red-spotted toads have been observed eating recently metamorphosed toads.**
LIFE CYCLE	**Egg- Larvae (Tadpole)- Frog 1. As a tadpole, they will have many body changes (metamorphosis). 2.They grow legs, lose their tails, and their gills are replaced by lungs.**
PREDATORS	**Tadpoles- coyotes, foxes, raccoons, salamander larvae and some aquatic invertebrate**
SEXUAL MATURITY	**First or second season following metamorphosis**
MATING HABITS	**1. Males leave their underground chambers after a sufficient spring or summer rainstorm awakens them. 2. Males chorus from a pool's edge until the female awakens and appears at the water. 3, The female carries developed eggs, which need external fertilization. When the pair joins, the male mounts the larger female in a piggyback embrace, 4. She releases her eggs one at a time, rather than in long strings, and is the only North American toad to do so. 5. The male fertilizes the eggs, which are enveloped in a gelatinous coating to protect the embryo. 6. The eggs sink to the bottom of the pool, where they will hatch in only a few hours.**
MATING SEASON	**April to September with elevation and rainfall influencing the timing**
GESTATION	**1. A few hours after fertilization. 2. Depending upon the size of the pool, the tadpoles take between 6 to 8 weeks to become adults.**
OFFSPRING BORN	**Number of eggs laid is 30-5,000 with an average of 1,500.**
# OF OFFSPRING	**1,500 however, only a few survive to adulthood**
THE YOUNG	**Larvae are generally black with metallic bronze flecks and are often observed clustered in large aggregations in stream habitats, resting on muddy banks.**
TIME WITH MOTHER	**None**
THREATS	**Chemicals in the environment are rapidly absorbed through the thin membrane covering the body.**
TYPE OF FEET	**Four feet with three toes each**
OTHER INFORMATIONS	**1. Behind their eyes are two small, rounded glandular structures called parotoid glands. 2. On some toads, these may emit a potent toxin, although the red-spotted toads produce little or no toxins.**
HUMAN USAGE	**None**
ADAPTATIONS	**1. They can lose 40 percent of their body water and still survive. This**

	adaptation that allows the toad to stray from water or to seek new habitats. **2. Small amounts of water, even dew, may be absorbed through a thin, translucent pelvic patch located behind the legs and extending up onto the abdomen. This allows the toads to absorb moisture and exchange electrolytes through their underside while in contact with damp ground.** **3. There is a report about the presence of presumably toxic indolealklamines from the skin and paratoid glands of red- spotted toads. This makes them distasteful and, in some cases, lethal to predators.**

Amphibians 1

Red Spotted Toad

1. Red Spotted Toad
Photo from NPS

2. Red Spotted Toad
Photo from Wikipedia

Barred Tiger Salamander

1. Barred Tiger Salamander in larvae form
Photo from Pinterest

2. Barred Tiger Salamander
Photo from Wikipedia

Couch's Spadefoot Toad

1. Couch's Spadefoot Toad
Photo from Wikipedia

2. Couch's Spadefoot Toad
Photo by Matt Jeppson

SECTION 12

BIRDS

Birds: Class Aves

Distinguishing Features of Birds

1. **Most birds have hollow bones. Most flightless birds have hollow bones. The only birds with marrow-filled bones are the ratites (ostrich, emu, cassowary, rhea, kiwi, moa, elephant bird) and the penguins (penguins do not have hollow bones, they are filled to make the bird heavier for diving)**
2. **All birds have feathers.**

Feathers

1. **Birds have feathers which are made from tough fibrous protein keratin, a protein which is also used to make horn, nails, and hair by different animals.**
2. **Feathers grow quite quickly on birds and are sealed off at the base. Full developed feathers become 'dead matter' just like the finger nails of a human being, however, they are still attached to muscles at the base of each feather which can move the individual feathers and keep them in place.**
3. **Some feathers, particularly female bird feathers, are dull in color for the specific reasons of safety and camouflage while male bird feathers are generally colorful for the purpose of displaying and for finding a mate.**
4. **Feathers have many different functions apart from helping the bird to fly or swim. They are used for protection, insulation, waterproofing, camouflage, communication, and display.**

TYPES OF FEATHERS

Birds have many different types of feathers, but they are either contour feathers or down feathers.

Contour feathers are distributed into flight feathers and those that cover the body. Flight feathers are the long feathers of the tail and wing. The feather that makes up the wings are called remiges and are divided into three group

1. CONTOUR FEATHERS:

- **are the outer layer of feathers that form a stream-lined aerodynamic shape surface which includes the flight feathers (wings and tail)**
- **give the bird its characteristic appearance (color and smooth shape).**
- **provide the body protection from the air, rainwater, and wind.**
- **appear on every part of the bird's body except for its feet, legs, and beak.**

CONTOUR FLIGHT FEATHERS STRUCTURE (wing, tail)

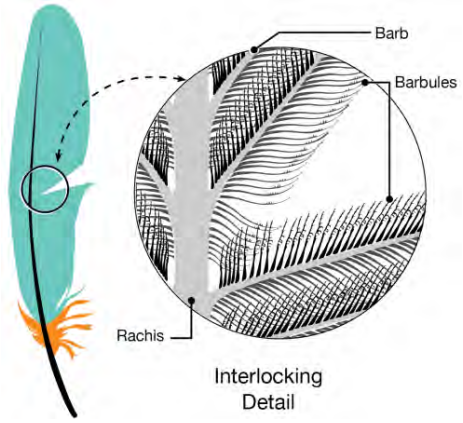
The tail feathers (retrices) and the long flight feathers of the wing feathers (remige) are similar in structure, but have different shapes for different uses. These feathers are important in flight, and have stiff shafts for strength. Flight control is an important factor of a bird's aerial activity. This action provides the bird's main form of aerial control allowing it to slow down, rise, descend, and bank.

A bird's primary feathers at the wing tips can be fanned out and twisted to adjust their resistance to the air flow. A small tuft of feathers on the anterior edge of the bird's wing, called the alula or the 'bird's thumb', which is used for slow speed maneuvering or landing. The alula is held flush against the wing and controls the airflow over the leading edge of the wing by moving slightly upwards and forwards creating a small slot on the wing's landing edge. This allows the wing to achieve a higher-than-normal angle of attack and lift without resulting in a stall.

At slow speeds, the tail feathers are also important as they act as a rudder for maneuvering and as a fanned-out air brake for landing. Secondary flight feathers are less adjustable but form an arched airfoil surface that generates lift as the bird moves through the air.

The flight feather has four main parts:

1. **the "quills" or "shaft" which runs the length of the feather and gives each feather its strength;**
2. **the smaller broad flat "vanes" that project out from either side of the shaft**
3. **"barbs" which project from the vanes are like the teeth of a comb**
4. **tiny "barbules" which project from the barbs. The barbules of adjacent feathers overlap and interlock. This process holds adjacent feathers together and provides a strong wing surface for flying.**



2. DOWN FEATHERS (lack barbules):

- **grow under the contour feathers.**
- **There are 5 types of down feathers: down, semiplume, bristle, filoplume, powder down**

1. Down

Underneath the contour feathers is a layer of down; down feathers do not have interconnecting barbules, which gives them a soft texture. The down feathers function as insulation. Newly hatched chicks are usually covered with down; only later do the contour feathers and the flight feathers begin to grow.

2. Semiplume

Loose & fluffy feathers similar to down feather; provides body insulation and increases the buoyancy of water birds.

3. Filoplume

Small hair-like feathers with a few barbs at the tip of the shaft; which occur among the contour feathers.

4. Bristle

Modified, vaneless contour feathers with only a few barbs at the base on a small, shaft or stiff rachis. They can occur around the eyes, nostrils, and in f lying insect-catching birds (such as tyrant flycatchers & goatsuckers) around the mouth, called rictal bristles.

5. Powder Down

**These are feathers that grow continuously and are never molted.
The barbs at their tips constantly disintegrate into a fine, talc-like, water-resistant powder. Birds such as herons use the powder to mop up the slime and dust that gets on their fronts during feeding. They are often abundant in birds that lack preen glands.**

Molting

In a process called molting, birds shed their feathers and grow new ones. Besides replacing worn feathers with new ones, the molt may be associated with camouflage or courtship plumage. The new feather grows inside a sheath. These new "pin feathers" are usually whitish in color and look like small pins projecting from the skin. The sheath contains a blood supply to provide the growing feather with nourishment. When the feather is grown, the sheath comes off in flakes, revealing the feather inside. The bird preens itself frequently at this time in order to remove the dead sheaths. The fully formed feather is made of dead material like the hair, nails and hooves of mammals.

Most birds molt once a year, replacing the worn feathers with new ones. Some, such as the parrots, molt continuously throughout the year. Other birds molt two or three times a year. For instance, many songbirds molt in the fall to a drab winter plumage and then molt again in the spring to the bright courtship colors. Ducks molt in the late summer prior to their long autumn migration. The flight feathers are all shed at one time, leaving the bird unable to fly. During this "eclipse molt," ducks are very secretive and will hide in the reeds, which form a camouflaging cover for them. After the fall migration, the ducks molt again, this time to the breeding plumage which is bright in males.

Molting may involve a gradual change in coloration. The rock ptarmigan of the arctic tundra is snow white in its winter plumage. As the spring arrives, the ptarmigan undergoes a slow molt, with brown feathers replacing the white ones, until the dull brown summer plumage is achieved. In the fall the molt continues, replacing brown feathers with white ones. Thus, the bird is camouflaged from predators during all seasons.

Cold Weather Adaptation

Feathers can be raised or lowered to vary the thickness of the insulation layer they form. In cold weather, birds fluff their feathers to increase the insulating layer. In warm weather, the feathers are held close to the body. In this respect, feathers are like the hairs of mammals, which can also be raised or lowered.

Preening and Bathing

One instinctive behavior among all birds is preening. The feathers of the body are run through the bill. This activity reconnects the barbules and is important in keeping the feathers in flying condition. At the base of the tail, most birds have a special oily gland called the uropygial gland. The bill is rubbed against this gland and the oil secretion is transferred to the feathers of the body during preening. The oil also helps to waterproof the feathers.

In addition to preening, many birds bathe in water or dust. These baths keep the skin in condition and help to reduce external parasites. Some species of birds (e.g., blue jays) engage in an activity called "anting" during which times ants are placed among the feathers of the tail and wings. Although the function of anting is not clearly understood, the fact that many species of ant emit repugnant substances indicates that the ants may help to repel external parasites.

Endothermy

Birds share with mammals the feature of warm-bloodedness, or endothermy. For a detailed explanation of the physiology and survival advantages of endothermy, see the section on endothermy under "Mammals" in this manual.

Endothermy is a prerequisite for powered flight, and a warm-blooded physiology is emphasized in the circulatory and respiratory systems of birds. They have a four chambered heart which achieves separation of venous and arterial blood. There are numerous air sacs associated with the lungs which contribute to the ventilation of the respiratory system and serve as evaporative coolers during periods of activity when too much

heat is produced by the body. The bird can cool itself by "gaping," or opening the beak. Air sacs also contribute to the buoyancy of the bird.

As with small mammals, small birds must eat large amounts of food to maintain their body temperature. The phrase "to eat like a bird" is misleading. An extreme example is the hummingbird which may eat twice its body weight in food per day.

Endothermy allows for "fast-acting" responses to sensory stimuli. The senses of birds are well developed and the area of the brain which coordinates response to sensory input is proportionately larger in birds than in most other vertebrates. The time required for a bird to process a visual image can be as little as half the time required by humans. This quick reaction time in birds has significant survival value, especially in flight.

Field of Vision

A visual adaptation is the field of vision, which can reach 300° in birds, compared to our own visual field of 45°. The avian eye can detect movement as well as color.

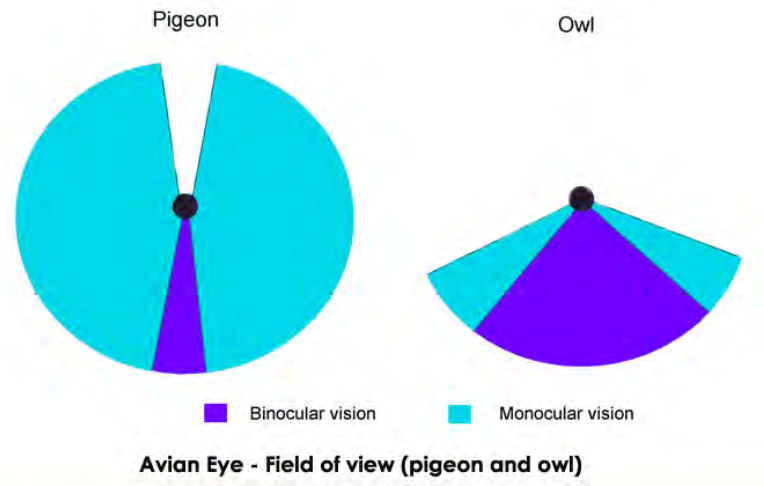
Monocular Vision

In most birds, the eyes are placed much nearer the sides of the head, which allows them to see different objects on opposite sides of their bodies at the same time. This gives the bird a greater overall field of view, but greatly reduces its binocular vision (the area in which both eyes can see an object). Most birds have monocular vision which allows them to see to the side and rear so they watch for predators without having to turn their head.

Binocular Vision

Birds of prey have their eyes on the front of their heads which allows them to estimate distances when hunting. To have clear vision, these birds cannot see objects located on their sides as other birds.

Because an owl's eyes are fixed in their sockets, it must rotate its neck to look around. It can rotate its head about 270 degrees



Avian Eye - Field of view (pigeon and owl)

Hearing and Smelling

In addition to excellent vision, birds can hear very well. All birds have ear openings in the side of the head, although they are usually hidden by feathers. Some birds, such as owls, rely more on hearing than vision when they hunt for food. Many birds can identify other birds individually by the slightest differences in song. In many, but by no means all bird species, the mother recognizes her chick among thousands of other peeping birds by its voice. A few birds have a well-developed sense of smell (vultures which feed on carrion).

Advantages of Flying

1. **Fliers gain access to food in the air (flying insects), food that must be reached from the air such as terminal flowers, or that can be located from the air (rodents, fish).**
2. **Great mobility and maneuverability enable fliers to search rapidly and efficiently for food and shelter.**
3. **Escape is provided from non-flying predators.**
4. **By migrating, fliers can travel to regions where climate, food supply, and nesting sites are favorable according to season.**
5. **Dispersal is possible over distances and geographic barriers otherwise insurmountable. Flight enabled birds to colonize the entire world; they are found in all corners of the globe except the interior of Antarctica.**

Migration

Migration allows the birds to seek new locations when food supplies dwindle. Since food supply is related to climate, migrations are seasonal in nature. Bird migration is triggered by the changing length of day, both in autumn and spring.

However, several other factors affect the exact time of migration. Birds of the tropics, where environmental conditions are fairly stable throughout the year, do not undergo major migrations. In the temperate regions, however, there are definite seasons. Birds in these regions may undergo very long migrations in search of food. Generally, these migrations are in a north-south direction. Some temperate species, such as the blue jay, do not undertake long migrations but have more localized movements. Many birds which inhabit mountainous areas undergo seasonal movements up and down the mountainside. Moving to an area a few hundred feet lower in elevation may accomplish the same climatic change as a migration of thousands of miles. The longest recorded migration belongs to an Arctic tern which was banded in northern Russia and then recaptured in Australia, a distance of 14,000 miles. Most birds migrate in flocks, perhaps seeking safety in numbers, or perhaps are all triggered by the same stimulus at the same time.

Wings

The wings of birds are adapted for different kinds of flight.

- **A long, broad wing is adapted for soaring in the birds of prey and for the slow, measured flight of the herons.**
- **Rapid fliers, many of which catch insects on the wing, have long, pointed wings. Ducks exemplify direct, rapid fliers with moderately short and pointed wings.**
- **Short, rounded wings indicate a slow flier, as with the bobwhite quail.**
- **Ratites (flightless birds) have greatly reduced wings and feathers that are too coarse to support the bird in flight.**
- **Some birds, like the chimney swift, have become such specialized fliers that they have almost lost the use of the hindlimbs for walking. The Chimney swift cannot take to the air if placed on a flat surface; its feet and legs function only in grasping vertical surfaces, such as the side of a chimney.**

The speed of flight varies with the species. Hummingbirds can hover in one spot. Racing pigeons can fly about 95 mph. Penguins "flying" through the water reach speeds of 30 mph. The record is held by the peregrine falcon, which reaches speeds of 200 mph in a dive.

Reproduction in Birds

Many (but by no means all) birds illustrate a principle of animal coloration called sexual dichromism; the two sexes are differently colored. Generally, the female is a dull, drab color, camouflaging her as she sits on the eggs. In contrast, the male is very brightly colored. He does not incubate the eggs. He is not as susceptible to predation. The female chooses to mate with the most brightly colored males. On the other hand, in some species of birds, both sexes incubate the eggs. Here, both sexes have dull colors for camouflage. The newly hatched chicks of many species are also mottled in dull colors for camouflage.

Birds are well known for staking out and defending territories during the breeding season. Usually, the male of the species acquires and maintains his territory by displaying visually or vocally, and by threatening invaders if necessary. Territoriality assures the occupants of the territory a suitable nesting site and sufficient food for the young. Colonial nesters (penguins, flamingos, herons) need only a very small nesting territory because their feeding grounds (oceans or lakes) are distant from their nesting grounds. In these birds, the territory extends only about as far as the bird can reach while sitting on the nest.

Much of the courtship behavior in birds is genetically programmed. Cranes go through elaborate dances. Many waterfowl have a sequence of head-bobbing and swimming. Ostriches get down on their "knees," shake their wings, and roll their heads from side to side. Colorful displays by the male are an important part of courtship in many species. Generally, there is a fairly strict sequence of events which precede mating. If either partner fails to respond "correctly" to a signal, the courtship terminates and mating does not occur. Theoretically, the result of this programmed sequence of behavior is that each species has its peculiarities; members of another species would not respond "'correctly" and no mating would occur. In fact, however, successful mating attempts between two closely related species sometimes do occur. So, in general, the system works, but exceptions happen.

In birds, fertilization is internal; the male inseminates the female through the cloaca (a single opening used for both excretion and reproduction) during mating. The process of insemination in birds is often referred to as a "cloacal kiss," which results in fertilized egg.

Eggs and Nest

There is diversity in birds' eggs. Naturally, the larger birds lay larger eggs. The contents of one ostrich egg are equal to three dozen chicken eggs. Clutch size (number of eggs) depends upon the species. Pheasants and partridge may lay up to 30 eggs. Most birds will lay a second clutch if the first one is lost. Many small birds normally lay two or three clutches per year.

The shape and color of the egg is related to the habitat. Many birds which nest on cliff ledges (auks and murres) lay pear-shaped eggs which roll in a small circle and are less likely to fall off the ledge. Owl eggs are almost round. The more typical shape is an ovoid between these two extremes. Eggs which are laid in open nests on the ground are usually spotted for camouflage. Eggs which are laid in elaborate nests hidden from view may be bright and colorful.

The variety of bird nests is remarkable. Many terns and penguins simply place a few stones together to form a nest. Weavers and orioles weave elaborate hanging nests from plant materials. The South American ovenbird builds a hollow ball from sand and cow dung. The mallee fowl lays its eggs in a huge pile of rotting vegetable matter, which is collected by the male. The internal temperature of the nest is tested with the beak, and material is removed from the top if the fermenting vegetation produces too much heat. Many birds utilize natural cavities for their nests, often a hole in a tree. The male hornbill seals the female in a tree cavity except for a small hole through which he passes her food.

Incubation

The incubation period depends upon the species. The extremes are about 13 days for many small, perching birds and 81 days for the royal albatross. During the breeding season, most incubating birds have naked patches on their breast where the eggs are warmed next to the skin (brood patch). Incubation is performed by the female only (pheasants), the male only (emu) or both sexes (ostrich). Upon hatching, baby birds fall into two categories.

Altricial or Precocial

Some species are altricial - they depend upon the parents for food and warmth for several weeks. The newly hatched chicks are naked and helpless. Generally, altricial birds build elaborate, well-constructed nests.

Other birds are precocial - the chick leaves the nest soon after hatching and follows the parents in search of food. The chicks are fully developed when they hatch. Baby ducklings can swim within hours of hatching. Generally, precocial birds lay larger eggs and have longer incubation periods than altricial birds. Both factors are related to the advanced state of the hatchling.

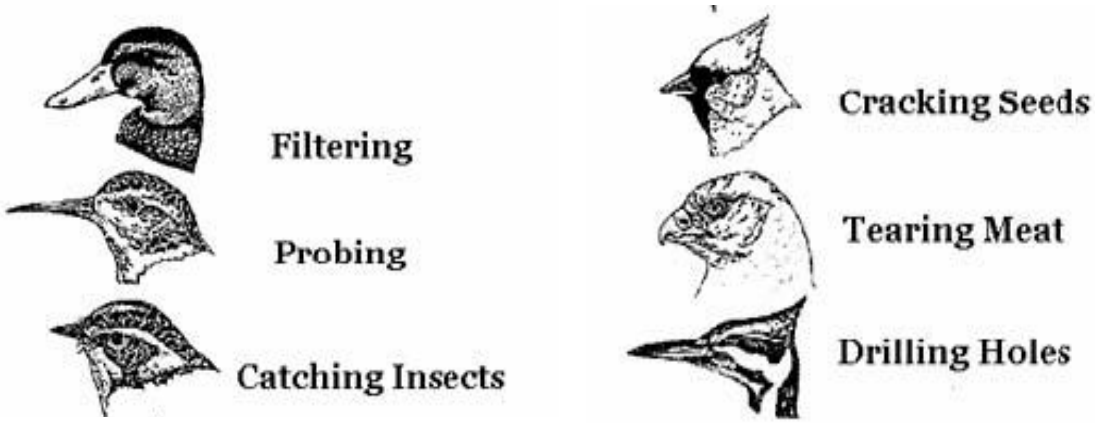
Bills and Feet

While the shape of a bird's body and wings are for the most part are dictated by the physical demands of flight, there is a wide variation in the shape and size of the bill, the legs, and the feet.

Bills

The bill of a bird is adapted to its way of life, especially its feeding habit. Birds of prey have sharp, hooked bills for ripping apart flesh. Finches and other seedeaters have short, conical bills for cracking seeds. The long, pointed bills of woodpeckers are adapted for catching insects in the bark of trees. The angled bill of the flamingo has a sieve-like structure for capturing small aquatic organisms. Lorikeets, members of the parrot group, have a small, brush-like tongue. This specialized tongue is an adaptation for collecting and eating pollen and nectar, the lorikeet's major food source.

Feet



The feet of birds are also adapted to the bird's way of life, particularly to its habitat. Swimming birds, like penguins and waterfowl, have webs between the toes to aid in propulsion through the water. Flamingos use their wide, webbed feet to stir up mud, which contains their food items. The birds of prey have strong, hooked claws for grasping flesh. The flightless birds have long toes for running. Some shore birds have long, slender toes to support their weight in mud or aquatic vegetation. The passerine birds (perching birds) have three toes pointing forward and one toe pointing backward for perching; when the bird perches on a limb, ligaments in the legs automatically lock the toes around the branch. This arrangement allows the bird to rest or even sleep in a perching position with no energy expended for maintaining a grip on the branch. Woodpeckers and parrots have two toes pointing forward and two pointing backward. This arrangement of toes affords better footing on vertical tree trunks. The double-wattled cassowary has a large claw on its inside toe which it uses as a defense weapon.

Shape of Bird Foot	Type of Bird Foot	Adaptation and Lifestyle
	Climbing	Feet like these help birds, like woodpeckers, climb trees. Notice the sharp nails for digging into the wood, and the back toes so that the bird doesn't topple backward.
	Swimming	Webbed feet help birds, like ducks, paddle through the water more efficiently.
	Running	For running quickly, birds like emus, often have three toes, all of which face forward.
	Perching	Feet with four toes, one of which is in the back, are useful for perching on tree branches. Birds, like blue jays, wrap their toes around the branch to help balance.
	Grasping	Predatory birds, like hawks, have clawlike feet called *talons* for grabbing their prey.
	Scratching	Chickens, and other birds that scratch in the dirt for insects, usually have feet with four toes, all of which have strong nails for digging into the ground.

Audible Communication

Most birds use their voice for audible communication. A few, such as the storks, lack a syrinx (voice box) and rely on other means of sound production, such as clattering the bill. Those birds which have a voice box similar to humans (parrots, mynah birds, starlings) are capable of "talking," i.e., mimicking human sounds. Call notes in birds are generally very simple, abrupt sounds which communicate messages of alarm or distress. Some gregarious birds have a vocal sentry system to warn the flock of approaching danger.

For the most part, true song is restricted to the passerines or perching birds. The song of each individual bird is unique, which allows others to identify the individual singer. The function of song is to announce the presence of the singer. Song plays an important part in claiming and maintaining territory during the breeding season.

Pellets

An interesting behavior which occurs in some birds (owls and crows) is the casting of pellets. Pellets contain undigested material, usually bone or hair in the case of owls, cast up from the digestive tract and out of the bird's mouth.

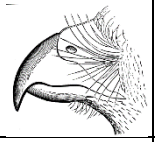
Social Behavior

There are relatively few learned behaviors in birds. To an extent, the song of a bird is learned from others of the species, and such activities as swimming and diving may be partially learned.

Social behavior in birds is most developed in those species which congregate in flocks. In these birds, there is a definite peck order, or hierarchy, with the older and more experienced birds in the top position. Generally, the pecking order is established with bluffs and threats. Physical confrontations are rare since one of the antagonists usually backs down in time. In this way, unnecessary loss of individuals is avoided. Hierarchy assures the survival of the most fit individuals. During times of food shortage or harsh climate conditions, the old and weak birds are the first to perish because they are generally at the bottom of the peck order. The strongest and healthiest individuals survive to reproduce and continue the species. This is one way that natural selection favors certain individuals to ensure the success of the species.

AMERICAN KESTREL (Falco sparverius)
See Bird Plate 1

FAMILY	**Falconidae (falcons)**
OTHER NAMES	**K-bird, sparrow hawk (because of its size)**
LIFE SPAN	**10 years**
CALLED	**Female: falcon males tiercel baby eyass, eyas group: flight, hover, soar**
SIZE	**9 to 11 inches**
WEIGHT	**3 ¼ to 4 ½ ounces**
WING SPAN	**19 to 24 inches**
FLYING SPEED	**39 mph**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Open areas with short vegetation and a few trees, deserts, grasslands, farm fields, meadows, forest clearings**
RANGE	**They range throughout North America, including much of Canada and into Alaska.**
SOCIAL BEHAVIOR	**Solitary for most of the year, but they are considered to the monogamous during mating season**
COMMUNICA-TION	**1. They are extremely vocal all year with the young fledglings being the most vocal. 2. They make a high pitched "kee-kee-kee" sound. Loud, ringing *killy-killy killy or klee-klee-klee* used all year round**
TYPE OF DIET	**Omnivore: grasshoppers (a favorite), cicadas, beetles, dragonflies, scorpions, spiders, butterflies, moths, caterpillars, earthworms, crayfish, voles, mice, shrews, bats, small snakes, lizards, frogs, small songbirds. flickers**
PREDATORS	**Barn owls, Cooper's hawk, red-tailed hawk, American crows, Northern goshawks, sharp-shinned hawk, rat snakes, corn snakes, fire ants**
SEXUAL MATURITY	**1 year**
MATING SEASON	**March through July depending on their location**
MATING HABITS	**1. The male advertise his territory by repeatedly flying high, diving while calling "klee" sounds. 2. The female flies slowly with stiff, fluttering wingbeats with the wings held just below**

	horizontal. **3 The male may bring food for female and pass it to her in flight.** **4. The male searches for possible nest cavities. When he finds some suitable crevices, he shows them to the female, who makes the final selection.**
NEST	**1. Kestrels do not build nest, but rather use a cavity of a tree (woodpecker hole or a tree hollow), or a rock crevice of a cliff, a dirt bank, a hollow, giant cactus, or even a nook in a human-built structure.** **2. If the cavity floor is composed of loose material, the female hollows out a shallow depression there.**
EGGS	**4 to 5 white with brown markings**
INCUBATION	**29 to 31 days by both parents**
THE YOUNG	**1. The female stays with the young, while the male brings the food to the female which she will feed to the young. After a few weeks, the mother begins hunting food also.** **2. After they fledge, the young birds continue to beg food from their parents by nosily chasing them.** **3. They learn to hunt by watching their parents, and are hunting on their own by the end of summer.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**29 to 31 days**
# OF BROODS PER YEAR	**1**
THREATS	**1. Loss of habitat** **2. Pesticides and other pollutants are killing their food (insects) and causing their egg clutches to be smaller.**
HUMAN USAGE	**None**
OTHER INFORMATION	**1. They are one of the most abundant and colorful raptors in the Americas.** **2. They are the smallest of the hawks.**
FEET 	**1. They have powerful feet with sharp, long talons used for grasping and holding prey.** **2. The talons grow continually because they are worn down with usage.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow.** **2. It is a strong weapon when used for defense.** **3. It is used to groom its feathers.** **4. It grows continually because it is worn down with usage.**
FEATHERS, WINGS, FLYING	**1. They are gracefully buoyant in flight, but are small enough to get tossed around in the wind.** **2. When hovering, they face into the wind, flap their wings, and adjust their long tails, so they can stay in place.**
BODY ADAPTATIONS	**They have acute eye sight.**
WEATHER ADAPTATIONS	**1. In colder regions of North America kestrels will migrate for the winter.** **2. Residents of southern areas tend not migrate.**
DEFENSE ADAPTATIONS	**1. You may see American Kestrels harassing larger hawks and eagles during migration, and attacking hawks in their territories during breeding season.** **2. Kestrels compete over the limited supply of nesting cavities with other cavity-nesters, and sometimes successfully fight off or evict bluebirds, Northern Flickers, small squirrels, and other competitors from their chosen sites.** **2. Kestrels may attack larger eagles to protect their territories during breeding season. They can sometimes chase off bluebirds, northern flickers, and even small squirrels.**
HUNTING ADAPTATIONS	**1. They sit on a perch to watch for prey.** **2. They usually seize their food from the ground. The smaller prey may be eaten on the ground, but the larger prey will be carried back to the perch.** **3. They can also catch prey in the air.** **4. They will hide surplus food in grass clumps, tree roots, bushes, fence posts, tree limbs, and cavities to save for a later time when hunting is bad.** **5. Although kestrels are usually diurnal, they will sit at lit stadium lights to search for insects.** **6. Individual kestrels often specialize on one kind of prey.**

AMERICAN ROBIN (Turdus migratorius)
See Bird Plate 4

FAMILY	**Turdidae (thrushes)**
LIFE SPAN	**2-year average**
SIZE	**9 to 11 inches long**
WEIGHT	**2.7 ounces**
WING SPAN	**14 to 16 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**American Robins are common across the continent in gardens, parks, yards, golf courses, fields, pastures, tundra, as well as deciduous woodlands, pine forests, shrub lands, and forests.**
RANGE	**Throughout most of North America, from Alaska and Canada southward to Mexico**
SHELTER	**1. During the day, they break up in small groups to search for food.** **2. At night, they will assemble in flocks to roost in trees.** **3. During nesting time, the males and independent young robins will roost in trees, while the females remain in their nests. When nesting is over, the female adults will go to the roosts and join the rest of the flock.** **4. During fall and winter they will roost in large flocks.**
COMMUNICA-TION	**1. Its song is commonly described as a *cheerly* carol, made up of discrete units, often repeated, and spliced together into a string with brief pauses in between.** **2. It is one of the first birds to sing at dawn and last to sing at dusk.** **3. They sing when storms approach and again when storms have passed.** **4. They have several calls used for communicating specific information such as when a ground predator approaches and when a nest or robin is being directly threatened.**
TYPE OF DIET	**Omnivore: earthworms, beetle grubs, caterpillars, insects, snails, spiders, fruits: including chokecherries, hawthorn, dogwood, sumac (robins eat a lot of fruit in fall and winter.) juniper berries and honeysuckle berries which could make them intoxicated if they eat just them**
PREDATORS	**1. The adults:** **hawks, falcons, owls, golden eagles, etc., larger snakes like rat snakes, cats, dogs** **2. Juvenile and eggs:** **jays, common grackles, American crows, common ravens, squirrels, snakes**
SEXUAL MATURITY	**1 year**
MATING SEASON	**The American robin begins to breed shortly after returning to its summer range. It is one of the first North American bird species to lay eggs, which lasts from April to July.**
MATING HABITS	**1. Monogamous** **2. In spring, males attract females by singing, raising, and spreading their tails, flaping their wings, and inflating their white-striped throats.** **3. Male and female approach each other holding their bills wide open and touching them.**
NEST	**1. Female chooses the nest sites that are typically located on one or several horizontal branches that are hidden in dense leaves.** **2. They also nest in gutters, eaves, on outdoor light fixtures, or under eaves or awnings on human homes when such locations provide adequate shelter.** **3. In the western prairies, they may build their nests on the ground or in thickets, while in Alaska they sometimes nest on buildings or cliffs.** **4. The male usually brings the nest material, and it takes the female 2 to 6 days to build the nest which is 6-8 inches across, 3-6 inches high, and weighs about 7 ounces.** **5. The outer nest is a cup made of long coarse grasses, twigs, paper, debris, worked into solid foundation of smeared mud. The inner nest is lined with fine grasses and other soft materials.** **6. They usually will not use birdhouses.** **7. A new nest is built for each brood.**
EGGS	**3 to 5 sky blue or blue-green and unmarked**
INCUBATION	**12 to 14 days by female**
THE YOUNG	**1. Young are fed regurgitated food for the first 4 days.** **2. The chicks are fed insects, berries, and worms.** **3. Both parents feed young, though female does more of the feeding.**

	4. Parents are very aggressive in defense of their nest. **5. The male often tends the first brood while the female begins to incubate the next clutch.** **6. Waste accumulation does not occur in the nest because adults collect and take it away.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**1. 14 to 16 days** **2. Even after leaving the nest, the juveniles will be fed by their parents for a while.**
# OF BROODS PER YEAR	**2 to 3**
THREATS	**Because the robin forages largely on lawns, it is vulnerable to pesticide poisoning.**
OTHER INFORMATION	**1. Robins are the largest North American thrush.** **2. Brown-headed cowbirds lay eggs in robin nests, but the robins usually reject the eggs** **3. One robin can eat as much as 14 feet of earthworms in one day.**
 **FEET**	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and cause the toes to lock on the perch.** **3. When the bird begins to stand up, the legs cause the tendon to relax and the toes unlock.**
BEAKS 	**Probing thin, curved beak used for to probe for worms in the soil.**
WEATHER ADAPTATIONS	**1. Migration of northern birds to southwestern states, Mexico, and Central America.** **2. Non-migratory in New Mexico** **3. Most depart south by the end of August and begin to return north in February and March.** **4. During winter, many robins move to moist woods where berry-producing trees and shrubs are common.**
DEFENSE ADAPTATIONS	**1. They will band together to drive away a predator.** **2. When feeding in flocks, they can be vigilant, watching other birds for reactions to predators.**
HUNTING ADAPTATIONS	**1. When foraging on the ground, they run across a lawn and then stop and cock their heads to the left, right, or forward using their eyes and hearing to find worms.** **2. In long grass, robins may hop or fly just above the ground powered by slow, powerful wingbeats.** **3. American Robins often find worms by staring, motionless, at the ground with the head cocked to one side.** **4. They will gather in numbers after lawns are mowed or sprinklers are being used.** **5. They are attracted to freshly turned soil in gardens that may have worms and grubs.** **6. Robins sometimes fight over worms that others have caught.**

AMERICAN BALD EAGLE (Haliaeetus leucocephalus)

See Bird Plate 1

FAMILY	**Accipitridae (hawks, kites, eagles, and old-world vultures)** **The bald eagle is a sea or fish eagle.**
CALLED	**Baby: eaglet, fledgling; group: convocation, aerie**
LIFE SPAN	**15 to 20 years in wilderness in captivity : average 29 to 30 year** **one captive lived to be 48 years old**
SIZE	**Female: 35 to 37 inches Male: 30 to 34 inches**
WEIGHT	**Females-10 to 12 pounds Males- 8 to 10 pounds**
WING SPAN	**Female: about 7 feet Male: about 6 feet**
FLYING SPEED	**30 to 35 mph while gliding and flapping 75 to 99 mph when diving** **They soar on thermal convection currents.**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**During mating season, any kind of wetlands such as seacoast, rivers, large lakes, or marshes that have an abundance of fish** **Occupy varied habitats from the bayous of Louisiana to the Sonoran Desert and the eastern deciduous forests of Quebec and New England**

RANGE	**Most of North America, including Canada, all continental United States and northern Mexico** **Northern birds are migratory, while southern birds are resident, remaining on their breeding territory all year.**
SOCIAL BEHAVIOR	**Mates for life, but will take another mate if the first one dies.** **Though often solitary, in winter they will gather in groups at communal roosts and feeding sites.**
COMMUNICA-TION	**They are very vocal having a variety of short shrills, high-pitched whistles and twittering.**
TYPE OF DIET	**Carnivore: mostly fish (even in dry areas), ducks, rodents, rabbits, ground squirrels, raccoons, snakes, carrion**
PREDATORS	**None**
SEXUAL MATURITY	**4 to 5 years old** **It takes about five years for their head and tail feathers to gradually turn white.**
MATING SEASON	**1. Late September to early April- depending on the region** **2. The female lays her eggs 5 to 10 days after mating.**
MATING HABITS	**The pair usually begins building or adding branches to their nest. The male makes elaborate, spectacular calls and flight display. The flight includes swoops, chases, and cartwheels, in which they fly high, lock talons, and free fall, separating just before hitting the ground. They also perch together, rub against each other, beak kiss, and hunt and share their food. When the female is ready to mate, she will wiggle her tail or mount while vocalizing.**
NEST	**1. Nest built in tall trees or on cliffs are up to 13 feet deep, 5 to 9 feet in diameter, and can weigh up to 2,000. pounds .** **2. They build the largest nest of any North American bird.** **3. They will use the same nest for several years with new material (branches) and lining added each year.** **4. Usually a nest will collapse in storms or when the supporting branches of the tree break from its weight.**
EGGS	**1 to 3; usually 2**
INCUBATION	**1. 34-36 days. Both the male and female take turns incubating the eggs, but the female does most of the incubation.** **2. The parent not incubating will hunt for food.**
THE YOUNG	**1.For the first two to three weeks of the nestling period, at least one adult is at the nest almost 100% of the time.** **2. At first, both parents bring prey to the nest, tearing food into small pieces and feeding it directly to their young.** **3. After 3-6 weeks, the young begin pecking at the food the parents have dropped in nest.** **4. In seasons when prey is scarce, only largest young may survive.** **5. They have the fastest North American bird growing rate of up to 6 oz. a day.** **6. The young eaglets pick up and manipulate sticks, play tug of war with each other, practice holding things in their talons, and stretch and flap their wings.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**1. At about 8 weeks, they are strong enough to flap their wings lift their feet off the nest platform, and rise in the air.** **2. They will remain close to the nest and be attended by their parents for about 8 weeks before they leave the nest.**
# OF BROODS PER YEAR	**1**
THREATS	**1. Starvation** **2. Humans using poisonous chemicals, shooting them, or accidentally hitting them with cars.** **3. Habitat loss.**
HUMAN USAGE	**National bird of United States that appears on money**
OTHER INFORMATION	**1. The American bald eagle became our country's national emblem in 1782.** **2. The only eagle that exists only in North America.** **3. Immature bald eagles have a mixture of brown and white feathers, with a black beak and brown eyes. Throughout the first five years prior to becoming fully mature, a bald eagle's feathers, eyes, and beak gradually change color.** **4. When flying, the bald eagle very rarely flaps its wings but soars instead, holding**

	its wings almost completely flat. 5. Their beaks, talons, and feathers are made of keratin (the same substance that makes human hair and fingernails.) 6. By the 1950s there were only 412 nesting pairs of American bald eagles due to hunting and loss of suitable habitat . Laws began to protect them from hunting, but the use of the pesticide DDT caused the thinning of egg shells that prevented the hatching of babies. In 1972, the use of DDT was banned in the United States. The American bald eagle had been declared an endangered species in 1967, but with the enforcement of several laws, they were de-listed on June 28, 2007.
FEET 	1. They have powerful feet with sharp, long talons used for grasping and holding prey. 2. The talons continue to grow because they are worn down with usage. 3. It has been estimated that the gripping power (pounds by square inch) of the bald eagle is ten times greater than that of a human.
BEAKS 	1. Sharp, hooked beaks are used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow. 2. It is a strong weapon when used for defense. 3. It is used to groom its feathers. 4. It continues to grow because it is worn down with usage. 5. The outside of the bill is mostly non-living material, with little blood supply.
VISION AND HEARING ADAPTATIONS	1. Even though their eyes are almost as large as a human's, they see 4 times sharper than a human. 2. They can see a fish from 1 mile away.
BODY ADAPTATION	Bones: 1. They have hollow bones, so they will be light enough to fly. 2. The skeleton weighs about ½ pound which is only about 5 -6 % of their weight. 3. They are strong enough to lift prey that weighs up to 5 lbs.
FEATHERS, WINGS, FLIGHT	1. To ensure that they always have enough feathers to fly, they molt their feathers in patches, taking about 1/2 years to replace all of them. 2. They have about 7,000 feathers.
WEATHER ADAPTATIONS	1. Their skin is protected by feathers lined with down. 2. Their feet are cold resistant, consisting of mostly tendon. 3. Since eagles do not sweat, they cool down by perching in the shade and hold their wings away from their bodies. 4. It is partially migratory, depending on its location. If its territory has access to open water, it remains there year-round, but if the body of water freezes during the winter, making it impossible to obtain food, it migrates to the south or to the coast. 5. They select migration routes which take advantage of thermals, updrafts, and food resources.
HUNTING ADAPTATIONS	1. They frequently harass other birds to steal their food, and occasionally do the same to mammals such as river or sea otters. 2. Does much hunting by watching from a high perch, then swooping down to catch prey in its talons. 3. They also hunt by cruising very low over sea or land and take the prey by surprise. 4. Where fish are abundant (as at spawning runs), they may wade in shallow water to pursue them. 5. Because they can float, they sometimes use their wings to "row" over water that is too deep to wade in. 6. They can become very noisy when they bicker with each other over prey. 7. They may push a turkey vulture out of the way of a carcass.

BLACK CHINED HUMMINGBIRD (Archilochus alexandri)

See Bird Plate 2

FAMILY	Trochilidae (hummingbirds native only to the Americas)
OTHER NAMES	Hummers
CALLED	Female: hen; male: cock; baby: chick, hatchling; group: party, bouquet, glittering, hover, shimmer, tune
LIFE SPAN	3 to 5 years
SIZE	3.5- 3.75 inches in length
WEIGHT	.1 ounce
WING SPAN	4 to 5 inches
FLYING SPEED	20-25 mph

TIME OF ACTIVITY	**Diurnal** **Hummingbirds usually feed heavily in morning and in the evening hours until they begin to settle in about a half hour or so before dark. But in some locations--especially if there is artificial lighting such as porch light--hummingbirds may feed well into the night, usually during warmer weather. Hummingbirds also fly at night, but this almost always happens during migration.**
RANGE	**Black-chinned hummingbirds are found in most of the western United States, reaching north into Canada in Alberta and British Columbia, east to Oklahoma, and as far south as Mexico.**
HABITAT	**1. They can be found in mountains, woodlands, orchards, meadows, deserts, and chaparral habitats.** **2. Black-chins have adapted well to urban settings, as long as water, numerous flowering shrubs and vines, and tall trees are nearby.**
SOCIAL BEHAVIOR	**Solitary**
COMMUNICATION	**1. Repetitive teew or tchew** **2. When defending its feeding territory or giving chase, it combines teew calls with high-pitched twitters and squeaks.**
TYPE OF DIET	**1. They are mostly nectarous, visiting sages, ocotillo, agave, fairy dusters, honeysuckle, trumpet vine, thistle, penstemon, apple blossoms, and columbine. They will visit 2,000 to 5,000 flowers each day, and will need 155,000 calories in that time period.** **2. For protein, they will eat small insects, spiders, and gnats (especially during the three weeks the mother feeds the young.)** **3. Sugar-water from feeders.** **4. There is evidence that hummingbirds return to the same feeder locations each year.** **5. They get most of their water from nectar.** **6. They are attracted to red flowers and tubular shaped flowers.**
PREDATORS	**Crows, jays, roadrunners, flycatchers, dragonflies, praying mantises, cats, dogs, squirrels, chipmunk, snakes** **Plants: can be impaled on cactus spines, cocklebur, or get caught in sticky tree sap**
SEXUAL MATURITY	**1 year**
MATING SEASON	**Late March to mid-August**
MATING HABITS	**1. Polygamous** **2. The males show up about a week ahead of the females and younger birds.** **3. They go on a scouting mission, to stake out the best nesting territory they can find in order to impress a female with their ability as providers.** **4. The male performs an elaborate courtship display during breeding season. The courtship dive of the male is a long, pendulum-like swoop above a perched female. At the bottom of the dive, he produces a long-drawn-out vocalization.** **5. Sometimes the dive takes the shape of a narrow, horizontal figure eight. During this dive, the wing and tail feathers make a loud whistling sound.** **6. Once mated, the male leaves and will mate with other females that he can attack to his territory.**
NEST	**1. The female builds the nest 3 to 10 feet above the ground in a fork of a deciduous tree or shrub often near some water.** **2. The compact cup nest is made of plant fibers, grasses, bud scales, bark, other small items, and spider webbing.** **3. The mother molds the materials as she places them into the nest by twirling around against the sides, sometimes pressing so hard she ruffles up her breast feathers.** **4. She camouflages the outside with dry leaves, debris, and lichens.** **5. The diameter of the nest is about 1 ½ inches.**
EGGS	**1. Two pinto bean size white eggs.** **2. Hummingbirds lay the smallest bird eggs.**
INCUBATION	**13 to 16 days by female**
THE YOUNG	**1. The mother feeds the young by sticking her bill deep into their mouths and regurgitating tiny insects.** **2. As the hatchlings grow, the spider webbing allows the bottom of the nest to stretch, while the opening stays small to keep in the heat.** **3. The mother may be feeding young in one nest while incubating eggs in another.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**

FLEDGE AT	**20 to 21 days**
# OF BROODS PER YEAR	**1 to 2, sometimes 3**
HUMAN USAGE	**Some plants are only pollinated by hummingbirds.**
OTHER INFORMATION	**1. There are more than 300 species of hummingbirds worldwide, of which 14 can be found in New Mexico.** **2. Black chinned hummingbirds are the least colorful hummingbirds of the USA.** **3. Hummingbirds are very intelligent, and can remember places and individual people from one year to the next.** **4. Hummingbirds have the highest energy output per ounce of any warm-blooded creature, a necessity in order to support the rapid beating of their wings.** **5. Hummingbirds burn food so fast they often eat 1.5 to 3 times their body weight in food per day! In order to gather enough nectar, hummingbirds must visit hundreds of flowers every day.** **6. Hummingbirds sleep in a state of torpor to save up to 60% of their energy. This deep sleep lowers their temperature, heart rate, and breathing. It takes from 20 minutes to an hour to fully wake up. When they recover, they will eat 25% of their daily intake.** **7. They lack the insulating downy feathers that are typical for many other bird species.** **8. They bathe in water or by hovering against wet plants.**
FEET	**A hummingbird cannot walk or hop, but it can shuffle with its extremely short, weak legs.**
BEAK 	**1. Probing beaks are long and slender, designed primarily to probe into many species of small flowers and to snap up tiny flying insects.** **2. Their tongue is fringed with tiny hairs and curls into a "double straw" shape in the back, allowing them to "wick up" nectar.**
VISION AND HEARING ADAPTATIONS	**1. Hummingbirds can see things at a farther distance, and are able to see a wider spectrum of colors (into the ultraviolet range) than humans can.** **2. They are especially attracted to the color red.** **3. They can hear higher-pitched sounds than humans can hear.**
FEATHERS, WINGS, FLYING	**1. They get their name from the "humming" sound produced by their wings in rapid motion.** **2. Black chinned hummingbirds wings move at 50 beats per second and require massive muscles that make up 1/3 of their bodyweight.** **3. Hummingbirds can be compared to a helicopter because they are able to fly forward, sideways, up, and down, and "hover" in mid-air.** **4. This is due to their unusual wing structure. Unlike other birds' wings that have a shoulder, elbow, wrist and hand, hummingbirds' wings are all hand with a very short upper and lower "arm." They are the only birds that cannot bend their wings at the elbow or wrist.** **5. Hummingbirds can rotate their wings backward, which creates downward 'lift' and backward 'thrust'. By alternating flapping their wings forward and backward, the up sided down forces and forward and back forces cancel each other out, so the hummingbird hovers in one place.** **6. The iridescent color of a hummingbird's lower throat is due to the structure of the feathers which act similar to prisms or facets that reflect when caught just right in the light.**
WEATHER ADAPTATIONS	**1. Migration** **2. Most Black-chinned Hummingbirds winter in Mexico.** **3. They prepare for their long journey by doubling their body weight by eating lots of nectar and insects.** **4. They do not travel in a group, so the individuals can feed when they need to eat and because they are so tiny, they are not very noticeable to predators.**
DEFENSE ADAPTATIONS	**1. The black-chinned hummingbird uses diving displays up to 40– 60 ft (12–18 m) above the ground for defense, and thus they produce a variety of tones as air passes through their feathers during the plunge. This can also startle the predators.** **2. They will fly toward one another aggressively, to chase each other away.**
HUNTING ADAPTATIONS	**1. They hover at flowers and extend their long skinny tongues that are twice as long as their bills, deep into the center of the flower.** **2. At feeders, they may either hover or perch.** **3. They catch small insects in the air, pluck them from plants, or take them from spider webs.** **4. They will chase other hummingbirds away from a food source.** **5. They will even attack larger birds that are trying to move in on their food.**

BURROWING OWL (Athene cunicularia)

See Bird Plate 2

FAMILY	**Strigidae**
OTHER NAMES	**Ground owl, prairie dog owl, long-legged owl, prairie owl. Cowboys sometimes called these owls "howdy birds," because they seemed to nod in greeting from the entrances to their burrows in prairie-dog towns.**
CALLED	**Baby fledgling, owlets; group: parliament, bazaar, glaring, stooping, wisdom**
LIFE SPAN	**6 to 8 years**
SIZE	**about 8 1/2- 11 inches long**
WEIGHT	**4 ½ to 5 ounces**
WING SPAN	**20-24 in.**
FLYING SPEED	**12 mph**
TIME OF ACTIVITY	**1. They hunt all hours of the day and night. 2. Between their hunting for food, they will sleep on dirt mounds at their burrow's entrance or in depressions in the ground.**
RANGE	**1. Summer breeding populations can be found from the Midwest to the eastern parts of the Pacific states and into Canada. 2. Winter populations are found in Central America and Mexico. 3. Year-round, burrowing owls can be seen in Arizona and New Mexico, Mexico, and parts of South America, excluding the Amazon rainforest.**
HABITAT	**1. Grasslands, deserts, and steppe environments; on golf courses, pastures, agricultural fields, airport medians, and road embankments; in cemeteries and urban vacant lots**
SHELTER	**1. Non-migrating owls use burrows year-round. 2. Preferred sites have loose soil, a bit of elevation to avoid flooding, and nearby lookouts such as dirt mounds, bushes, fence posts, or road signs. 3. If the ground is soft enough, they will dig their own burrows. 4. They use burrows dug by prairie dogs, ground squirrels, badgers, foxes, gophers, skunks, armadillos, kangaroo rats, and tortoises. 4. Both members of a pair enlarge and maintain the existing burrow by digging with their beaks and kicking back soil with their feet. 5. Burrows tend to make numerous twists and turns, with a mound of dirt at the entrance and an opening at least 4–6 inches wide. 6. They have been known to nest in piles of PVC pipe and other lairs unintentionally provided by humans**
SOCIAL BEHAVIOR	**They live in loose colonies so they can warn others if predators approach and help drive them away.**
COMMUNICA-TION	**1. If a predator is outside the owls' burrows, the young will hiss like a rattlesnake to scare it away. 2. The adults make chattering and screeching sounds to warn others.**
TYPE OF DIET	**Carnivore: Mainly insects-beetles, caterpillars, dragonflies, and grasshoppers, crickets, moths, beetles, earthworms, scorpions, water bugs, earwigs: snakes, lizards, turtles, salamanders, baby ducks, water birds, mice, rats, gophers, voles, shrews, ground squirrels, bats, young rabbits, skunks**
PREDATORS	**Badgers, coyotes, raccoons, cats and dogs, skunks, foxes, snakes**
SEXUAL MATURITY	**1 year**
MATING SEASON	**March - August**
MATING HABITS	**1. Mostly monogamous 2. Mainly male display by circling overhead or flying dozens of feet into the air, hovering for a few seconds and then rapidly descending. 3. Both will vocalize, rub bills, and preen. 4. The male will present food to the female. 5. The male looks for good burrows and brings the female to choose the one she wants.**
NEST	**1. Nesting owls tend to use areas with a high density of surrounding burrows, which may provide extra escape options for developing young. 2. The nest burrow can be several yards long and is usually less than 3 feet deep. 3. Both prepare the nesting burrow by putting animal dung at the entrance and in the nest area, so it will attract dung beetles and other insects that they can eat. 4. They also gather feathers, grass, and other materials for their nest area and entrance.**

EGGS	**6-11 white eggs**
INCUBATION	**28-30 days by female while the male brings her food and stands guard near the entrance during the day**
THE YOUNG	**1. Usually all the eggs will hatch, but only about half of the young will survive.** **2. Both parents will feed the owlets.** **3. The adults will move the young to several nearby burrows to keep them from being caught by predators.** **4. During the nesting season, the male stands near the burrows and "sounds the alarm" if predators come.** **5. The owlets play-hunt by jumping on each other, on prey brought by their parents, and on dung around the burrow.** **6. They learn to hunt by watching their parents.** **7. The young ones stay with their parents for three months, but they will stay in the parent's territory.**
DEGREE OF DEPENDENCY	**Altricial – helpless at birth**
FLEDGE AT	**25-28 days**
# OF BROODS PER YEAR	**1**
THREATS	**Loss of habitat, the decline of prairie dogs and ground squirrels, and getting hit by cars**
HUMAN USAGE	**They are important at keeping rodent populations down in farming areas.**
OTHER INFORMATION	**1. They bob up and down when excited.** **2. They are the only owls that live in burrows.** **3. They do not chew their food. They swallow their food whole or tear it into pieces with their beaks. Parts of the animals that the owl cannot digest (bones, claws, teeth, fur, and feathers) get coughed up as pellets.**
FEET 	**1. They are frequently seen standing on only one foot.** **2. They have long, curved, very sharp talons for grabbing prey.** **3. They sometimes dig their own burrows using their feet and beaks.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow.** **2. It is a strong weapon when used for defense.** **3. It is used to groom its feathers.** **4. It continues to grow because it is worn down with usage.**
VISION AND HEARING ADAPTATIONS	**1. They have excellent senses of hearing and vision.** **2. One of their ears is higher than the other ear, so they can hear exactly where a prey is located.**
FEATHERS, WINGS, FLIGHT	**1. They have soft, fringed edges on their wings to muffle the sounds while they fly, so they can fly almost silently.** **2. They fly with irregular, jerky wing beats and may flap their wings asynchronously (not up and down together.)**
BODY ADAPTATIONS	**They can rotate their heads both directions by 270 degrees (three-quarters of the way.) This allows them to see in every direction- even straight backwards.**
WEATHER ADAPTATIONS	**1. During the summer they hunt both day and night, but during the winter, they become nocturnal.** **2. The males line the burrows with feathers and grasses to make their shelters cool in summer and warm in winter.** **3. Burrowing owls that live in very cold habitats will migrate to warmer climates for the winter.** **4. Living in burrows provides protection from predators and from extreme heat and cold weather.**
DEFENSE ADAPTATIONS	**1. For protection, they live in burrows.** **2. If they are face to face with a predator, they will take their "white-and-tail stance." They make the white feathers around their eyes and beaks show up more and spread their wings while bobbing on one foot. This is their way of trying to look larger to their predators.** **3. Their color camouflages them. They can look like a clump of grass from a distance.** **4. They have a coloration of feathers on the back of their heads that looks like an extra set of eyes to make predators think twice before going after them.** **5. When threatened, the owl retreats to the burrow and produces rattling and hissing**

	sounds like that of a rattlesnake. 6. Males defend their territories against other males by vocalizing, displaying in a weaving crouch with feathers fluffed, or chasing and attacking with outstretched talons.
HUNTING ADAPTATIONS	1. They hunt by walking, hopping, and running on the ground, but also, by flying from a perch, hovering over vegetation, and "fly catching" in the air. 2. Burrowing owls often stow extra food (rodents) to ensure an adequate supply during incubation and brooding. 3. They have a poor sense of smell which allows them to eat skunks.

CACTUS WREN (Campylorhynchus brunneicapillus)
See Bird Plate 2

FAMILY	Troglodytidae (wrens)
CALLED	Female: jenny; male: cock; baby: chick; group: chime, flight, flock, herd
LIFE SPAN	7 to 10 years
SIZE	7 to 8.5 inches
WEIGHT	6 ounces
WING SPAN	11 inches
TIME OF ACTIVITY	Diurnal
HABITAT	Deserts, arid foothills that have cactus, mesquite, yucca, and other types of desert scrub
RANGE	Arizona, New Mexico, western Texas, southwest Utah, southern California, and north-central Mexico
SOCIAL BEHAVIOR	1. Male and female stay together all year. 2. They are usually seen in pairs or family parties, strutting on the ground, or hopping in the brush, often posturing with spread wings and tails as they call to each other.
COMMUNICA-TION	They sing territorial songs, although the songs are not very musical. The song consists of a one-pitched monotone of chuh,chuh, chuh, chuh, gaining speed towards the end.
TYPE OF DIET	Omnivores: ants, beetles, grasshoppers, wasps, true bugs, a few spiders, small lizards, frogs berries, cactus fruit, seeds, some nectar
PREDATORS	1. Eggs and nestlings: often taken by coachwhip snakes that can climb the cholla. 2. Adults: coyotes, hawks, foxes, bobcats, domestic cats
SEXUAL MATURITY	Female- about 8 months
MATING SEASON	During wet winters, breeding season begins as early as late February through March, allowing time for double and sometimes triple broods. Mating season can last until September.
MATING HABITS	Monogamous The male crouches, extends wings, fans tail, and growls to the female.
NEST	1. The parents build their nest usually in a cholla, but sometimes in a yucca, mesquite, or in a hole in a saguaro. 2. Both parents build a large football shape nest with a tunnel leading to the center chamber. 3. The nest is a bulky mass of weeds, grass, and lined with feathers, animal hair, and grass. Parents will recycle materials from an old nest. 4. While female incubates the 1st clutch, the male builds a second nest that will be used for the 2nd clutch. 5. After the last brood leaves, the parents will roost in the nest the rest of the year. 6. Parents aggressively defend their nest.
EGGS	3 to 4 pale white to pink with brown marks 2 to 3 broods per year
INCUBATION	Female incubates for 14 to 16 days
THE YOUNG	1. The father feeds the young while the mother incubates the next clutch of eggs in a new nest built by the father. 2. The young will remain dependent on the parents for food for approximately 30 days after leaving the nest.
DEGREE OF DEPENDENCY	Altricial- helpless at birth
FLEDGE AT	19 to 23 days

# OF BROODS PER YEAR	**Up to 3**
THREATS	**Loss of habitat**
HUMAN USAGE	**None**
OTHER INFORMATION	**1. They are very active and curious birds. They quickly investigate anything new in their territory. If you leave your car windows down or the garage doors open, they are sure to enter and check it out thoroughly.** **2. The largest wren in the United States.** **3. They are the state bird of Arizona.**
FEET 	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and cause the toes to lock on the perch.** **3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAK 	**Thin, slender, pointed, tweezers-like beak for picking up insects off leaves, twigs, and bark**
BODY ADAPTATIONS	**They get almost all their water from the insects and food they eat.**
WEATHER ADAPTATIONS	**1. Non-migrator** **2. They forage at different times of the day depending on the heat. They begin the day on the ground, then move to the shade in the afternoon. By midafternoon, they stop to rest.**
DEFENSE ADAPTATIONS	**1. To protect the young, they build their nests in cholla.** **2. They defend their territory sometimes by destroying other birds' nest and eggs.** **3. They aggressively defend their nest.**
HUNTING ADAPTATIONS	**They use their beaks to probe bark crevices and ground litter, and turn over rocks and other objects to find food.**

COMMON RAVEN (Corvus corax)

See Bird Plate 4

FAMILY	**Corvidae (crows, jays, magpies, nutcrackers)**
OTHER NAMES	**Northern raven**
CALLED	**Female: hen: male: cock; group: unkindness, congress**
LIFE SPAN	**10 to 15 years in the wild**
SIZE	**Length: 22 to 27 inches long They are the largest of the ravens- about the size of a hawk. Males are larger than females. Tail length: 7.87 to 10 inches**
WEIGHT	**1 ½ to 4 ½ pounds**
WING SPAN	**39 to 59 inches**
FLYING SPEED	**22 to 28 mph**
TIME OF ACTIVITY	**Diurnal**
RANGE	**Common ravens occur over most of the Northern Hemisphere in nearly any habitat (eastern forests and the open Great Plains are exceptions)**
HABITAT	**Deserts, open plains, mountain forest, rocky cliffs, coastlines, and even Arctic tundra**
SOCIAL BEHAVIOR	**1. Young, unmated ravens roost together at night, but usually forage alone during the day. Sometimes they will form in large groups of several hundred.** **2. They seem capable of feeling empathy. When a raven's friend loses in a fight, they will seem to console the losing bird. They also remember birds they like and will respond in a friendly way to certain birds for at least three years after seeing them. (They also respond negatively to enemies and suspiciously to strange ravens.)**
COMMUNICA-TION	**1. Ravens are able to communicate to other ravens information about objects or events that they have observed.** **2. The raven has a large, complex, and varied vocabulary. They can imitate several sounds like car engines, toilets flushing, human voices, animal (wolves, foxes) and bird calls.** **3. They produce as many as 33 categories of sounds, and can be heard 1 mile away.** **4. They also make a knocking sound by snapping their bills together.** **5. They gesture to communicate. Ravens point with beaks to indicate an object or hold**

	up an object to get another bird's attention.
TYPE OF DIET	**Omnivores and scavengers: bird eggs and nestlings, berries, fruit, grain, seeds from bird feeders, fish, rodents, worms, insects, caterpillars, beetles, maggots, lizards, frogs, human garbage, undigested parts of animal feces, carrion- sick or injured animals (often done by several crows), they raid food caches of others**
PREDATORS	**Eggs and hatchling by: great horned owls, red-tailed hawks, golden and bald eagle** **Adults- rarely attacked, but if so, it is usually near nesting site: lynx, coyotes, cougars**
SEXUAL MATURITY	**1 year, but most of them begin to breed at 3 to 4 years.**
MATING SEASON	**January through March**
MATING HABITS	**1. Monogamous** **2. The male soars, swoops, and tumbles in mid-air. When perching, they coo, preen each other's feathers, touch each other's bills, and sometimes soar together.**
NEST	**1. Both parents build the nest on steep cliffs, bluffs, ledges, tall trees (especially conifers) or even power poles.** **2. The bulky basket shaped nest made of roots, mud, large sticks, and twigs is lined with soft plant materials (grass, bark strips, and moss) and animal fur** **3. Ravens may use the same nest every year, but they will add materials on top of it.**
EGGS	**1. 4 to 6 pale green with brown markings**
INCUBATION	**1. 18 to 21 days** **2. Male feeds the female while she is roosting.**
THE YOUNG	**1. Are feed by both parents.** **2. The young leave the nest about 5-6 weeks after hatching.** **2. The fledglings will stay with their parents for about 3 to 4 months before they can get all their own food.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**38 to 44 days**
THREATS	**1. Occasionally they are hit by cars while eating road kill.** **2. They are shot and trapped because some farmers consider them to be a nuisance.** **3. Some have lost their habitats.**
HUMAN USAGE	**1. They eat a lot of insects.** **2. Some ancient cultures believed the raven was a messenger for the gods.** **3. Celtic goddesses of warfare often took the form of ravens during battles.** **4. The Chinese said ravens caused bad weather in the forests to warn people that the gods were going to pass by.** **5. Some Native American tribes say the raven is a sly trickster who is involved in the creation of the world.**
OTHER INFORMATION	**1. They are known for their problem-solving ability.** **2. They have shown the capacity to communicate about objects or events that are distant in space or time.** **3. When it comes to intelligence, these birds rate up there with chimpanzees and dolphins. In one logic test, the raven had to get a hanging piece of food by pulling up a bit of the string, anchoring it with its claw, and repeating until the food was in reach. Many ravens got the food on the first try, some within 30 seconds. In the wild, ravens have pushed rocks on people to keep them from climbing to their nests, stolen fish by pulling a fishermen's line out of ice holes, and played dead beside a beaver carcass to scare other ravens away from a delicious feast.** **4. They watch where other common ravens bury their food and remember the locations of each other's food caches, so they can steal from them.** **5. Juveniles are among the most playful of bird species. They have been observed sliding down snowbanks, apparently purely for fun. They even engage in games with other species, such as playing catch-me-if-you-can with wolves, otters, and dogs.** **7. Common ravens are known to steal and cache shiny objects such as pebbles, pieces of metal, and golf balls.** **8. They make their own toys. They have been observed breaking off twigs to play with.** **9. Ravens are confident, inquisitive birds that strut around or occasionally bound forward with light, two-footed hops.**

FEET 	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and causes the toes to lock on the perch. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAK 	**1. The bill is large, thick, and slightly curved, with long feathers that cover the nostrils and base of the bill.** **2. They have shaggy throat feathers below the beak.**
VISION AND HEARING ADAPTATIONS	**They are alert birds with sharp eyesight and hearing.**
FEATHERS, WINGS, FLIGHT	**1. In flight, they are buoyant and graceful, interspersing soaring, gliding and slow flaps.** **2. Tail- long V (wedge) shape – longest feather in the middle. This is different from crows that look like an open fan with feathers basically, the same length.** **3. The wingtip feathers look like long "fingers" sticking out from the rest of the wings.** **4. Common ravens are known for spectacular aerobatic displays, such as flying in loops, preforming tumbling tricks, or interlocking talons with each other while in flight.**
WEATHER ADAPTATIONS	**1. They can change their diets during the different seasons.** **2. Ravens keep warm in the winter by raising their resting metabolic rate slightly.**
DEFENSE ADAPTATIONS	**1. Ravens are quite vigorous at defending their young and are usually successful at driving off perceived threats. They attack potential predators by flying at them and lunging with their large bills.** **2. Parents have been observed dropping stones on potential predators that venture close to their nests.**
HUNTING ADAPTATIONS	**1. They store surplus food items, especially those containing fat, and will learn to hide such food out of the sight of other ravens.** **2. They will take another raven's cache. This type of theft occurs so regularly that common ravens will fly extra distances from a food source to find better hiding places for food.** **3. They have also been observed pretending to make a cache without depositing the food, presumably to confuse onlookers.** **4. Ravens also raid the food caches of other species, such as grey wolves.** **5. They have been observed calling wolves to the site of dead animals. The wolves open the carcass, leaving the scraps more accessible to the birds** **6. They are not above tricking animals out of their food—one raven will distract the other animal and the other will steal its food.** **7. Juvenile ravens call other ravens to a food bonanza, usually a carcass, with a series of loud yells.** **8. Living as a scavenger and predator, it can survive at all seasons in surroundings as different as hot desert and high Arctic tundra.**

CURVE-BILL THRASHER (Toxostoma curvirostre)

See Bird Plate 2

FAMILY	**Mimidae (thrashers, mockingbirds, catbirds)**
LIFE SPAN	**10 years**
SIZE	**11 inches long**
WEIGHT	**3 ounces**
WING SPAN	**13 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Thorn brush and scrub, semi-desert (especially where mesquite or cholla cactus are present), shrubby areas, open brushy woodland, and around suburbs and cities if some native vegetation (especially cholla) is present**
RANGE	**Found in Colorado, Oklahoma, Texas, New Mexico, Arizona, part of Mexico**
SOCIAL BEHAVIOR	**Solitary or in pairs**
COMMUNICA-TION	**1. Their song is melodic, varied, and intricate, with low trills and warbles, often with two or three repetitions of phrases.** **2. Songs are similar to northern mockingbirds.** **3. It can mimic several birds including pyrrhuloxias and northern cardinals.**

	4. Its whit-whet sounds like a person whistling.
DIET	**Omnivore: beetles, ants, grasshopper, wasps, moths, butterflies, spiders, centipedes, snails, sowbugs, cactus seeds and fruit**
PREDATORS	**Young: Snakes, raptors, roadrunners**
MATING SEASONS	**Early spring- February- May**
MATING HABITS	**1. Especially in spring, male defends territory by singing. In courtship, male may follow female, perch on a conspicuous perch, and sing a lyrical song with great variation in its phrases.** **2. Typically, monogamous and will stay in the same territory throughout their lives**
NEST	**1. Both parents build a deep bowl-shape nest of thorny twigs, lined with fine grasses, rootlets, feathers, and animal hair.** **2. Nests are built in a fork of a cholla (ideally with shade) or in a yucca, prickly-pear, or thorny shrub.** **3. They sometimes build on top of an old nest of a cactus wren.** **4. They may build successive nests in the same cholla.**
EGGS	**The female lays 3 to 4 pale blue green with brown markings early in the morning on successive days**
INCUBATION	**12 to 14 days by both parents during day and female at night**
THE YOUNG	**1. Both parents feed the young. If nest is in exposed sun, the female may spend much time shading the nestlings.** **2. In situations where food is scarce, parents feed older fledglings first.** **3. The parents feed the young fruit, pollen, nectar, and insects taken from nearby cacti.** **4. They teach the young how to forage for food.** **5. Once they leave the nest, the young may "play," by bouncing, hopping, circling, and using their beaks to tug at grass and twigs.** **6. They leave their parents a few weeks after they fledge.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**14 to 18 days**
# OF BROODS PER YEAR	**2**
THREATS	**Loss of habitat**
HUMAN USAGE	**None**
OTHER INFORMATION	**Their extensive repertoire of melodies has led them to be known cuitiacoache (songbird) in Mexico.**
FEET 	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and causes the toes to lock on the perch.** **3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAK 	**Long down curved beak**
WEATHER ADAPTATIONS	**1. Non-migrator** **2. Parents shade the young from hot sun.**
DEFENSE ADAPTATIONS	**They will defend their immediate nesting neighborhood and food sources vigorously against competitors from other species as well as those from its own species.**
HUNTING ADAPTATIONS	**1. They forge on the ground by poking and probing in plant litter, turning over small rocks, and digging holes in the soil with their long, down-curved bills.** **2. When digging in hard dirt, they brace their tails against the ground, and pound them downward with heavy blows of their bills.**

GOLDEN EAGLES (Aquila chrysaetos)

See Bird Plate 1

FAMILY	**Accipitridae- diurnal birds of prey (hawks, kites, eagles, and old-world vultures)**

OTHER NAMES	**Black eagle, mountain eagle**
CALLED	**Baby: eaglets, fledglings group: convocation, aerie**
LIFE SPAN	**15 to 30 years**
SIZE	**3 feet long**
WEIGHT	**6 to 15 pounds**
WING SPAN	**7 feet**
FLYING SPEED	**Swoops at 200 mph.**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**1. Open mountains, foothills, plains, open country, desert, tundra** **2. Needs to be in good nesting areas (mountainous areas and upland forests) in the summer.** **3. Often hunts along marshes or rivers.**
RANGE	**1. They range from Mexico through much of western North America as far north as Alaska.** **2. Golden eagles are also found in Asia, northern Africa, and Europe.**
SOCIAL BEHAVIOR	**olitary- they do not stay with large groups in the winter.**
COMMUNICA-TION	**They occasionally produce a weak, high shrill sound in flight.**
TYPE OF DIET	**Carnivore : rabbits, ground squirrels, prairie dogs, skunks, young foxes, voles, mice, young deer, or pronghorns if they are sick or hurt, game birds, crows, sparrows, snakes, lizards, some eat tortoises by dropping them on rocks to crack open the shell some carrion during winter when food is scarce**
PREDATORS	**None**
SEXUAL MATURITY	**3 to 5 years**
MATING SEASON	**February-May depending on the weather in their location**
MATING HABITS	**1. Monogamous** **2. Nest building may begin 1-3 months prior to mating and is considered part of the breeding process.** **3. In courtship, they circle high in air performing plunges and looping flights.**
NEST	**1. They nest in rocky crags, cliff ledges, large trees, or human structures such as telephone poles and windmills.** **2. A site may be used for many years, or they may use an alternate nest site if they did not have hatchlings the year before.** **3. Both the male and female build the nest. The nest is a bulky platform of sticks, lined with weeds, grass, leaves, moss, or even animal bones, shed antlers and human-made items like wire may be used.** **4. The average bald eagle nest is 4 to 5 feet in diameter and 2 to 4 feet deep.** **5. Each year the adult pair will add 1-2 feet of new material to the nest. Over years, the nest may become up to 8 to 10 feet wide and 3 to 4 feet deep. Sometimes the nest will become too heavy for the tree to support it, and the parents must build a new nest.**
EGGS	**1-4 eggs (usually 2) off white with irregular brownish spotting that average 3 inches long by 2 inches wide.**
INCUBATION	**1. 41-45 days** **2. Like most birds, eagles develop a brood patch, or bare spot on their belly, to better facilitate heat transfer to the egg during incubation. Both male and female eagles develop a brood patch.**
THE YOUNG	**1. It can take a day for the hatchling to completely break free of the egg after pipping.** **2. Eggs hatch in the order in which they were laid.** **3. Female remains with young most of the time at first, while male does most of the hunting, bringing pieces of food back to the nest.** **4. Female also does much hunting as the young get bigger.** **5. Parents do not ensure that all eaglets are fed equally. The largest eaglet gets the majority of the food, and usually 1 to 2 young survive to fledge.** **6. Prior to their first flight, nestlings will flap their wings in the nest or while jumping to an adjacent branch in behavior known as branching.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**Around 10 weeks**

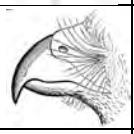
# OF BROODS PER YEAR	**1 brood every 2 years**
THREATS	**Chemicals, loss of habit, hunted, trapped for feathers, wind turbines**
HUMAN USAGE	**1. The Golden Eagle was important to many Native American tribes, who admired the eagle's courage and strength, and who ascribed mystical powers to the bird and even to its feathers. 2. For centuries, this species has been one of the most highly regarded birds used in falconry.**
OTHER INFORMATION	**1. North America's largest bird of prey 2. They are the national bird of Mexico. 3. They are protected by law.**
FEET 	**1. They have powerful feet with sharp, long talons used for grasping and holding prey. 2. The talons continue to grow because they are worn down with usage.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow 2. It is a strong weapon when used for defense. 3. It is used to groom its feathers. 4. It continues to grow because it is worn down with usage.**
VISION AND HEARING ADAPTATIONS	**1. They have very good eyesight so they can see their prey from a long distance as they soar. 2. They have 2 sets of eyelids. The outer eyelid is like a human's and the semi translucent inner eyelid cleans and moistens the eye.**
FEATHERS, WINGS, FLYING	**1. They ride in the sky by using thermals and by soaring for long periods of time without flapping their wings. 2. They typically soar or glide with wings lifted into a slight "V"and the wingtip feathers spread like fingers. 3. They capture prey on or near the ground, locating it by soaring, flying low over the ground, or hunting from a perch, but they are fast enough to catch birds in flight.**
WEATHER ADAPTATIONS	**They will migrate for the winter if there is not enough food to be found. Some golden eagles migrate, but others do not—depending on the conditions of their geographic location. Alaskan and Canadian eagles typically fly south in the fall, for example, while birds that live in the western continental U.S. tend to remain in their ranges year-round.**
DEFENSE ADAPTATIONS	**1. They build nests on cliffs or in trees to keep their babies safe. 2. Their coloring helps them blend into their environment.**
HUNTING ADAPTATIONS	**1. Golden eagles hunt in a range of ways; they may soar and search for prey from on high, fly low, or sit in a tree on the look-out. 2. When prey is spotted, the eagle plunges to capture it with its powerful talons. 3. Members of a pair sometime hunt together, with the second bird capturing prey that evades the first. 4. They do not have to travel far because they are such good hunters.**

GREAT-HORNED OWLS (Bubo virginianus)

See Bird Plate 2

FAMILY	**Strigidae (true owls-not barn owls)**
OTHER NAMES	**Hoot owl, tiger owl, cat owl**
CALLED	**Baby: fledgling, owlet group: parliament, bazaar, glaring, stooping, wisdom**
LIFE SPAN	**12 to 13 years**
SIZE	**17 to 25 inches tall**
WEIGHT	**Males: 3 pounds Female: 4 pounds**
WING SPAN	**4 to 5 feet**
FLYING SPEED	**40 mph when flying level**
TIME OF ACTIVITY	**Nocturnal**
RANGE	**Found almost throughout North America and much of South America**
HABITAT	**Forest interspersed with fields or other open areas, swamps, desert, tundra edges, tropical rainforest, cities, orchards, suburbs, and parks**
SOCIAL BEHAVIOR	**1. Solitary 2. They only stay with their mate during the nesting season.**

COMMUNICA-TION	**<u>Sounds:</u>** **1. The great horned owl's call is normally a low-pitched but loud *ho-ho-hoo hoo hoo*.. Both sexes hoot, but males have a lower-pitched voice than females.** **2. Occasionally they will make odd sounds including chuckles, screeches, squawks, barks, and even a cat like mee owwwwww sounds when a nest area or territory is disturbed, during courtship, or as the young are developing their vocal abilities.** **3. Young owls who are still in the care of their parents make loud, persistent hissing or loud, piercing screeching sounds.** **<u>Body Language:</u>** **Their large ear tufts lie flat when they are irritated and stand upright when they are inquisitive.**
ROOST	**Great horned owls roost during the day in protected rocky caves or on tree limbs.**
TYPE OF DIET	**Carnivore: rodents (majority of diet) squirrels, skunks (eats regularly), raccoons, porcupines, cats, dogs, kit foxes, bat, rabbits, turkeys, crows, red-tailed hawks, smaller owls, spiders, scorpions, centipedes, worms, insects, snakes, lizards, turtles, frogs, toads, salamanders**
PREDATORS	**None**
SEXUAL MATURITY	**2 years**
MATING SEASON	**Courtship begins as early as January or February and by March females are incubating eggs.**
MATING HABITS	**1. Monogamous** **2. The males may begin courtship with hooting, but the female may not hoot until weeks later.** **3. He might perform a display flight.** **4. When close, they bow to each other, with drooped wings.** **5. Mutual bill rubbing and preening also occurs.** **6. He may bring the female freshly caught prey to share with her.** **7. Males select nesting sites and bring the females' attention to them by flying to them and then stomping on them.**
NEST	**1. They use the nest of other birds (hawks, crows) or even a squirrel's nest.** **2. They may add some feathers to their nest.** **3. Their nest can be in tree holes, stumps, caves.** **4. Most nests are used for only one season.**
EGGS	**1. 2-3 (sometimes up to 6) dull whitish eggs** **2. The female typically lays an egg every couple of days until the clutch is complete.**
INCUBATION	**1. 28 to 35 days by the female using her featherless abdomen brood patch to keep them warm** **2. The male brings her food.** **3. The first eggs laid will hatch before the later laid eggs.**
THE YOUNG	**1. The young are fed by both parents.** **2. Parents fiercely defend their nest site against intruders.** **3. If young owls fall out of the nest prematurely, the adults will feed the bird on the ground.** **4. Young start roaming from the nest onto nearby branches at 6 to 7 weeks, but cannot fly well at this time. They are fed for another few weeks as they are slowly weaned.** **5. Families remain loosely associated during summer before young disperse in the autumn.** **6. Parents occasionally bring food items to the young through September when all will disperse.** **7. Because they hatch early, they have time to learn hunting skills before winter begins.**
DEGREE OF DEPENDENCE	**Altricial- helpless at birth**
FLEDGE AT	**The young fledge from the nest at 45-55 days old**
# OF BROODS PER YEAR	**1**
THREATS	**Most mortality in modern times is human-related, caused by owls flying into man-made objects, including buildings, cars, power lines, wind generators, or barbed wire, shootings, trappings, and road kills.**
HUMAN USAGE	**1. Native Americans associated the meaning of owls with wisdom, foresight, and as keeper of sacred knowledge.**

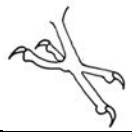
	2. Some considered owls to be a witch's communicative bond, and they thus are feared as a sign of impending death and doom.
OTHER INFORMATION	**1. Several hours after an owl has eaten, its stomach forms a pellet of fur, feathers, exoskeletons, and bones – indigestible parts of its meal. The owl then "upchucks" this pellet. Owls may have a favorite roost or perch spot where they cast out these pellets.** **2. A single owl requires about 1.8 to 3.5 ounces of food per day and can subsist on a large kill over several days.**
FEET 	**1. An owl's foot has four toes.** **2. When in flight, and sometimes when perching, 3 of these toes face forward, and one backwards.** **3. When perched, or clutching prey, the outer front toe on each foot swivels to face the rear. It can do this because of a unique flexible joint.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow.** **2. Used for grooming feathers** **3. Beak continues to grow because it is worn down by usage.**
VISION AND HEARING ADAPTATIONS	**1. Their incredible sense of hearing allows them to hunt at night.** **2. They can hear a mouse moving a foot under snow.** **3. They can pinpoint prey in total darkness.** **4. Their ears are located on the sides of the head, but the openings of the ears are bilaterally asymmetrical (slightly tilted in different directions), often the right ear is longer and set higher up on the skull.** **5. Owls will turn their heads so the sound hits both ears simultaneously and therefore the bird can look in the exact direction at which the sound is coming from.** **6. While flying, it can make corrections in mid-flight depending on the prey's movements.** **5. The brain of an owl is thought to be much more complex than that of other birds in regards to hearing.** **6. Because their eyes are fixed in their sockets - they cannot move their eyes up or down or side to side so, they must move the whole head to compensate. They can rotate their heads 270 degrees because of extra vertebra in their necks.**
FEATHERS, WINGS, FLIGHT	**1. Their tufts (plumbicons) of feathers are not ears or horns. The purpose of these tufts is not fully understood, but the theory that they serve as a visual cue in territorial and socio-sexual interactions with other owls is generally accepted.** **2. They use the tuft to express body language. If the tufts are flattened, it shows the owl is upset. If the tuffs are up, it shows the owl is curious.** **3. The facial disk is shaped like a shallow bowl, similar to a radar dish which collects the sounds and funnels them to the ear openings.** **4. Their large ears are covered by special feathers that are located behind the facial dish feathers. These feathers can be spread to make a funnel for sound to enter the ear that allows them to hear even the smallest sounds.** **5, Owl feathers are soft to the touch. This helps to deaden the sound of air rushing over the feathers while the bird is in flight.** **6. The front edge of the first primary or wing feather is toothed like a hand saw. This helps wind pass over the wings and keep the bird's flight noiseless.** **7. Their short, wide wings allow them to maneuver among the trees of the forest.**
WEATHER ADAPTATIONS	**1. Great Horned Owls are covered in extremely soft feathers that insulate them against the cold winter weather.** **2. It is normal for an owl to stand on one leg (sometimes alternating them) while resting or roosting. This might be done to warm them against their stomach or to reduce fatigue.**
DEFENSE ADAPTATIONS	**1. Males perform most of the territorial defense, but females frequently help in hooting contests with neighbors or intruders.** **2. They have 3 levels of defending their territory.** **3. The first defense is through vocalization (agitated bill-clapping, hissing, occasional low, drawn-out screams, and other guttural noises) without even having to see the the other owl.** **4. The next defense is display of fully spread wings providing a "wall" toward the intruder with the head either held beneath the wings and bill almost touching the ground or held upright. They may include bill-clapping, screams, and other guttural sounds.** **5. The last defense consists of spread wings, bill-clapping, hissing, higher pitched screams of a longer duration, with the body ready to strike with their feet. If this does not work,**

	the owl will hop forward and strike with its feet while trying to grasp and rake with its talons. 6. They are extremely aggressive when defending the nest and will continue to attack until the intruder is killed or driven off.
HUNTING ADAPTATIONS	1. Ears are bilaterally asymmetrical. This helps them locate the position of their prey. 2. Their keen senses of hearing and sight (night vision) help them catch their prey. 3. Their powerful feet have sharp, long talons to grasp and hold prey. 4. They can use different hunting styles. They can fly slowly at a low level over open areas to find prey. They will also sit at a vantage point, wait, fold its wings, and then ambush the prey. 5. Occasionally, they will walk on the ground or in shallow water to find smaller prey. 6. They have special feathers that allow them to fly silently. 7. They hunt mostly at night, but sometimes during the day. 8. They are very strong and can carry prey several times heavier than they are.

GREATER ROADRUNNER (Geococcyx californianus)

See Bird Plate 3

FAMILY	Cuculidae (cuckoos)
OTHER NAMES	Chaparral bird Spanish: paisano They gained their name from its habit of running on the road towards, with, or beside cars.
LIFE SPAN	6 to 8 years
SIZE	20 to 24 inches long
WEIGHT	7.8 to 19 ounces
WING SPAN	17 to 24 inches
TIME OF ACTIVITY	Diurnal
HABITAT	The Roadrunner prefers open country with sporadic brush, hot shrubby deserts (with creosote, mesquite, and chaparral), dry cholla grasslands, limestone hills, and open pinon/juniper habitat.
RANGE	The roadrunner lives in the southwestern United States, from California to the southwestern corner of Missouri, and down to northern Mexico.
SOCIAL BEHAVIOR	1. From February to July or August, they are in pairs. 2. The rest of the time they are solitary. 3. Before nesting begins, they are only together during the day.
COMMUNICA-TION	Roadrunners have several sounds: 1. A series of 6 to 8 low, coos that drop in pitch 2. A clattering sound by rolling mandibles (upper and lower parts of their bill) together that sounds like castanets 3. Hoarse guttural sounds 4. A kaa-kaa-kaa sound during mating season
DIET	Omnivore: spiders, scorpions, tarantulas, centipedes, grasshoppers, crickets, snails, caterpillars, lizards, snakes (including rattlesnakes) frogs, toads, baby sparrows, hummingbirds, bird eggs, mice, gophers, young ground squirrels, carrion, during winter some fruits (especially from cactus), seeds, and other vegetable matter make up about 10% of its diet.
PREDATORS	Raccoons, domestic cats, skunks, coyotes, and hawks
SEXUAL MATURITY	2 to 3 years
MATING SEASON	Varies each year depending on the temperature and availability of food.
MATING HABITS	1. Monogamous 2. The male must prove to the female that he will make a suitable mate. He follows the female performing certain rituals such as lowering his head to the ground then rising to the sky, bows rapidly flickering his wings, wagging his tail back and forth, making clacking sounds, and following the female, who ignores him. 3. He then offers a twig or other nest building material followed by the offering of some type of vertebrate (the type of food that is necessary to insure proper development of the young.) 4. He usually dances around her while she begs for the food. After mating, the male will present the female with the food.
NEST	1. Both parents choose a well-concealed nest site on a horizontal tree branch 3 to 10 feet off the ground or in a crotch of a sturdy bush, cactus, or small tree.

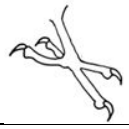
	2. They build a 17-inch diameter, 8-inch-high saucer-like nest of twigs lined with grasses, leaves, feathers, snakeskin, horse and cow manure, etc. If the male does not bring the twigs fast enough, the female makes a whining call to get him moving faster. **3. The parents may continue to work on the nest during incubation and build up the sides of the nest as the chicks grow.** **4. Pairs sometimes reuse a nest from a previous year.**
EGGS	**1. 4 to 6 white to pale yellowish eggs laid over a period of 3 days** **2. Some baby roadrunners are raised by other birds as the roadrunner is known as a brood parasite, which means the roadrunner will lay eggs in another bird's nest and allow that bird to care for the eggs and feed the young. They have been known to lay eggs in the nests of ravens and mockingbirds.**
INCUBATION	**1. 18 to 20 days by both parents** **2. The male sits on the eggs at night to maintain a high body temperature to keep the eggs warm.**
THE YOUNG	**1. Fed by both parents** **2. They leave the nest after about 18-21 days, and may begin catching their own food soon after that.** **3. The parents will still feed them for up to another 30-40 days.** **4. Male performs a distracting display to protect the nest.**
DEGREE OF DEPENDENCE	**Altricial – helpless at birth**
FLEDGE AT	**About 21 days**
# OF BROODS PER YEAR	**1 to 2 depending on rainfall**
THREATS	**1. habitat loss, household pets, traffic**
HUMAN USAGE	**1. Looney Tunes cartoon features the cunning Road Runner out smarting Wile E. Coyote.** **2. Some Pueblo Native American tribes, including the Hopi, believed the roadrunner provided protection against evil spirits.** **3. In Mexico, some said it brought babies, much like the white-stork was said to in Europe.** **4. Some Anglo frontier people believed roadrunners led lost people to trails.**
OTHER INFORMATION	**1. They get most of their fluids from the prey that has high water content. They also drink water when it is available.** **2. It reabsorbs water from its feces before excretion.** **3. A nasal gland under the eyes, eliminates excess salt, instead of using the urinary tract like most birds.** **4. They do not seem to be afraid of human.** **5. The roadrunner is the state bird of New Mexico.**
FEET 	**1. Their zygodactyl feet (2 toes pointing forward and 2 toes backward) leave X-shaped footprints in the sand.** **2 They are very fast runners, leaning over parallel to the ground with their tails streaming behind them.** **3. They can run up to 15 to 17 mph.**
BEAK 	**1.They grab their prey's neck with their long beaks and beat the prey on a rock or ground to kill it.** **2. Their beaks are not strong enough to tear meat apart, so they begin swallowing the prey whole and will run around with the food hanging from their mouth until it is digested.**
FEATHERS, WINGS, FLIGHT	**1. Their short wings can only keep them in the air gliding for a few seconds at a time. Once they land, they hit the ground running.** **2. They only fly (glide) to escape predators or when traveling down steep slopes.** **3. They use their tails and wings to help change directions, brake, balance, and turn while they are running.** **4. They have a bare patch of blue and orange skin behind each eye.**
BODY ADAPTATIONS	**1. The roadrunner's nasal gland eliminates excess salt, instead of using the urinary tract like most birds.** **2. It can survive without drinking water, if it consumes prey with high water content.** **3. Its extreme quickness allows it to snatch a humming bird or dragonfly from midair.**
WEATHER ADAPTATION	**1. To warm itself during the day, it turns its back to the sun, fluffs up its feathers to exposes the black skin on its back to the sun. This lets the bird warm up without**

	using a lot of metabolic energy. 2. It reduces its activity 50% during the heat of midday. 3. To lower its body heat, it flutters up the area under its chin, which has no feathers. 4. During the cold desert night, the roadrunner lowers its body temperature slightly, going into a slight torpor to conserve energy. 5. During the winter months, many succumb to freezing, icy weather.
DEFENSE ADAPTATIONS	1. When threatened, they erect their crest and reveal a bright orange patch of skin behind the eye. 2. Both members of a pair patrol their territory-which can measure up to a half-mile in diameter—and drive off intruders 3. Their coloring blends into the environment.
HUNTING ADAPTATIONS	<u>Catching Snakes</u> 1. The roadrunner is one of the very few animals quick enough to prey upon rattlesnakes (usually under 3 feet.) 2. It waves its tail from side to side and flares out its wings to distract the snake. 3. It leaps into the air to avoid a rattlesnake bite as it aims to grab the snake's head in midair. 4. Once it secures the snakes, the bird repeatedly beats the snake against the ground or a rock causing the vertebrate to break in several places. This also helps flatten the snake making it easier to swallow. 5. Since the roadrunner's beak cannot break off the food, it then swallows its prey whole. 6. It is often unable to swallow the entire length at one time, so, it just runs around with the snake dangling from its mouth, consuming another inch or two as the snake slowly digest. 7. Roadrunners will sometimes hunt with another roadrunner: One distracts the snake by jumping and flapping, and the other sneaks up and pins its head.

LADDER-BACKED WOODPECKER (Picoides scalaris)

See Bird Plate 3

FAMILY	**Picidae (woodpeckers)**
OTHER NAMES	**"Cactus Woodpecker" since it nests in cactus plants.**
CALLED	**Baby chick group: descent, drumming, gatling**
LIFE SPAN	**4 ½ years**
SIZE	**6-7 inches**
WEIGHT	**1.1 ounces**
WING SPAN	**11 to 12 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Deserts, river woods, groves, dry woods, arid brush. In the United States in dry areas of the southwest, including brush land, desert washes, mesquites, riverside trees in prairie country, towns. Moves into adjacent habitats such as oaks and pinyon-juniper stands in foothills, woods on Texas coast. In Central America, also in thorn forest, pine-oak woods, even coastal mangroves.**
RANGE	**The species can be found year-round over the southwestern United States (north to extreme southern Nevada and extreme southeastern Colorado), most of Mexico, and locally in Central America as far south as Nicaragua.**
SOCIAL BEHAVIOR	**1. Monogamous 2. The birds are often seen in pairs but can also form into small family groups of up to four birds.**
COMMUNICA-TION	**The call is a clear, high-pitched "pik" sound that is often repeated.**
TYPE OF DIET	**Omnivore: wood-boring beetles and their larvae, caterpillars, true bugs, ants, suet from mutton, sunflower seeds, nuts, cactus fruit, other fruits, berries**
PREDATORS	**No known predators, however snakes, hawks, and owls are known to prey on woodpeckers in general.**
SEXUAL MATURITY	**1 year**
MATING SEASON	**January- March**
MATING HABITS	**1. During the mating period, the birds show fluttering displays 2. Other displays include crest raising, bobbing and turning heads, and tail or wing spreading.**

NEST	**1. The nests are excavated in dead limbs, stumps, fence posts, yuccas, agaves and large cacti, usually 3 to 30 feet off the ground. They will also nest in riparian areas that contain cottonwoods, willows, and mesquite. 2. The male usually excavates the hole with some assistance from the female. 3. The nest is lined with bark chips.**
EGGS	**3 to 5 white**
INCUBATION	**13 days by both parents**
THE YOUNG	**Both parents feed the young This pair will incubate the eggs for 13 days and the parents will continue to care for them another two weeks after that.**
DEGEE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**14 to 16 days after hatching**
THREATS	**None**
# OF BROODS PER YEAR	**1**
OTHER INFORMATION	**1. They are primarily colored black and white, with a barred pattern on their back and wings resembling the rungs of a ladder. 2. Their consumption of wood-boring beetles and other destructive insects aids in the control of insect populations, thus rescuing many trees from disease. 3. They do not get headaches from banging on trees because they have thickened skulls and powerful neck muscles that allow them to deliver sharp blows without hurting their bodies. 4. Females do not have red on their heads.**
FEET 	**This species has zygodactyl feet and rigid tail feathers which enable it to climb and drill while balancing itself.**
FEATHERS, WINGS, FLIGHT	**1. They flit about in a quick, undulating flight pattern. 2. As it soars, the bird flaps its wings rapidly. In flight, the shallow flapping alternates with brief gliding periods.**
BEAK 	**1. Strong, thick, chisel-like beaks which tapers to the tip for chipping away tree bark and drilling into the tree's inner bark to find insects or make nests.**
WEATHER ADAPTATIONS	**Non-migratory**
DEFENSE ADAPTATIONS	**They will drum on a hollow log or tree to announce their territory.**
HUNTING ADAPTATIONS	**1. They move rapidly and tend to cover fairly long distances between foraging sites. 2. They use their chisel-like bill to probe, tap, and pry off bark. 3. Male feeds closer to the ground to find insects. 4. Females feed and tend to hunt higher in the trees and pulls bugs from leaves and cracks in the bark.**

MOURNING DOVE (Zenaida macroura)

See Bird Plate 4

FAMILY	**Columbidae (pigeons, doves)**
OTHER NAMES	**Turtle dove, rain dove, once was called the Carolina pigeon**
CALLED	**Female: hen male: called baby: squab group: dole, dule, flight, piteousness**
LIFE SPAN	**1. The average lifespan of first year birds is 1 - 1.5 years. 2. If these birds survive their first year, they can live on average 4 - 5 years.**
SIZE	**12 inches long**
WEIGHT	**4.2 ounces**
WING SPAN	**15 to 18 inches**
FLYING SPEED	**55 mph**
TIME OF ACTIVITY	**Crepuscular**
HABITAT	**Grassland, forest, towns, open woodland**
RANGE	**From southern Canada to central Mexico, this is one of our most common birds.**

SOCIAL BEHAVIOR	**When male and female mourning doves pair up for the reproductive season, they generally will stick together for that season, including sleeping in the same nest. Sometimes they will stay together for the winter, but if not, they will reconnect the next spring.**
COMMUNICA-TION	**1. To attract females, the male's call is a distinctive, plaintive cooOOoo-woo-woo-woooo which may be mistaken for the call of an owl at first.** **2. Mated males call the female to their nest with a *cooOOoo*.** **3. Males make a soft *ork* when they rejoin their mates,** **4. Male or female make (a short *roo-oo*)as an alarm when threatened.**
TYPE OF DIET	**Herbivore: wheat, millet, corn, sunflower seeds, corn, pine nuts, sweetgum seeds, pokeberry, sesame. buckwheat, rye, prickly poppy, grass, weed seed**
PREDATORS	**Falcon, hawks, housecats, squirrels** **During nesting the following will eat their eggs: grackles, crows, jays, magpies, nutcrackers, ravens, snakes**
SEXUAL MATURITY	**Around 85 days**
MATING SEASON	**1. Begins as early as March** **2. Peak season: April-July** **3. Some may still breed in October in some areas**
MATING HABITS	**1. Monogamous** **2. The coo signals the beginning of the breeding season.** **3. Courtship begins with a noisy wingbeat by the male, followed by a graceful, circular glide with outstretched wings and head down.** **4. After landing, the male will approach the female with a puffed-out breast, bobbing head, and a cooing song.** **5. Mated pairs will often preen each other's feathers with gentle nibbles around the neck.** **6. Eventually, the pair will progress to grasping beaks and bobbing their heads up and down in unison.**
NEST **.**	**1. The nest is usually built in dense foliage on the branch of an evergreen, orchard tree, mesquite, cottonwood, vines, or on the ground, in hanging baskets and other man made objects.** **2. The male brings the nest materials and stands on the female's back to pass them off to her.** **3. The female stands in the middle of the nest, about 8 inches across, and arranges the twigs, pine needles, grass blades into a bowl shape nest that often falls apart during a storm.** **4. The nest can be so poorly put together that often you can see through it from the bottom.** **5. Mourning doves sometimes reuse their own nest or other species' nests.** **6. If they feel any threat from predators, whether human or animal, they may go elsewhere to nest, abandoning both eggs and nestlings.**
EGGS	**2 white**
INCUBATION	**13 to 14 days** **The males incubate during the day and the females at night.**
THE YOUNG	**1. Both parents produce a regurgitated liquid called crop-milk (not really milk) to feed the squabs for the first few days. The parents open their mouths wide and let the nestlings stick their heads inside to obtain the nourishment.** **2. After a few days, the parents start providing seeds as well.** **3. The fledglings will stay up to 2 more weeks to be fed.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**12 to 14 days**
# OF BROODS PER YEAR	**2 to 3, but up to 5** **Each year, mortality can reach 58% a year for adults and 69% for the young.**
THREATS	**Lead poisoning when they eat spent shot left over in hunting fields, hunting**
HUMAN USAGE	**Gamebird**
FEET 	**The species usually forages on the ground, walking, not hopping.**

BEAK 	**Relatively small, short, and narrow with a slightly bent down tip used for eating seeds and fruit**
FEATHERS, WINGS, FLIGHT	**1. While flying, the wings make a fluttery whistling sound as the wind rushes through their wings.** **2. The wing whistle is much louder and more noticeable upon take-off and landing.**
WEATHER ADAPTATIONS	**1. Non-migratory** **2. Will move around some to find food**
DEFENSE ADAPTATIONS	**1. Males have favorite "cooing perches" they defend from other males.** **2. Doves rarely leave their nest unattended.** **3. If the attending parent is flushed from the nest, it will display a "broken wing" performance by fluttering on the ground acting as if it is injured to distract the predator.** **4. The dove will desert the nest.**
HUNTING ADAPTATIONS	**1. Forages mostly on ground and in the open.** **2. They peck or push aside ground litter, but do not scratch at the ground.** **3. Sometimes they will perch on plants to take seeds.** **4. Eats quickly to fill crop with seeds, then digests them while resting.** **5. Regularly swallows grit (small gravel) to aid in digestion of hard seeds.**

NORTHERN MOCKINGBIRD (Mimus polyglottos)

See Bird Plate 4

FAMILY	**mimid (mockingbirds, thrashers, catbirds)**
OTHER NAMES	**Scientific name means mimic of many tongues**
CALLED	**Group: echo, exactness, plagiary, ridicule**
LIFE SPAN	**Up to 8 years**
SIZE	**8 to 11 inches Males are slightly larger.**
WEIGHT	**1.4 to 2 ounces**
WING SPAN	**12 to 15 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Open grounds with short grass, suburban hedges and lawns, farmlands, roadsides, thickets, brushy areas, dense low shrubs, desert thickets, woodland edges, stream sides in canyons**
RANGE	**They range throughout North America from southern Canada south to Mexico. They have even been introduced and established in Hawaii. Mockingbirds live year-around across Texas.**
SOCIAL BEHAVIOR	**Northern Mockingbirds are found alone or in pairs throughout the year.**
COMMUNICA-TION	**1. A male may learn around 150 songs during his lifetime. The songs are a wide variety of mimicked phrases, with the phrases often repeated three or more times.** **2. They can accurately imitate almost anything including rusty hinges, whistling, cackling hens, sirens, crickets, dog barking, musical instruments, animals, and other birds. Electronic analysis could not tell the difference between the mockingbird and the original sound.** **3. Scientists think they produce these copycat calls to show off for potential mates.**
TYPE OF DIET	**Omnivore: insects, beetles, grasshoppers, caterpillars, ants, wasps, spiders, snails, mealworms, earthworms, moths, butterflies, bees, weevils, chinch bugs, small lizards, snakes, berries (holly, mulberries, raspberries, blackberries, hackberries, sumac) and fruits (apples, pomegranates, grapes, figs)** **Mockingbirds can drink from puddles, river and lake edges, or dew and rain droplets that amass onto plants. Adult mockingbirds also have been seen drinking sap from the cuts on recently pruned trees.**
PREDATORS	**Eggs and nestlings:** **blue jays, crows, red-tailed hawks, owls, snakes, squirrels, cats, raccoons** **Fledglings** **domestic cats, raccoons, red-tailed hawks, crows** **Adults:** **great horned owls, screech owls, sharp-shinned, hawks, scrub jays**
SEXUAL MATURITY	**1 year**

MATING SEASON	**1. Males usually arrive sometime in February before the breeding season to establish their territories.** **2. Mating can occur from February through August.**
MATING HABITS	**1. These birds are monogamous; however, females will sometimes find a new mate.** **2. Males arrive first to claim their territory, usually to the same breeding spots from the previous year.** **3. Singing is an important part of mating. Scientists have determined that females are attracted to males that make the most different songs.** **4. To attract the female, the male sings throughout the day and often leaps a few feet into the air and flap his wings. Then the male and female will chase each other.** **5. Most night singers are unmated males. They continue to sing loudly until late in the season and will eventually abandon the area.** **6. Once a pair bond is established, the songs are shortened and more subdued. Sitting together quietly, both mockingbirds make a "hew-hew" call to keep in contact.**
NEST	**1. The nest is built in a dense shrub or tree, usually 3-10' above the ground.** **2. The male probably chooses the nest site and begins building several nests before the female chooses one to finish with weeds, grass leaves, rootlets, moss, and animal hair then lays her eggs in it.** **3. The male does most of the work, while the female watches for predators.** **4. Mockingbirds rarely reuse their nests. They may build as many as 5 to 6 nests per breeding season. Each nest takes 2 to 3 days to build.**
EGGS	**3-4 greenish to bluish gray, with blotches of russet eggs**
INCUBATION	**12 to 13 days by female**
THE YOUNG	**1. Both parents feed the nestlings.** **2. The young leave the nest about 12 days after hatching, but are not able to fly well for another week.** **3, The female may lay eggs in a different nest while the male is taking care of the young.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**11 to 13 days**
# OF BROODS PER YEAR	**2 to 3**
OTHER INFORMATION	**1. From the late 17th through 19th century, people kept mockingbirds in cages so they could enjoy their singing. So many were captured that they nearly vanished from parts of the East Coast.** **2. Thomas Jefferson had a pet mockingbird named Dick.** **3. Mockingbirds are the state birds of Arkansas, Florida, Mississippi, Tennessee, and Texas.** **4. A 2009 study showed that the bird was able to recognize individual humans, particularly noting those who had previously been intruders or threats to their territory.** **5. The Migratory Bird Treaty Act of 1918 makes it illegal to kill, harm, or harass migratory birds, which includes mockingbirds.** **6. In Harper Lee's novel To Kill a Mockingbird Atticus says, it is a sin to kill a mockingbird because it is a creature that does not do any harm and also gives pleasure.**
FEET 	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and causes the toes to lock on the perch.** **3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAKS 	**Long, thin bill with a hint of a downward curve**
FEATHERS, WINGS, FLIGHT	**The Northern Mockingbird frequently gives a "wing flash" display, where it half or fully opens its wings in jerky intermediate steps, showing off the big white patches. No one knows why.**
WEATHER ADAPTATIONS	**Some migrate**
DEFENSE ADAPTATIONS	**1. Mockingbirds will aggressively defend their nests and territory against other birds and animals. They may even use a distinct call to summon help from other mockingbirds.** **2. They will harass cats and dogs, other birds, and even humans if they feel threatened.**

	3. Females typically fend off other female mockingbirds, while males confront male intruders. 4. Males disputing territory boundaries fly toward each other, land near the boundary, and face off, silently hopping from one side to another. Eventually, one bird retreats and the other chases it a short way. If neither bird retreats, they may fly at each other, grappling with wings and claws and pecking at each other. 5. Unlike other birds, mockingbirds defend two separate territories- the breeding territory and their fall and winter-feeding territory.
HUNTING ADAPTATIONS	1. They capture insects mostly while walking and running on ground. 2. Also watches from low perches and flies down to capture prey on ground below. 3. They perc in shrubs and trees to eat berries. They sometimes fly up and hover to grab hanging fruit.

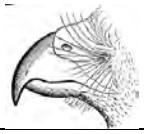
PYRRHULOXIA (Cardinalis sinuatus)
See Bird Plate 4

FAMILY	Cardinalidae (tangers, cardials, pyrrhuloxia, grosbeak, bunting, dickcissel)
OTHER NAMES	Desert cardinal
LIFE SPAN	Not known, but 1 reportedly lived 8 years
SIZE	7 ½ to 8 inches
WEIGHT	.8 to 1 ½ ounces
WING SPAN	about 10 ½ to 12 inches
FLYING SPEED	20 mph
TIME OF ACTIVITY	Crepuscular
HABITAT	Mesquite areas, acacia scrub, desert uplands and washes, arid canyons, residential areas with mesquite In winter they may wander into farm country, open woods, and forest edges.
RANGE	Arizona, New Mexico, Texas, and woodland edges of Mexico
SOCIAL BEHAVIOR	They will share their territory with the Northern cardinal. During the winter they will forge in large (hundreds) flocks.
COMMUNICA-TION	1. Pyrrhuloxias make a sharp, metallic *cheek* or *chip* note, similar to that of the Northern Cardinal but lower in pitch. 2. Other calls include a chattering contact call, a series of soft chipping notes during foraging, and a " tseep" call used by begging fledglings. 3. Pyrrhuloxias often call while in flight. 4. Males have about a dozen songs that last 2 to 3 seconds, used to establish and maintain territories. 5. Females occasionally sing while defending nests.
TYPE OF DIET	Omnivore: beetles, caterpillars, grasshoppers, cotton worms, weevils, mesquite, grasses, weeds, sunflowers, wild fruit, cactus fruit, seeds from bird feeders Though they will drink at pools of water, when possible, they seem to get most of their water from insects in spring and summer.
PREDATORS	Feral and domestic cats, Ferruginous pygmy-owls, greater roadrunners
SEXUAL MATURITY	1 year
MATING SEASON	Mid-March through mid-August
MATING HABITS	1. To begin breeding season, the male establishes and defends his territory by chasing away other males by singing. 2. Males court females by giving a distinctive call, approaching her with a wing-fluttering sound, bowing the head, and sometimes offering a piece of food. 3. The pair will forage together and exchange soft calls. 4. Probably monogamous. Some pairs will stay together year-round while others will go separate ways after the young leave.
NEST	Female builds a compact (3 inches across and 1 ½ inches deep) cup-shaped nest of grass, bark, and bits of twigs in a dense thorny bush (often mesquite or gray thorn) about 5 to 15 feet off the ground and away from the trunk and main branches. The nest is lined with rootlets, horse hair, plant fibers, feathers, spider webs.
EGGS	2 to 5 pale grayish white to greenish white, with brown and gray spots

INCUBATION	**About 14 days by female only. Male often feeds the female.**
THE YOUNG	**Both parents bring food for the nestlings. They reach complete growth and are independent within a month.**
DEGREE OF DEPENDENCY	**Altricial**
FLEDGE AT	**About 10 days, but they can take up to 30 days before they are fully fledged.**
# OF BROODS PER YEAR	**1**
THREATS	**Habitat loss and cats**
HUMAN USAGE	**None**
OTHER INFORMATION	**There are ways to tell the difference between a cardinal and a pyrrhuloxia: 1. If the bill is large, thickly pointed, and red or red-orange, it is a cardinal. If the bill is small, rounded, parrot-like and yellow, it is a Pyrrhuloxia. 2. If there is any black on the face, around the bill and into the eye, it is a Cardinal. If the face is red around the bill and into the eye, it is a Pyrrhuloxia. 3. If gray is a predominate color, it is likely to be a Pyrrhuloxia.**
FEET 	**1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch. 2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and causes the toes to lock on the perch. 3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAK 	**Short, strong, curved, parrot-shaped used to crack open and crush seeds.**
FEATHERS, WINGS, FLIGHT	**Flies with a smooth wave-like motion, with a few wing beats and glides. It flies short distances of about 200 feet.**
WEATHER ADAPTATIONS	**1. Non-migratory, but they sometimes stray out of their area. 2. They will find a cool place to rest when the day is hot.**
DEFENSE ADAPTATIONS	**1. The male sings to defend his territory when breeding season begins. 2. When predators appear, the pair will vocally react from their perch and may excitedly hop from branch to branch while calling loudly.**
HUNTING ADAPTATIONS	**1. Forages mostly while hopping on ground, but will also forage in shrubs and low trees.**

RED-TAILED HAWK (Buteo jamaicensis)
See Bird Plate 1

FAMILY	**Accipitridea (hawks, eagles, kites)**
OTHER NAMES	**Chicken hawk, buzzard hawks, red hawks**
CALLED	**Female: hens male: tierces baby: eyas group: cast, when in a large group: kettle, aerie ; when in a spiraling flight; boil**
LIFE SPAN	**10-21 years.**
SIZE	**Male 18 to 22 inches Female 19 to 25 inches**
WEIGHT	**Male: 1 ¾ to 2-pound Female: 2 to 2 ½ pounds**
WING SPAN	**Male: 3 ¾ to 4 ¼ feet Female: 4 ¼ to 4 ¾ feet**
FLYING SPEED	**1. They dive at a speed of at least 120 miles per hour. 2. Typical soaring and flying speed is 20 to 40 mph.**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Open fields, deserts, grasslands, meadows with scattered trees, forest, rural to urban areas**
RANGE	**1. They are North America's most common hawk. 2. They are found all over the continent, in Central America, and in the West Indies.**
SOCIAL BEHAVIOR	**Solitary except at mating season.**
COMMUNICA-TION	**1. A powerful long high-pitch descending scream 2. Young will make repeated begging sounds.**
TYPE OF DIET	**Carnivore : mice, rats, gophers, rabbits, squirrels, skunks, cats, bats, turtles, lizards, snakes, salamanders, spiders, beetles, centipedes, pheasants, quails, crows, doves, quail, wild turkey water fowl, fresh road kill (carrion)**

PREDATORS	**raccoons, foxes, great-horned owls**
SEXUAL MATURITY	**3 years, at which time they develop the red tail**
MATING SEASON	**March through April**
MATING HABITS	**Monogamous** **The courtship begins with both hawks soaring in circles at great heights. The male dives down in a steep drop then goes up again at a steep angle. He repeats this several times before he approaches the female hawk and they grab each other's talons and fall spiraling towards the earth.**
NEST	**1. Both build a bulky bowl shape (3 feet across and 3 feet deep) nest of sticks lined with leafy green branches, pine needles, and other softer materials in a tree, cliff ledge, or even on a man-made structure high above the ground.** **2. They will use and add to the nest year after year.**
EGGS	**1. 1 to 3 white with brown spots eggs every year** **2. The size of the clutch depends on the availability of prey.** **3. The eggs are usually laid every other day.**
INCUBATION	**28-35 days mostly by the female** **Eggs will hatch over 2 to 4 days depending when they were laid**
THE YOUNG	**1. Female remains with young most of the time during first few weeks.** **2. Male brings most food, and female tears it into small pieces to feed to the young.** **3. After about 4-5 weeks, food is dropped in nest, and young feed on it themselves.** **4. Young leave the nest about 6-7 weeks after hatching, and practice flapping their wings and balancing in the wind on the edge of the nest.**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**42 to 48 days, but stay with the adults for another 30 to 70 days before becoming fully independent**
# OF BROODS PER YEAR	**1**
THREATS	**1. Taken to be used as falconry because they are so common and easily trained as capable hunters.** **2. Most hawks captured for falconry in the United States are red-tails.** **3. Falconers are permitted to take only passage hawks (which have left the nest, are on their own, but are less than a year old).**
HUMAN USAGE	**1. Sport of falconry** **2. The feathers and other parts of the red-tailed hawk are considered sacred to many Native Americans.** **3. Feathers from golden eagles, bald eagles, and red-tailed eagles are regulated by the "Eagle Feather Law."**
FEET 	**1. They have powerful feet with sharp, long talons used for grasping and holding prey.** **2. The talons continue to grow because they are worn down with usage.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces small enough to swallow.** **2. It is a strong weapon when used for defense.** **3. It is used to groom its feathers.** **4. It continues to grow because it is worn down with usage.**
VISION AND HEARING ADAPTATIONS	**1. Their eyesight is eight times greater than a human, so while they are flying, they can see the slightest movement of prey in the grass below.** **2. They have large eyes and many retinal cells to allow them to clearly see prey from far distances. This allows them to determine if the potential prey is safe to capture or should be avoided because it is dangerous to them.**
WEATHER ADAPTATIONS	**Northern (mostly Canada) Red-tails may migrate far to the south, while many at central or southern latitudes (especially adults) are permanent residents.**
DEFENSE ADAPTATIONS	**1. They build their nests in very high trees to keep other animals away from their eggs and young.** **2. While nesting, the females aggressively protect their babies.** **3. Very territorial, the males aggressively defend their areas.** **4. During disputes, the males dive steeply, talons extended, and swoop up and down**

	repeatedly.
HUNTING ADAPTATIONS	**1. They have long curved sharp talons that grab and kill their prey.** **2. They have strong hooked beaks, so they can tear their food apart.** **3. They soar to save energy while they hunt.** **4. They sometimes work with another hawk to catch a prey.** **5. They can dive at high speeds to catch their prey.** **6. They carry small prey to a perch, but large prey is often partly eaten on the ground.** **7. Juvenile birds may be seen eating road-killed animals.** **8. They use two methods for hunting:** • **Does most hunting by watching from a high perch, then swooping down to capture prey in its talons** • **Also hunts by soaring in wide circles over fields, watching for prey below. They attack in a slow, controlled dive with the legs outstretched. They will also catch birds in flight.**

SCALED QUAIL (Callipepla squamata)
See Bird Plate 3

FAMILY	**Odontophoridae (new world quails)**
OTHER NAMES	**Blue Quail or Cotton-Top Quail**
CALLED	**Female: hen males: cock baby: chick group: covey, bevy, battery, drift, flush, rout**
LIFE SPAN	**1 ½ years**
SIZE	**10 to 11 inches**
WEIGHT	**6 to 6 ½ oz.**
WING SPAN	**15 inches**
TIME OF ACTIVITY	**Crepuscular**
RANGE	**Northern and central Mexico, Arizona, New Mexico, western Texas, and the southwestern portion of Kansas**
HABITAT	**Rolling hills, uplands with scattered shrubs and open patches of land that include little leaf sumac and althorn, grassland, desert grasslands, pinon-juniper areas**
SHELTER	**1. Short grass where they can be inconspicuous.** **2. At night, coveys of scaled quail roost on the ground in dense low growth.**
SOCIAL BEHAVIOR	**Scaled Quail are highly social and live in large groups (coveys) from September to April. Then the pairs form and the coveys break up until they regroup again in the fall.**
COMMUNICA-TION	**1. Male birds make several vocalizations (“cree”, “squawk”, “skook”, or “whock” during the breeding season.** **2. They have a gathering call “chip-churr” or “chin-tang” to reunite a covey.** **3. Other calls include: the group alarm cry, the individual fright cry, chick calls, and several different conversation notes.**
TYPE OF DIET	**Omnivorous : grains, plant shoots, green vegetation including leaves, grasses, succulents (mostly during the winter and spring months), berries, and seeds from sumac, mesquite, snakeweed, ragweed, Russian thistle, broomweed, grasshoppers, beetles (especially in the spring and summer)** **They can obtain water from the foods they consume.**
PREDATORS	**Red-tailed hawks, falcons, roadrunners, great horned owls, American kestrel, snakes, coyotes, skunks, the eggs are eaten by raccoons, coyotes, skunks**
SEXUAL MATURITY	**About 6 months**
MATING SEASON	**Pairs begin forming in late February to early March with actual mating from April to September.**
MATING HABITS	**1. Monogamous** **2. In the spring, the coveys break up and the birds pair up to begin the reproductive process.** **3. The male displays its plumage and makes its calls, and briefly chases the female.** **4. Unmated males call to attract mates throughout the breeding season.**
NEST	**1. Female scrapes the ground to form a depression (3 inches deep and 9 inches across) that both parents line with dried grasses, leaves, and a few feathers.** **2. The nest is well hidden within dense vegetation of bushes, grasses, sagebrush, little leaf sumac, prickly pear, yucca, etc.**
EGGS	**12 to 14 whitish speckled with light brown eggs**

INCUBATION	**22 to 23 days by female**
THE YOUNG	**1. Both parents tend young, with male often standing guard on higher perch while female and young feed on the ground.** **2. Leave the nest shortly after hatching and feed themselves.** **3. They are accompanied by at least one, usually both, parents, who show them how to find food.** **4. As the young mature, they tend to join with other family units to form winter flocks, generally, from 20 to 200 birds.** **5. As winter progresses, the number of birds in the flock decreases from hunting, predation, weather-related deaths, and other causes.** **6. A first-year mortality of 70 percent or more is normal.**
DECREE OF DEPENDENCY	**Precocial – can take care of themselves shortly after birth**
FLEDGE AT	**4 weeks**
# OF BROODS PER YEAR	**1**
THREATS	**Overgrazing of land can destroy their cover.**
HUMAN USAGE	**Scaled quail are popular gamebirds.**
OTHER INFORMATION	**They can run up to 15 miles per hour.**
FEET 	**Scratching feet have nail-like toes used for scratching the soil for food.**
BEAK 	**The bills are short, pointed, and serrated and are used for eating insects and seeds off the ground.**
FEATHERS, WINGS, FLIGHT	**1. Although they are capable of short bursts of strong flight, New World quails prefer to walk, and will run from danger (or hide), taking off explosively only as a last resort.** **2. The white crest on the top of their head gives them the name cotton-top.**
WEATHER ADAPTATIONS	**1. During winter, the bird's gut morphology changes to collect more energy from lower-quality foods such as tumbleweed seeds.** **2. At night, they roost in groups on the ground and form a small circle with their heads facing outward. When temperatures are cooler, this roosting circle becomes tighter.**
DEFENSE ADAPTATIONS	**1. At night, they form a circle with their heads facing outward, so they can be alert to approaching predators.** **2. They run to escape predators because their bodies are too heavy to fly well.** **3. Care-of-young calls often occur when a female quail with a brood is flushed or put under pressure. The female will begin a "broken-wing act" and send a shrill "ping-g-g" sound.**
HUNTING ADAPTATIONS	**1. Hunts for food twice a day (mid-morning and before dark.)**

STELLAR'S JAY (Cyanoitta stelleri)
See Bird Plate 5

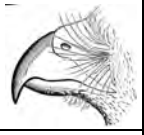
FAMILY	**Corvidae (crows, ravens, jays, magpies)**
CALLED	**Group: band, cast, party, scold**
LIFE SPAN	**16 years**
SIZE	**11 to 13 inches long**
WEIGHT	**3 to 4 ½ ounces**
WING SPAN	**17 to 19 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Pine- oak forests, campgrounds, picnic areas, parks, well-wooded suburbs**
RANGE	**Common on the West Coast, from Alaska and the Yukon in the north to Arizona and New Mexico in the south**
SOCIAL BEHAVIOR	**1. Travel in groups of up to 12 which include family members.** **2. Members of a pair are rarely apart after breeding.** **3. Steller's Jays keep up a running commentary on events and often instigate mobbing of**

	predators and other possibly dangerous intruders 4. Will join in mixed-species flocks
COMMUNICA-TION	1. One common call is a harsh "SHACK-Sheck-sheck-sheck-sheck-sheck" series. 2. "Skreeka! skreeka!" call sounds almost exactly like an old-fashioned pump handle. 3. Soft, breathy "hoodle, hoodle" whistle 4. Its alarm call is a harsh, nasal "wah." 5. Females produce a rattling sound. 6. Males make a high-pitched "gleep, gleep" sounds. 7. They imitate the vocalizations of many species of birds, other animals (squirrels, chickens, dogs), and sounds of non-animal origin.
TYPE OF DIET	Omnivore: Diet is about two-thirds vegetable and one-third animal matter. pine seeds, sunflower seeds, acorns, cracked corn, shelled raw peanuts, berries, wild fruit, cultivated fruit, small rodents, snakes, lizards, frogs, other birds' eggs, nestlings, carrion, in summer: beetles, wasps, bees, spiders They will scavenge picnic and camp sites, garbage, feeders, cat food dishes, food scraps.
PREDATORS	common raven, red-tailed hawks, owls, Cooper's hawk, northern goshawk Eggs: squirrels
SEXUAL MATURITY	1 year
MATING SEASON	Late April through early June
MATING HABITS	1. Monogamous 2. In courtship, male feeds female. 3. Male circles around the female. He stands sideways to a female, spreads his tail, and tilts wings and body toward her. 4. He usually accompanies this display with a song.
NEST	In a conifer tree, both parents build a cup shape nest using sticks, twigs, leaves, moss, mud and lined with pine needles, soft rootlets, or animal hair.
EGGS	3 to 5 pale green with brown markings
INCUBATION	1. 14 to 16 days by female 2. The male feeds the female while she incubates the eggs. 3. They will become very noisy and aggressive if the nest is threatened.
THE YOUNG	Male and female feed nestlings.
DECREE OF DEPENDENCY	Altricial- helpless
FLEDGE AT	16 to 18 days
# OF BROODS PER YEAR	1
OTHER INFORMATION	1. Steller's Jays are bold, inquisitive, intelligent, and noisy. 2. They have great spatial memories that they use to find their food caches. 3. They can work in groups to outsmart humans and cats. Example: It took them approximately 12 hours to learn that the plastic swivel-head owl in a garden is not a legitimate foe. 4. They are very good at imitating other birds, especially Red-tailed and Red-shouldered hawks, flickers, as wells as squirrels, and cats.
FEET 	1. Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch. 2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and cause the toes to lock on the perch. 3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock. 4. They use their feet to hold the nuts they are cracking. 5. They scratch their heads by extending the foot over top of their wing. 6. They do not walk but rather hop while on the ground. They climb limbs in trees by hopping from branch to branch, spiraling near the tree's trunk.
BEAK 	1. Strong, thick, cone-shape for eating corn, cracking seeds, and opening nuts 2. Frequently wipes bill after feeding. 3. Sleeps with head turned backward and beak tucked into back feathers.
FEATHERS, WINGS, FLYING	Strong and deliberate flight, but not sustained for long distances.

WEATHER ADAPATIONS	**1. Non-migratory** **2. The Steller's jays that live in mountainous areas will move up the mountains in the summer and back down to mountain valleys in the winter.**
HUNTING ADAPTATIONS	**1. Forages mostly high in trees but also low or on ground.** **2. Opens hard seeds and acorns by pounding on them with its beak.** **3. They frequently remove stored food from caches of other birds.** **4. They will scare smaller songbirds away from feeders.** **5. They carry several nuts at a time in their mouth and throat, then cache them one by one in the ground or trees as a winter food store.**

SWAINSON'S HAWK (Buteo swainsoni)
See Bird Plate 1

FAMILY	**Accipitridae (hawks, eagles, kites)**
OTHER NAMES	**Grasshopper hawk**
CALLED	**Baby: eyas group: kettle**
LIFE SPAN	**16 to 19 years**
SIZE	**19 to 22 inches long**
WEIGHT	**2 pounds**
WING SPAN	**46 to 58 inches**
FLYING SPEED	**120 mph diving speed**
TIME OF ACTIVITY	**Crepuscule**
HABITAT	**Open country, fields, prairies, roadsides, hay and alfalfa fields, pastures, grain crops, and row crops, or perched atop adjacent fence posts and overhead sprinkler systems** **They favor open habitats for foraging, rely on scattered stands of trees near agricultural fields and grasslands for nesting sites.**
RANGE	**Grasslands, deserts, open areas**
SOCIAL BEHAVIOR	**A highly gregarious species, the Swainson's Hawk forages and migrates in flocks sometimes numbering in the thousands.**
COMMUNICA-TION	**Long high-pitched call**
TYPE OF DIET	**Omnivores** **1. The young are fed "the three r's" rodents, rabbits, and reptiles and squirrels, bats, even carrion.** **2. When not breeding, however, they are almost exclusively insectivorous: eating grasshoppers, caterpillars, crickets, dragonflies, butterflies, moths, and beetles.**
PREDATORS	**Great horned owls**
SEXUAL MATURITY	**About 2 years for females**
MATING SEASON	**1. Monogamous** **2. March or April**
MATING HABITS	**Courting partners perform a "sky dance": they soar in circles high above the nest site, with the male making steep dives and recoveries before rejoining the female.**
NEST	**1. Male Swainson's Hawks choose the nest site, usually 15 to 30 feet off the ground near the top of a solitary tree or in a small grove of trees along a stream, or near agricultural fields and pastures where they feed.** **2. Have been known to nest on a transmission tower or power pole, or sometimes on the ledge of a cliff or steep slope.** **3. The male usually brings most of the materials: sticks, twigs, grass, debris items such as rope and wire.** **4. Male and female build the nest which can take up to 2 weeks, with the finished nest reaching 2 feet in diameter and over a foot high.** **5.The inner bowl measures up to 8 inches around and 2.75 inches deep.** **6. Both partners line the bowl with fresh, leafy green twigs, grass, hay, weed stalks, or bark. The lining can include cow dung or wool.** **7. Swainson's hawks may reuse a nest from a previous year, or refurbish a crow, raven, or magpie nest.**
EGGS	**1 to 5 pale bluish white fading to dull white, usually lightly spotted with brown eggs**
INCUBATION	**28 to 35 days by female** **Male brings food to female**

THE YOUNG	**1. Both parents bring food for young, but at first female may remain with the young much of time while male hunts.** **2. The young hawks chase grasshoppers and crickets on the ground before they learn how to catch other kinds of prey**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**38 to 46 days after hatching** **They may stay with their parents until fall migration.**
# OF BROODS PER YEAR	**1**
THREATS	**1. Loss of prey** **2. Loss of nesting sites** **3. Eating grasshoppers that ate toxic pesticides in Argentina**
HUMAN USAGE	**Helpful to farmers because they eat insects and rodents.**
FEET 	**1. They have powerful feet with sharp, long talons used for grasping and holding prey.** **2. The talons continue to grow because they are worn down with usage.**
BEAK 	**1. Sharp, hooked beaks used to grab the prey's skull or neck, kill it, slice through the tough skin, and tear it into pieces that are small enough to swallow.** **2. It is a strong weapon when used for defense.** **3. It is used to groom its feathers.** **4. It continues to grow because it is worn down with usage.**
FEATHERS, WINGS, FLIGHT	**1. Often flies with a slight upturned wing in a teetering vulture-like flight.** **2. A migrating bird waits for the air to warm, then soars on the rising air currents with wings and tail spread wide. At the top of the thermal the hawk folds its primary feathers back, closes its tail and soars south, using gravity to make distance as it searches for another thermal.**
WEATHER ADAPTATIONS	**1. Migratory** **2. Starting in late August and September, nearly the whole population of Swainson's Hawks migrates from North America to Argentina, a roundtrip of more than 12,000 miles for the northernmost breeders.** **3. Swainson's hawks "flock up" into kettles numbering in the tens of thousands, often mixing with turkey vultures, broad-winged hawks, and Mississippi kites to create a virtual river of migrating birds that create "migratory points" in Texas, Mexico, and Central America.**
DEFENSE ADAPTATIONS	**Breeding birds are aggressive around the nest site and chase off intruders, including red-tailed hawks, American kestrels, turkey vultures, and golden eagles.**
HUNTING ADAPTATIONS	**1. May soar or hover over grasslands searching for food** **2. May perch on sprinkler rigs or fence posts and scan the ground for food** **3. Often forage on foot, running after insects and small mammals with wings partly outstretched.** **4. Skilled at catching flying insects in the air**

TURKEY VULTURE (Cathartes aura)
See Bird Plate 3

FAMILY	**Cathartidae** **There are six other species of New World vultures in this family.**
OTHER NAMES	**Buzzard, turkey buzzard**
CALLED	**Group: venue, cast, committee, meal, vortex, wake** **When they are circling in the air, they are called a kettle.**
LIFE SPAN	**16 years**
SIZE	**25-32 inches long**
WEIGHT	**2 ½ -5 ½ lbs.**
WING SPAN	**5 1/2 – 6 feet**
FLYING SPEED	**Soars up to 60 mph They can glide for 6 hr. without flapping its wings.**
TIME OF ACTIVITY	**Diurnal**
RANGE	**From southern Canada to the southernmost tip of South America**
HABITAT	**Open country, semi-open areas, subtropical forests, shrub lands, pastures, deserts, foothills, pastures, grasslands, wetlands, roadsides, farm fields, landfills, trash heaps**

SHELTER	**1. They nest in sides of cliffs, caves, rock crevice, a burrow, tree stumps, and even scratch out an indentation on the ground for its nest.** **2. There is little or no construction of the nest.** **3. At night they roost on poles, towers, dead trees, and fence posts**
SOCIAL BEHAVIOR	**1. During the day, they usually fly alone.** **2. They might also fly in flocks (kettles) while searching for food or when migrating.** **3. At night they roost in large numbers (up to several hundred) which may include some black vultures.**
COMMUNICA-TION	**Lacking a voice box, they can only make grunting or low hissing sounds when they feel threatened.**
TYPE OF DIET	**They are scavengers that eat mostly dead animals (carrion.)** **1. Vultures prefer to eat fresh meat (1 to 2 days old.) They will turn their nose up at rotten meat if there is any alternative available. They also prefer the meat of herbivorous animals, avoiding that of dogs and other carnivores.** **2. They may eat some plants such as leaves, grasses, juniper berries, grapes, and pumpkins.** **3. Occasionally they may kill a weak or young animal.** **4. They can go at least one week without food and still be healthy.** **5. When they find food, they will stuff themselves.**
PREDATORS	**Turkey vultures' eggs and young are prey to these predators: raccoon, foxes, snakes**
SEXUAL MATURITY	**3 years**
MATING SEASON	**1. The breeding season varies according to latitude.** **2. In the southern United States, it begins in March, peaks in April to May, and continues into June.**
MATING HABITS	**1. Courtship rituals of the turkey vulture involve several individuals gathering in a circle, where they perform hopping movements around the perimeter of the circle with wings partially spread.** **2. They perform aerial courtship displays during which one bird follows the other and precisely mimics the lead bird's flight path. Flight displays are usually brief, although occasionally they are repeated for several hours.** **3. The species is monogamous, and evidence suggests that pairs remain together until one member dies. Existing pairs return to and reuse nesting sites year after year. For several days to several weeks prior to egg-laying, the pair spends time sitting together at the nest.**
EGGS	**Usually two whitish, blotched with brown and lavender eggs**
INCUBATION	**40 days with both parents taking turns sitting on the eggs**
THE YOUNG	**1. The parents take turns brooding the newly hatched young continually for the first five days. Thereafter, the parents spend less time brooding.** **2. Parents regurgitate food and care for the young for 10-11 weeks. (They cannot carry food with their talons.)** **3. The young can defend themselves by hissing and regurgitating food.** **4. When the young hatch, they have dark grey heads but are otherwise covered in snowy white down feathers. Little by little, their dark feathers will start to grow in. By the time they are about 1 year old; they will exhibit their distinguishing bright red heads**
DEGREE OF DEPENDENCY	**Altricial- helpless at birth**
FLEDGE AT	**1. 60 to 80 days** **2. For one to three weeks after their first flight, fledglings perch and roost at the nest site and continue to be fed by their parents.** **3. It is difficult for the fledglings to learn to scavenge, so they may stay in the nest for 16 to 20 weeks.**
# OF BROODS PER YEAR	**1**
THREAT	**1. Some farmers and ranchers mistakenly think they harm their animals and have killed them.** **2. Turkey vultures are protected by Migratory Bird Treaty of 1918.** **3. Drugs given to animals that are then eaten by turkey vulture can slowly poison them.**
HUMAN USAGE	**1. None.** **2. They benefit the environment by consuming decaying carcasses.** **3. Ancient Egyptians worshipped them as gods.** **4. Mayans wore vulture jewelry.**

OTHER INFORMATION	**1. While flying, they hold their wings in a v shape.** **2. They are gentle and non-aggressive birds.** **3. When they sneeze, they sound like a cat.** **4. Although extremely graceful in flight, landing can be difficult for Turkey Vultures. Before touching down, they spread their wings and shift their weight backward, to maximize wind resistance against their heavy bodies.** **5. Turkey Vultures are often seen standing in a spread-winged stance. The stance is believed to serve multiple functions: drying the wings, warming the body, baking off bacteria.** **6. As they continue to age, they develop white "warts" on their faces, typically around the eyes.** **8. Male and female turkey vultures are identical in appearance.**
FEET 	**1. Toes are arranged in the classic, anisodactyl (3 toes in front, 1 toe in back) pattern. Their feet are plantigrade (flat,) relatively weak, and poorly adapted to grasping.** **2. The talons are also not designed for grasping, as they are long and relatively blunt, so they are not able to carry off their food.** **3. The turkey vulture is awkward on the ground with an ungainly, hopping walk.** **4. They often place one or two feet on their food when eating.**
BEAK 	**Bone colored, curved, and weak, so it cannot tear the tough hides of larger animals**
VISION AND HEARING ADAPTATIONS	**1. Vultures have excellent daytime eyesight.** **2. They feed on dead animals (carrion) found by both sight and scent.** **3. Like all other birds, the Turkey Vulture has a third, clear eyelid. This is known as the nictitating membrane. It serves to moisten the eye and clear it of debris, without completely compromising vision.**
FEATHERS, WINGS, FLIGHT	**1. Vultures save energy by soaring so they do not have to flap their wings much. When soaring, vultures hold their wings in a shallow "V" shape, above their backs, and often tip them from side-to-side in the wind.** **2. The flight of the turkey vulture is an example of static soaring flight, in which it flaps its wings very infrequently, and takes advantage of rising thermals to stay soaring.** **3. They spend 2 to 3 hours each day nibbling and preening their feathers.** **4. It requires a great deal of effort to take flight, flapping its wings while pushing off the ground and hopping with its feet.**
BODY ADAPTATIONS	**1. The Turkey Vulture has no nasal septum (wall dividing the nostrils). From the side, you can see in one nostril and out the other.** **2. American Vultures can smell, but African vultures cannot. The Turkey Vulture has the best sense of smell of the American vultures.** **3. To cool themselves down when too hot, they urinate on their unfathered, blood vessel-filled legs, allowing for evaporative cooling but staining their legs white.** **4. They save energy by lowering their body temperature (torpor) at night.** **5. They bask while perched (with wings outstretched) to warm up in the morning.**
WEATHER ADAPTATIONS	**1. They migrate to warmer climates for the winter.** **2. In cold weather, turkey vultures tighten the muscles in their neck and forehead, drawing their feathery coat up around their head. They then fluff their feathers to hold in an insulating layer of warm air.**
DEFENSE ADAPTATIONS	**1. If they are cornered, they will regurgitate their food. It is not known whether they do this to disgust the predator or to make them lighter, so they can fly away faster.** **2. They will make hissing sounds to protect themselves from other animals.** **3. If cornered, they may roll over and play dead.**
HUNTING ADAPTATIONS	**1. American vultures find food both with their eyesight and sense of smell. Turkey vultures are attracted to the smell of mercaptan, a gas produced by the beginnings of decay. The olfactory lobe of its brain, responsible for processing smells, is particularly large compared to that of other animals.** **2. If a carcass is small, an individual vulture will rapidly descend to feed on it.** **3. If a carcass is large, many birds will flock to the area.** **4. While eating, most vultures fight with each other, hiss, shove, peck and scratch.**
SPECIAL ADAPTATIONS	**1. They get a lot of their moisture from the dead animals they eat.** **2. Their powerful kidneys cause them to not excrete a lot of water.**

	3. They will urinate on their legs to cool themselves and the uric acid is so strong that it kills off any bacteria that might be there. **4. Their bald heads allow them to eat dead animals without getting diseases, because after they eat, they sit in the sun to kill off any bacteria that might have gotten on their heads.** **5. Their strong digestive systems kill bacteria that was living on the dead animals that they eat.**

WESTERN KINGBIRD (Tyrannus verticalis)
See Bird Plate 4

FAMILY	**Tyrannidae (flycatchers)**
OTHER NAMES	**Once was called the Arkansas kingbird**
CALLED	**Group: coronation, court, tyranny**
LIFE SPAN	**Up to 6 years**
SIZE	**7.9–9.4 inches long**
WEIGHT	**1.3 to 1.6 ounces**
WING SPAN	**15 to 16 inches**
TIME OF ACTIVITY	**Diurnal**
HABITAT	**Open habitats of valleys, lowlands, grasslands, deserts, sagebrush areas, riparian, woodlands, farm fields, urban areas that have open areas for hunting and trees and shrubs for nesting**
RANGE	**Western kingbirds are found as far north as southern Canada and as far south as the border of the United States and Mexico. These birds are found as far east as the Mississippi River, although they are sometimes found in parts of Wisconsin and Illinois. Their western range stops shy of the Pacific coast. Populations of these birds are also known to winter in southern Florida**
SOCIAL BEHAVIOR	**Mostly solitary except during breeding season.**
COMMUNICA-TION	**1. Western kingbirds have a high, squeaky song (like a squeaky toy,) which sounds like "pidik pik pidik peekado". Their call is best described as a rapid and rising shrill, described as “widik pik widi pik pik”. They also have a sharp, hard “kit” call.** **2. When they sense a threat they flutter their crown feathers, flutter, or flick their wings, and crouch.**
TYPE OF DIET	**Insectivore, but some plants: bees, wasps, flies, spiders, caterpillars, butterflies, moths, bugs, grasshoppers, crickets, beetles, millipedes, some berries, and fruit**
PREDATORS	**Nest predators: owls, hawks, falcons, ravens, crows, magpies, shrikes, squirrels, woodrats, snakes**
SEXUAL MATURITY	**1 year**
MATING SEASON	**May to mid-July**
MATING HABITS	**1. Monogamous** **2. Males usually arrive at breeding areas before females and patrol the loosely defined borders of their territories.** **3. The male flies up (as high as 60 feet) and down in vertical zigzags, stalls, flutters nearly in place, vibrates his feathers, sings rapid sputtering songs, does flips and twists as he falls toward the ground.** **4. Both males and females visit potential nesting locations, but it is unclear which one chooses the site.**
NEST	**1. The nest is usually in a tree with a vertical fork or on horizontal limb, 15-30' above ground.** **2. Sometimes on building ledges or towers, in empty sheds, windmills, on cliff ledges** **3. The female builds a 6 inches wide and 4 inches deep cup nest of grass, weeds, fine twigs, plant fibers, and lines it with feathers, plant down, animal hair, cloth, and bits of paper.** **5. They may nest in the same tree as other birds such as mourning doves, grackles, Bullock’s orioles, house sparrows, American robins, house wrens, and northern flickers.**
EGGS	**3 to 5 white, creamy, or pinkish with heavy blotches of brown, black, or lavender eggs**
INCUBATION	**Female incubates the eggs for 18 to 19 days.**
THE YOUNG	**1. Both parents stay together to feed their young for up to three weeks after the young have fledged.** **2. Parents teach the young to hunt by bringing wounded insects to the nest and letting the**

	young chase them.
DEGREE OF DEPENDECY	Altricial- helpless at birth
FLEDGE AT	16 to 19 days
# OF BROODS PER YEAR	1 or 2 times if the first nest fails
THREATS	None- they are increasing in population because they like areas that have been cleared by humans.
HUMAN USAGE	Farmers benefit from them because they eat insects.
VISION AND HEARING ADAPTATIONS	Rapid vision (twice as fast as humans) for spotting insects quickly
FEET 	1. Perching feet-3 toes facing forward and 1 toe facing backward 2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and cause the toes to lock on the perch. 3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.
BEAKS 	1. Short, wide beak used to catch insects in flight. 2. "Whiskers" (modified feathers) around the corners of the bill helps to widen the mouth opening to help catch and hold flying insects.
WEATHER ADAPTATIONS	Most of them spend the winter in open woodlands, grasslands, and fields of southern Mexico and Central America.
DEFENSE ADAPTATIONS	1. The males warn off intruders with harsh buzzes or whirring wings. 2. Both males and females defend their nest by snapping their bills and raising their red crowns (normally hidden under gray feathers on their heads) when provoked. 3. The pair defends its nesting area vigorously against other Western Kingbirds and other kingbird species. They even chase away larger predators, such as red-tailed hawks and American kestrels, using a harsh buzzing call, snapping their bills, and raising their hidden red crown feathers.
HUNTING ADAPTATIONS	1. They wait on an open perch and fly out to catch insects in flight, sometimes hovering and then dropping to catch food on the ground. 2. A kingbird on the hunt may capture two or more insects before returning to its perch, where it shakes them or beats them against the perch to subdue them. 3. Western Kingbirds also swoop down from perches on fences, trees, utility lines, or wires, to eat terrestrial prey, and glean insects from vegetation while hovering.

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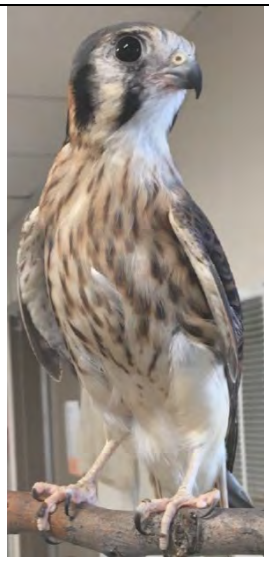
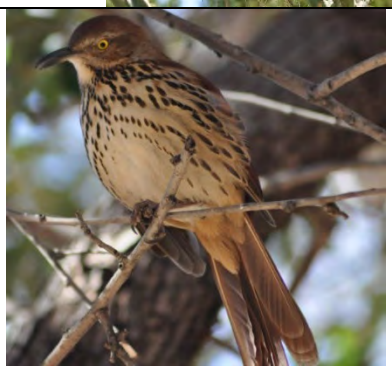
WHITE-WINGED DOVE (Zenaida asiatica)

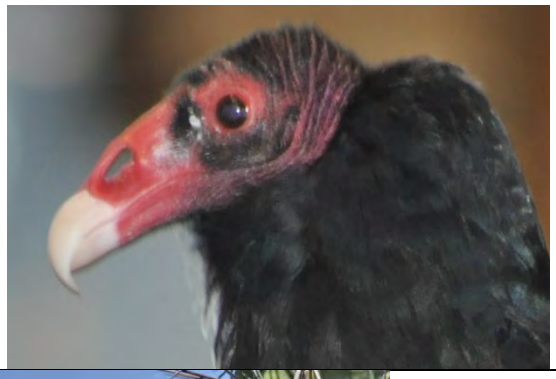
See Bird Plate 4

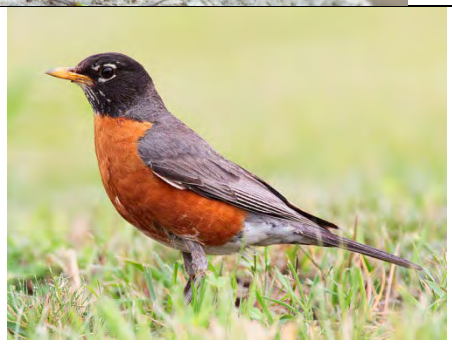
FAMILY	Columbidae (pigeons, doves)
CALLED	Female: hen male: cock baby: squab, check group: dole, dule, flight, piteousness
LIFE SPAN	10 to 15 years
SIZE	11 to 12 inches
WEIGHT	5.4 ounces
WING SPAN	16 inches
TIME OF ACTIVITY	Crepuscular
HABITAT	The white-winged dove inhabits scrub, woodlands, desert, urban, and cultivated areas.
RANGE	1. The range extends from the south-western United States through Mexico, Central America, and the Caribbean. 2. They are expanding their range.
SOCIAL BEHAVIOR	Solitary, but feeds in large groups
COMMUNICA-TION	1. "Coo-cuk-ca-roo" 2, A drawn-out "hoo-a" sound is used to tell others about the presence of a predator.
TYPE OF DIET	Seeds of sunflower, milo, corn, safflower, grains, fruit from trees and cactus
PREDATORS	Grackles, cactus wrens, Gila woodpeckers, great, horned owls, crows, hawks, foxes, coyotes, rats, house cats, domestic dogs, ringtails, raccoons, king snakes, rat snakes
SEXUAL MATURITY	85 days

MATING SEASON	**April through August**
MATING HABITS	**1. Monogamous** **2. Courting and nesting males will occasionally strike bills and slap wings with each other, but they mostly defend their cooing perches and nests by calling or flailing their wings and tail.** **3. Males perform courtship flights, spiraling up into the sky and then returning to the branch he started from in a stiff-wing glide.** **4. While calling, the male may bow, circle around the female, puff up his neck, raise his wings, and fan his tail to entice her to mate.**
NESTS	**1. Males bring the sticks, grasses, stems of weeds.** **2. Female builds the relative flimsy bowl nest in a cactus, shrub, ledge or low in a tree.** **3. When a predator comes to call at the nest, they may feign a broken wing to lead the intruder away.**
EGGS	**1 to 2 buff or white eggs**
INCUBATION	**13 to 14 days by both parents**
THE YOUNG	**1. Both parents feed regurgitated liquid called crop-milk to the young for the first few days.** **2. They leave the nest after 13 to 18 days.**
DEGREE OF DEPENDENCY	**Altricial – helpless at birth**
FLEDGE AT	**13 to 14 days**
# OF BROODS PER YEAR	**The female may start a new clutch as early as 3 days following fledging or upon loss of the first clutch.**
THREATS	**None- they are increasing in population**
HUMAN USAGE	**1. Gamebird** **2. They can be an agricultural pest, descending on grain crops in large flocks.**
OTHER INFORMATION	**1. They will fly 20 miles to get drinking water.** **2. The female is smaller than the male.** **3. Their bright-orange eyes and blue "eye shadow," black mark below the ear coverts, and white wings distinguish them from mourning doves.** **4. They can suck and swallow water without moving their heads.**
FEET 	**1.Perching feet have three toes facing forward and one long toe facing backward that wraps around a branch.** **2. This arrangement allows the bird to keep its grip. When it lands, the tendons tighten and cause the toes to lock on the perch.** **3. When the bird begins to stand up, the legs cause the tendons to relax and the toes unlock.**
BEAK 	**Relatively small, short, and narrow with a slightly bent down tip used for eating seeds and fruit.**
FEATHERS, WINGS, FLIGHT	**They often produce a staccato whir with their wings, and sometimes their wingtip makes a whistling sound.**
WEATHER ADAPTATIONS	**May migrate in some locations.**
DEFENSE ADAPTATIONS	**1. Males will slap their wings to ward off intruders.** **2. Sometimes, they escape by flying directly into the bushes.**
HUNTING ADAPTATIONS	**They feed in groups.**

		Bird Plate 1
Eagles: **1. American Bald Eagle** **2. Golden Eagle**		
Hawk **1. Harris's Hawk** **Falcon** **2. Kestrel Falcon**		
Hawks: **1. Red-Tailed Hawk** **2. Red-Tailed Hawk Ear** **3. Swainson's Hawk**	 	

		Bird Plate 2
Owls: **1. Great Horned Owl** **2. Burrowing Owl**		
Wren: **1. Cactus Wren** **2. Cactus Wren nest in cholla**		
Thrasher: **1. Curve-billed Thrasher** **2. Brown Thrasher**		
Hummingbirds: **1. Male Black Chinned Hummingbird** **from Wikipedia** **2. Female Black Chinned Hummingbird** **from Wikipedia**		

		Bird Plate 3
Roadrunner 1. **Roadrunner** **2. Colorful skin by Roadrunner's eye**		
Turkey Vulture **1. Turkey Vulture** **2. Turkey Vulture** **3. Large nostril used to smell dead animals**	 	
Woodpecker **1. Ladder- Backed Woodpecker** **by Alan Wilson** **Game Bird** **1. Scaled Quail**		

		Bird Plate 4
Song Birds: **1. Pyrrhuloxia** **2. Mockingbird**		
Songbirds: **1. Mourning dove in nest** **2. Common Raven**		
Songbirds: **1. White-winged dove** **2. White-winged dove in nest**		
Songbirds **1. American Robin** From Wikipedia **1. Western Kingbird** from Wikipedia		

		Bird Plate 5
Songbirds **1. Blue Jay** **2. Steller's Jay** By San Francisco Citizen		
Songbirds **1. Male Cassin's Finch** by Greg Lasley **2. Female Cassin's Finch** by naturepicson.com		
Song Bird **1. Male House Finch** by Greg Lavaty **2. Female House Finch** from Wikipedia		
Song Bird **1. Male House Wren** by Evan Lipton **2. Female House Wren** By Douglas Faulder		

North American Birds of Prey

Bird Plate 6

SECTION 13

MAMMALS

Mammals: Class Mammalia

The term "mammal" is derived from “mamma,” the Latin word for breast. One of the defining features of all mammals is that they nurse the young with milk secreted from the mammary glands of the female. Another defining feature of mammals is that the skin is covered with hair or fur. In some mammals (whales and elephants), hair is present on the body in the early stages of life, but most of it is lost in adulthood. Hair is a very effective insulator.

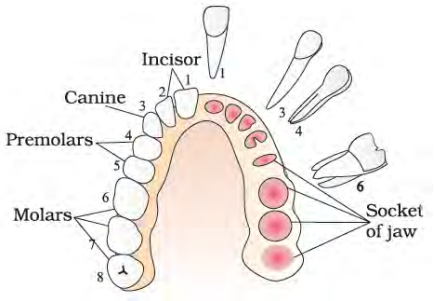
Mammalian hair grows from follicles in the outer layer of the skin. Associated with each hair there is a sebaceous gland which produces oil for lubrication and waterproofing. This oil gives the animal's coat its luster. Each hair is also attached to a tiny muscle which raises and lowers the hair. This means that the thickness of the insulating layer of hair can be controlled. In cold weather, the hairs are raised to increase the thickness of the insulation. In warm weather, the hair is held closer to the skin, decreasing the size of the insulating layer, and allowing heat from the body to escape more easily.

In addition to oil glands, mammals have sweat glands in their skin. The number of sweat glands in the skin varies with different species; in mammals with large numbers of sweat glands, the evaporation of sweat cools the body and prevents overheating (other methods of cooling include panting and wallowing). Mammary glands are modified sweat glands. They no longer function in temperature control, but have become specialized for producing milk.

A third distinguishing feature of mammals is their teeth. Mammalian teeth are usually replaced only once during the individual's lifetime and they are quite diverse in shape and number. Other vertebrate groups do not have teeth (birds) or possess a monotonous mouthful of uniformly shaped teeth that are continuously replaced throughout the life of the individual (reptiles).

Mammals are grouped into different orders based upon the shape and number of their teeth, as well as other features. One reason for the success of mammals as a group is their ability to exploit a wide variety of food resources, an ability that uses the teeth. We humans possess representatives of all four of these mammalian teeth.

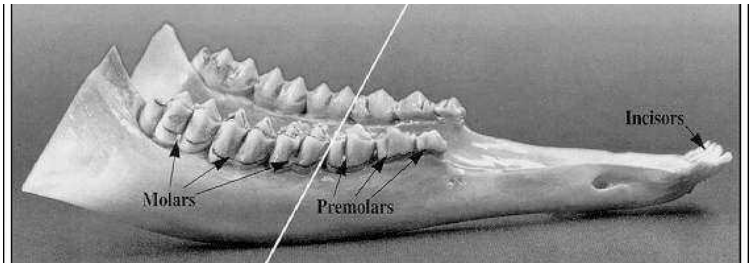
- **Incisors: Front designed for cutting.**
- **Canines: Stabbing teeth, usually behind the incisors.**
- **Premolars: Cheek teeth, in front of molars, of variable shape.**
- **Molars: Cheek teeth, usually flattened for grinding.**



The specialized teeth reflect the diet of the animals.

Herbivores

- **Herbivores (plant eaters) have flat teeth that they use to grind tough plant materials.**
- **Herbivores basically have two types of teeth.**
- **The front flat teeth, or incisors, are used for cutting the plant food.**
- **Between the incisors and molars is an open space along the jaw that does not have any teeth.**
- **The broad, flattened back teeth-premolars and molars are used for chewing and grinding the food.**
- **Example of desert herbivore prey: deer, elk, bison, rabbits, mice, kangaroo rats, bighorn sheep, pronghorn**



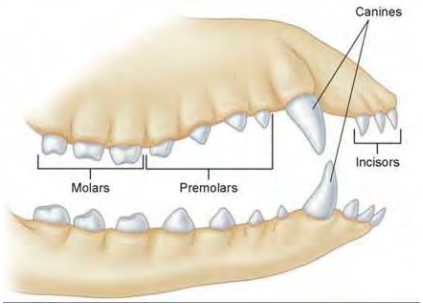
Carnivores

- **Carnivores (mostly eat meat), so they have sharp, pointed teeth for grabbing and cutting their food.**
- **Incisors: Chisel-like teeth that are used for cutting, gnawing, and grooming.**
- **Canines: Pointed teeth used for grabbing, piercing, gripping, and tearing.**
- **Premolars and molars: Teeth that have blunt points and hollows that interlock as they crush and grind the meat. They do not usually chew the meat completely, but rather swallow it whole or in chunks.**
- **Examples of predators: wolves, mountain lions, bobcats**

Omnivores

- **Many animals, including humans, are omnivores (eats both plants and meat)**
- **They have some teeth (incisors and canines) that are used to cut, bite, and tear meat.**
- **Other teeth (premolars and molars) are used to chew and grind fruits, vegetables, and grains.**
- **Some desert omnivores are: raccoons, skunks, javelinas, badgers, black bears, foxes**

Javelina



Endothermy

Mammals and birds are warm-blooded, or endothermic (endo=from within; therm = heat). This means that they can maintain a constant body temperature, usually higher than the temperature of their surroundings. For this reason, mammals and birds are classified as "higher vertebrates" in contrast to the cold-blooded "lower vertebrates"- reptiles, amphibians, and fish.

Along with birds, mammals have the more efficient and sensitive physiology associated with endothermy. They are active and energetic animals with efficient respiratory and circulatory systems. In mammals, a diaphragm between the abdomen and the chest cavity allows for greater air intake into the lungs, and the heart is divided into four chambers, resulting in separation of the arterial and venous blood. These two anatomical adaptations increase the oxygen content of the blood reaching the body tissues, allowing for a more efficient utilization of the body's fuel (food).

FUEL + OXYGEN = ENERGY + HEAT

Of course, there are limits to this ability to maintain a constant body temperature. At extreme temperatures the body's cooling or heating mechanisms may fail, but under most of life's circumstances endothermic animals are able to maintain a constant, optimum body temperature.

Many of the body's physiological processes are most efficient at particular temperatures. Thus, one of the advantages of endothermy is that the animal is capable of sustained high levels of activity. Endothermy is a prerequisite for such activities as powered flight, marathon running, horse racing, and basketball playing. The following is a comparison of an ectothermic group (reptiles) and an endothermic group (mammals) which shows a few of the survival advantages of endothermy.

Reptiles	Mammals
Reptiles must complete their necessary nocturnal activities before they lose the body heat accumulated during the day or at dusk	Mammals can operate throughout the night hours in habitats where nighttime is quite cold.
Reptiles must seek cover from prolonged or intense heat or they will overheat.	Mammals can be active during the heat of the day or in direct sunlight.
Reptiles must hibernate during the winter season in temperate climates.	Mammals can be active all year round in temperate climates.
Reptiles must rest for an extended period after even a short burst of high-level activity.	Mammals can maintain a high level of activity for long periods with little or no recovery time necessary.

The costs of maintaining a constant high body temperature are great. Mammals need between ten and one hundred times the calorie input that reptiles do, depending upon their size. Just as we burn fuel to heat our homes, mammals burn fuel (food) to get the heat necessary to maintain their body temperature. Some heat is always lost at the surface of the body, so this fuel burning process is continuous. The heat loss to the environment is greatest in the smallest animals. The tiny shrew loses such a large percentage of its fuel (food) intake as escaping body heat that it must eat during nearly all its waking hours.

Reproduction of Mammals

In terms of reproduction, mammals went in for quality rather than quantity, with small litters of young which receive much more parental care than in other vertebrate groups. Once born, the young are nourished by the mother's milk and cared for until they are old enough to fend for themselves. Because the mother is the food supply, some degree of parental care exists continually.

In placental mammals, the young develop within the body of the mother for a longer time than in marsupials. The survival advantages of the placental mode of reproduction are illustrated in the following comparison of placental mammals and birds.

Birds	Mammals
Egg is laid in some sort of nest and is vulnerable to predators.	Egg develops inside the mother and is automatically protected.
One or both parents must incubate the egg.	Parents can be mobile while the egg is developing within the female.
Food supply for newly hatched offspring must be sought away from the nest and returned to the nest.	Food is supplied from the mother’s milk.

These survival advantages are enhanced the longer the offspring stays inside the mother's womb, and are part of the reason for the success of placental mammals.

Variations within Placental Mammals

Mammals exhibit a wide range of reproductive patterns. At one end of this range certain species (mice) typically build nests, have large litters, and their offspring are nearly helpless at birth. Pregnancy and lactation are of brief duration, sexual maturity is at an early age, and the life span is short. These species have relatively small brains and relatively simple systems.

At the other end of this range are species (monkeys) which have fewer offspring and carry their young with them, or the young can cling to or follow the mother soon after birth. Pregnancy and lactation are longer, sexual maturity is reached only after an extended period of development, and the life span is longer. These species exemplify the mammalian trend to a stronger degree, where fewer offspring are produced but the few which are born are well cared for and are more likely to live a long time.

Some species, particularly those that live in the environmentally stable tropical regions, are polyestrous. The female may mate and produce a litter more than once a year. Mammals living in regions of the world where dry or cold seasons affect the food supply are generally monstrous, with the female mating only once a year.

Changes in day length and climate activate various glands in the body which stimulate sexual activity. Such a system ensures that offspring will be born during a season when sufficient food is available.

In many regions of the world animals are exposed to definite seasonal variations in climate and food supply.

- **Some mammals (caribou), undertake seasonal migrations.**
- **Some mammals (bears) go into a state of deep sleep called hibernation. During true hibernation body temperature drops several degrees and body processes slow down considerably.**

Times of Activity

- **Even when they are normally active, mammals require periods of rest or sleep. The typical pattern for rest in mammals is one or two extended periods of inactivity during a 24-hour cycle. The resting place may be very simple or quite elaborate.**
- **Animals active during the day are termed diurnal.**
- **Those active at night and sleep during the day are termed nocturnal.**
- **Most mammals are crepuscular; they are active at dawn and dusk, and have two extended periods of rest (night and day.)**

Locomotion

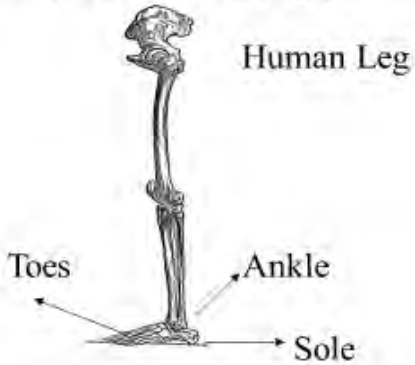
Mammals have three types of feet:

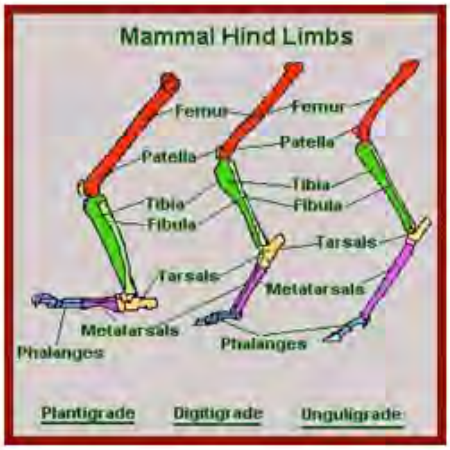
1. **Plantigrade**
2. **Unguligrade**
3. **Digitigrade**

PLANTIGRADE

Plantigrades are animals that make contact with the entire flat surface of their feet touching (or planted on) the ground at some point during the step. They are slow in speed compared to other runners.

Examples: humans, bears, raccoons, rabbits, badgers, porcupines, and skunks. Try this: "Walk" your hands across your desk using the entire flat part of your hands including your fingers.





DIGITIGRADE

Digitigrades are animals that walk so that only their toes (digits), not the soles, touch the ground. The digitigrade's ankles (tarsals) are much higher in the limb than in a human's. Their heels are permanently raised. They are generally faster than plantigrades and quieter than other types of animals.
Examples: wolves, foxes, coyotes, mountain lions, and bobcats.
Try this: Walk your hand across your desk using your finger tips with the palms of your hands held up.

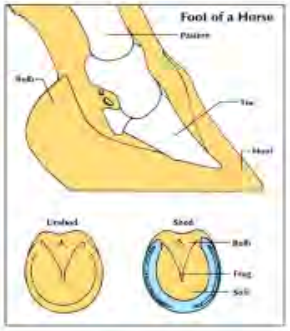
Another adaptation associated with a long, slender leg is the fusion of the normally separate limb bones in order to increase their weight-bearing strength. Without this bone fusion, ungulates could not have achieved much in the way of size.

UNGULIGRADE

Unguligrades (ungulates) are animals that walk on the tips of their "toenails." These large hardened "toenails" are hooves. Ungulates have a long stride, so they can move swiftly to get away from their predators. Their hooves are made out of the same substance (keratin) that makes up our nails.

Examples: horses, deer, pronghorn, elk, bison, and javelina.

Try this: "Walk" your hands across your desk with your fingers bent under so you are "walking" on your fingernails.



Ungulate Digestion

Most ungulates can use plant foods such as leaves and grass which have relatively little food value for other mammals. Those without a chambered stomach are aided by a large caecum in which fermenting bacteria help to digest plant material. Those with a chambered stomach (the ruminants) have an even more efficient digestive system. They can quickly consume a quantity of vegetation, which is stored temporarily in the first chamber of the stomach, called the rumen. While in the rumen, the food is mixed with bacteria, which help to digest it. Later, in a place of relative safety, the animal regurgitates this food from the rumen and gives it a thorough chewing.

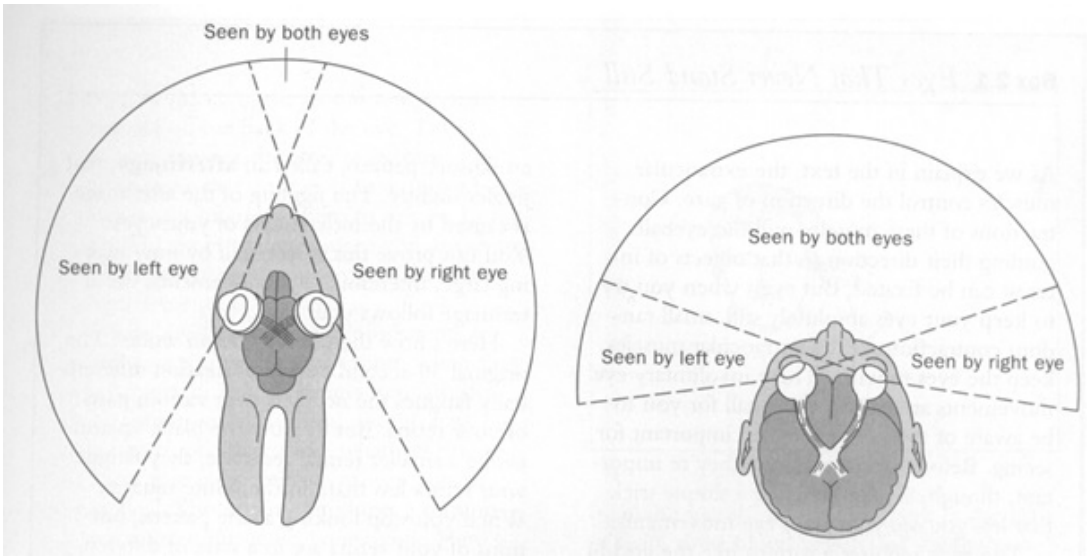
After this second chewing, the food returns to the stomach, this time passing into the second chamber and continuing on down the digestive tract. This second chewing is referred to as "cud chewing."

Chewing is accomplished by an exceptionally large set of teeth with ridged surfaces which aid in grinding the vegetable food. The incisor teeth are used for cropping the vegetation. In the even-toed ungulates, the upper incisors are sometimes absent, and the flat palate forms a sort of cutting board which the lower incisors can cut against.

Field of Vision

Mammals have either monocular or binocular field of vision depending on their food acquisition.

Prey (Monocular) Vision **Predator (Binocular) Vision**



Predator's Binocular Vision

Predators' eyes face forward so, they can see the animals they are chasing. This allows them to focus their vision on just the prey. They have great depth perception, so they can see how close or far away the prey is. Predators have their best vision in their binocular area because they are seeing the prey with both eyes. They do not see the prey as well in their monocular areas because they can only see with the eye on that side. Eyes in the front like to hunt. (predators)

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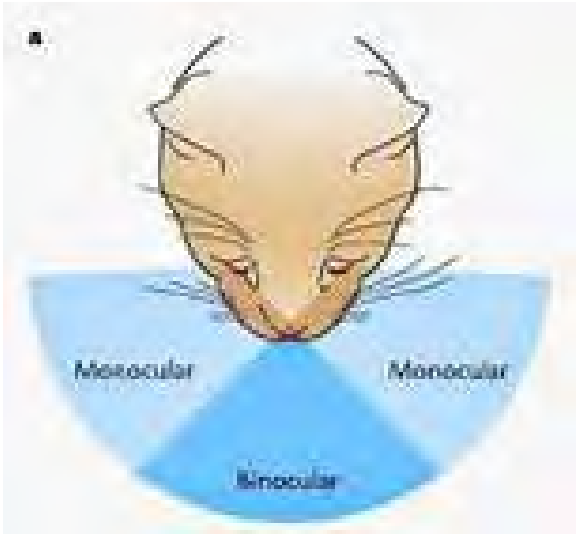
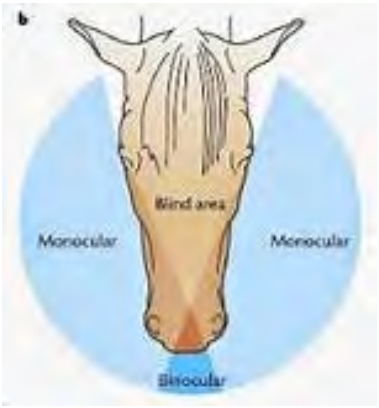


Prey's Monocular Vision

Prey have monocular vision, meaning they use each eye separately. This allows them to see two different objects on opposite sides of their bodies at the same time. This gives them a greater overall field of view of what might be approaching them from their sides and even from their rear without having to turn their heads.



Horns or Antlers

Horns or antlers are commonly found in ungulates, particularly among some members of the even-toed group. Both structures are used for display and as weapons in ritualized contests between males, but there is an important difference between them.

- **Antlers are shed each year in the winter and new ones begin to grow in the spring. Only members of the deer family have antlers, and usually only the males. Antlers are composed of pure bone. While growing, they are covered with a velvety skin filled with blood vessels and nerves. This velvet dries up and is rubbed off before the beginning of the mating season in late summer-early autumn. Currently the antlers are dead bone. If they are broken off it will not cause loss of blood or pain to the animals. Animals with antlers: deer, elk**

- **Horns are permanent and continue to grow throughout the animal's life. They have a two-part structure. The interior portion of bone is an extension of the skull. The bone is covered by an exterior sheath that is formed of specialized hair follicles (similar to human fingernails). They come in a variety of shapes and sizes, but they never branch as antlers do. Horns are usually found on males and (in diminutive form) females.**
  Animals with horns are: antelopes, bison, cattle, sheep, and goats.

  The American pronghorn has a unique type of horn. There is a permanent bony core but the horn covering (sheath) is shed each year and regrown.

Degree of Independence At Birth

Some animals are very dependent on their parents at birth, while others are capable of immediately or quickly care for themselves.

Altricial- young are underdeveloped (helpless) at the time of birth and depend on the adult(s) to feed and care for them for a specific amount of time. Altricial newborns are relatively immobile, lack hair or down, (birds) not able to obtain their food, and must be cared for by adults.

Precocial- the young are relatively mature and mobile from the time of birth or hatching (birds). They are able to move freely from birth or hatching and require little parental care.

AMERICAN HOG-NOSED SKUNK (Conepatus leucontus)

See Mammal Plate 4

FAMILY	**Mephitidae (skunks)**
OTHER NAMES	**Western hog-nosed, common hog-nose- recent studies have proven that these skunks are all-American hog-nosed skunks. Also called rooter skunks because of their rooting and overturning rocks and debris looking for food. Also called badger skunk because of similar digging characteristics.**
CALLED	**Female: sow male: boar baby: kits group- surfeit**
LIFE SPAN	**2 to 5 years Up to 90% of young skunks die in their first winter.**
SIZE	**16-18 inches long**
WEIGHT	**3 to 10 pounds**
RUNNNING SPEED	**up to 10 mph**
TIME OF ACTIVITY	**Nocturnal, but in the winter, it can be seen during the day looking for food.**
HABITAT	**Desert scrub, mesquite grasslands, canyons, rocky terrain, open woodlands, mountain forests, and riparian (rivers or steam banks) areas They are rarely ever found more than two miles from a water source.**
SHELTER	**They burrow beneath rocks, roots of trees, river banks or even in an old burrow that has been deserted by another animal.**
SOCIAL BEHAVIOR	**Solitary, but may share a den with other skunks (up to 15) during the winter**
COMMUNICATION	**Vocal: hiss, screech, churr, growl, squeals, twitter, cooing Body: when it feels threatened- it will flee if possible. It may also: fluff fur, shake tail, stamp ground with front feet, stand on its hind legs, perform a backward shuffle, spit, and/or spray.**
TYPE OF DIET	**Omnivorous: beetles, larva, earthworms, black widows, scorpions, bees, grasshoppers, grubs- most of their diet, small rodents, some plants**
PREDATORS	**Great horned owls, golden and bald eagles, coyotes, bobcats, gray foxes, mountain lions, American badger**
SEXUAL MATURITY	**10 to 12 months**
MATING HABITS	**1. The males are very active during mating season and will travel in search of a mate. Large numbers of males are killed by cars each year during mating season. 2. Males fighting over females are extremely aggressive but do not use their spray as a weapon during mating season. 3. After mating, females no longer associate with males and will become aggressive toward them.**
MATING SEASON	**February through March**
GESTATION	**62 to 65 days- implantation can be delayed until 18 to 20 days after mating**
OFFSPRING BORN	**Late April to early June**
# OF OFFSPRING	**1 to 5 (usually 2 to 4) every year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. The kits are born naked with black and white skin (matching the future fur coat). 2. Eyes open at about 24 days. 3. The musky odor is present at 8 to 10 days. 4. They are weaned at 2 months. 5. They are usually active (including nursing) during the day while the mother is sleeping.**
TIME WITH MOTHER	**1. The young will stay in the den until late June or July and then will follow their mother in single file. 2. The mother is protective of her kits, and will spray at any sign of danger. 3. Kits will generally stay with their mother until they are ready to mate, at about 1 year of age.**
DEGREE OF INDEPENDENCE	**Precocial- need to be cared for**
THREATS	**Vehicles, rabies**
TYPE OF FEET	**Plantigrade Their short legs and flat feet make them look like they waddle.**
TRACKS	**Between 1 to 2 inches long, with hind prints slightly longer and thinner than front. Claws show some of the time.**

OTHER INFORMATION	**1. Skunks are very adaptable and often find food and nesting sites around human habitations.** **2. There have been cases of skunks entering homes through pet doors, dining with the family cat and finding a quiet closet or empty bed to spend the night. As long as the skunk does not feel threatened, it will not spray.** **3. They are built low to the ground (like badgers) to aid in searching for their food. They have strong shoulders and forearms and long, sharp downward curving claws for digging. Their acute sense of smell and their long hog like snout with its wide nose helps them locate underground food. They have small eyes and ears to help minimize the amount of dirt that can get in them.** **4. American hog-nosed skunks are easy to identify because they have a broad white stripe from the base of their head to its all-white tail.**
HUMAN USAGE	**In the 1900's they were bred for their fur.**
DEFENSE ADAPTATIONS	**1. They have developed anal glands that emit musk if threatened. These glands have a nipple that allows the skunk to accurately spray the attacker at a range of up to 15 feet.** **2. Their spray causes temporary blindness and intense pain if it enters the eyes.** **3. Skunks rarely attack unless cornered or defending their young. If approached by an intruder and unable to flee, a skunk will usually fluff its fur, shake its tail, stamp the ground with its front feet, growl, stand on its hind legs, turn its head and spit to scare the potential attacker. It may also perform a temporary handstand. If those techniques do not work, it will lift up its tail and spray.** **4. Their black and white coloring is a warning to predators to keep away.**
WEATHER ADAPTATIONS	**1. In the winter the body will get a thick layer of fat to protect it from the cold.** **2. They do not actually hibernate, but they will hole up in their burrows for a few weeks to two months (torpid state).** **3. On warmer winter days the skunks may emerge from their dens to search for food.**

AMERICAN BADGER (Taxidea taxus)
See Mammal Plate 4

FAMILY	**Mustelidae (weasels, badgers, otters, ferrets)**
OTHER NAMES	**None**
CALLED	**Female: sow male: boar baby: cub or kit group: cete or colony**
LIFE SPAN	**3 to 10 years and up to 14 years in captivity**
SIZE	**20 to 30 inches long**
WEIGHT	**Female: 15 pounds Males: 20 to 25 pounds** **They may weigh more in the fall as they prepare for winter.**
RUNNNING SPEED	**18 mph for short periods of time**
TIME OF ACTIVITY	**Nocturnal- sometimes seen during the day**
HABITAT	**Treeless areas from low deserts to alpine meadows, and grasslands that have sandy soil where they can dig easily**
SHELTER	**1. American badgers use a burrow for sleep, protection from weather, hiding, excess food storage, and natal denning.** **2. Because badgers can delete an area of rodents quickly, they must move often (from 5 to 8 miles a night) to find food sources. Especially in the summer, they may dig a new burrow every day or two.** **3. The only times a badger will use a burrow for a longer period is in the winter and when the young are small.** **4. They usually enlarge a prairie dog, gopher, or other animals' burrows by making the openings 8 to 12 inches in an elliptical shape to accommodate their bodies' shape.** **5. The burrow's entrance will have a large mound of dirt containing bones, fur, rattlesnake rattles, and scat. Many other mounds with the same elliptical openings are nearby where the badger has dug out its burrowing prey.** **6. The deserted burrows are often used by coyotes, snakes, skunks, tortoises, and burrowing owls. Badgers may return and reuse their burrows.** **7. The female will dig 2 to 4 burrows with connecting tunnels to provide safety for her cubs. This den can be used for most of the winter, unless the mother needs to move her litter so she can find a new food source. Natal dens are usually larger and more complex.**

	8. Their dens range from about 4 feet to 10 feet in depth and 20 to 30 feet in length. **9. They use grass and leaves as bedding. These materials are taken outside the den to air out before being returned.**
SOCIAL BEHAVIOR	**1. They are shy and solitary except during breeding season.** **2. They live in family groups in the spring and summer when the babies are small.** **3. They have a hierarchy. Most clans have a dominant boar (male) who tries to control all the females (sows) for breeding.** **4. When the young boars get older, they will try to become the dominant male. Usually, the younger males are ejected from the clan. They will try to force their way into another clan or try to form a new clan. If they cannot, they will live alone.**
COMMUNICATION	**They make loud snarls, growling, hissing, squealing sounds when threatened.**
TYPE OF DIET	**Carnivore: rodents-gophers, rats, mice, squirrels, kangaroo rats, and prairie dogs make up most of their diet that they usually dig up, rabbits, carrion- very important in the winter, small birds, invertebrates- earthworms, bees, rattlesnakes (but not the head) and lizards, bird eggs, toads, frogs, skunks**
PREDATORS	**These predators may kill young badgers, but most would not tangle with adults: golden eagles, wolves, mountain lions, coyotes, bears, bobcats**
SEXUAL MATURITY	**Females- 1 year (however about 30% of females as early as 4 to 5 month)** **Males- 16 months**
MATING HABITS	**The male has a large home range, where several females live. Both males and females will travel to look for mates.**
MATING SEASON	**July through August**
GESTATION	**250 days, however, American badgers experience delayed implantation so the fetuses do not begin to grow until February or March making the actual development 50 days**
OFFSPRING BORN	**March through June**
# OF OFFSPRING	**1 to 5 (usually 3) per year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. The cubs are born blind with dirty white fur only on their upper bodies. Their eyes open at 4 to 6 weeks.** **2. They grow quickly, and at 5 to 6 weeks, the kits first emerge from the den on their own.** **3. The young play games such as "tag" and "king of the mountain" which helps them develop coordination and strengthens their muscles.**
TIME WITH MOTHER	**1. The mother takes care of her kits alone.** **2. She feeds her young solid foods prior to complete weaning, and for a few weeks thereafter.** **3. The mother weans the babies at 8 weeks.** **4. She teaches her cubs how to hunt.** **5. The kits leave their mother in 5 to 6 months**
THREATS	**Humans: poison, automobiles, sport shooting, fur trapping, loss of habitat, and habitat fragmentation (which prevents them from moving to new areas)**
TYPE OF FEET	**Badgers walk on their toes (digitigrade) with a characteristic rolling gait.**
TRACKS	**Feet turn inward. Both front and rear prints are about 2 inches long with the back feet are narrower than the front.**
OTHER INFORMATION	**1. Badgers are very clean animals that bury their scat and clean themselves by licking their fur.** **2. Some badgers have demonstrated that they will tolerate a fox or coyote sharing the same den. In 1871, a lost Canadian boy shared a den with a badger, which at first tried to drive him away, and then appeared to adopt him by bringing him food.** **3. A badger's territory is about 3 or 4 square miles, but it may overlap with another badger's territory in areas with plenty of food. They do not defend their territories against other badgers.** **4. Coyotes will often stand by while badgers are burrowing, in order to catch fleeing rodents as they escape from an auxiliary tunnel.** **5. They are the fastest digging animal on earth, and the strongest for their size. An American badger in the mid0west was observed digging through the asphalt surface of a parking lot. It took him less than two minutes to disappear completely in the hole.**
HUMAN USAGE	**1. Badger hair is quite stiff and makes some of the finest paint and shaving brushes.** **2. American badgers are trapped by humans for their pelts.**
WEATHER ADAPTATIONS	**1. In the late fall badgers store up layers of fat to sustain them during periods of cold weather and deep snow.** **2. They line their dens with grasses and leaves to help insulate them from the cold.**

	3. During very cold weather, a badger will partially plug the den with soil to keep out water and help retain heat. 4. Although they do not hibernate in winter, they may remain in their dens for as long as a month at a time in the cold weather. 5. They are in torpor during the winter- sleeping about 29 hours at a time, allowing their temperatures to drop to 9 degrees Celsius, and their heartbeats drop to half the normal rate. This keeps them from using energy. When awake for short periods of time, their heart rate returns to normal. 6. They come out of their dens on warmer days to find food. 7. They will sprawl in shallow water to keep cool on a hot day.
DEFENSE ADAPTATIONS	1. Badgers' thick, loose skin, tough hide, and heavy neck muscles make it hard for predators to grasp and hold on to them. 2. Their good vision helps them see predators from a distance. 3. Their camouflage fur helps them blend into their habitat. 4. Their low-slung bodies, powerful jaws, sharp teeth, and tough claws make the badger almost impossible to knock over and be killed by predators. 5. When threatened, the badger releases a strong musky odor as a warning to predators to stay away. 6. Their hissing, growling, squealing, and snarling warn predators to stay away. 7. When a badger is threatened, it will often back into a burrow and bare its teeth and claws, and may then plug up the burrow's entrance. 8. If it is not near a burrow, it might quickly dig one, showering the predator with dirt.
HUNTING ADAPTATIONS	1. They have excellent senses of hearing and smelling to help them locate underground food and to continue locating the prey while they are digging. 2.Their bodies are broad and flattened and the heads are wedged-shaped so they fit underground better. 3. Their strong flexible snouts help them poke around underground to help them find their prey. 4. They have short, powerful front legs for digging. 5. Their 1 ½ to 1 ¾ inches long curved, strong, sharp front claws can dig quickly and pass the dirt to their hind feet that can kick the dirt backwards for up to 6 to 8 feet. 6. Their jaws are joined together so they cannot be dislocated when they hold tightly to their prey. 7. Badgers have 34 teeth, including four sharply pointed canine teeth for tearing apart meat. 8. They use their claws to hold tightly into their prey 9. Sometimes they will wait inside another animal's burrow until it comes back, so they can catch their prey. 10. Although they are mainly nocturnal, they will hunt in the day if necessary. 11. They often dig up hibernating animals to eat.

AMERICAN BISON (Bison bison)
See Mammal Plate 1

FAMILY	Bovidae (bison)
OTHER NAMES	They are incorrectly called buffalo which is an Asian and African animal.
CALLED	Female: cow male: bull baby: calf group: herd, gang
LIFE SPAN	20 to 25 years
SIZE	Males- 6 ft. high by 10 to 12 ft. long Females 5 ft. high by 7 to 8 ft. long
WEIGHT	Males- 1,000-2,000 lbs.; Females- 800-1,000 lbs.
RUNNNING SPEED	Up to 35 mph
TIME OF ACTIVITY	Crepuscular
HABITAT	Plains, prairies, grasslands, river valleys, open forest, semi-desert, scrublands
SHELTER	None- rest on the ground in a different spot each time
SOCIAL BEHAVIOR	1. The only time the females and males live together is during mating season. Herds can number in the thousands at that time. 2. The female herds (up to 100) will also include males under 3 years and a few older males. 3. Bulls live in small herds or alone. 4. Both female and male groups will have a dominant leader.
COMMUNICATION	<u>Sounds</u> 1. Grunt: especially used by cows and calves to communicate

	2. Growl: warning toward outsiders to stay away **3. Hiss and spit: with an immediate charge is a panic reaction** **4. Spit sound from nose: strong irritation** **5. Bellow: a challenge sound made by bulls as a challenge to other bulls for herd and territory dominancy** **<u>Behavior Language</u>** **1. Eye contact: a direct glaring is a sign of sizing up the "pecking order" and may lead to a challenge** **2. Head waving: another signal for a "pecking order" challenge** **3. Snorting and awing: a signal that a bison has decided that he/she is dominate and is going to prove it.** **4. Bucking like a bronco: shows excitement and is often done in play** **5. Position of the tail: can show if the bison is excited, ready for combat, and a signal for the herd to "group up" and act in formation against an outside threat.**
TYPE OF DIET	**Herbivore:** **Grasses, sagebrush (if there is not enough grass), berries, lichens, and horsetails**
PREDATORS	**Older, ill, or young bison are prey to: mountain lions, wolves, coyotes**
SEXUAL MATURITY	**2 to 3 years for both sexes**
MATING HABITS	**1. During the breeding season, dominant bulls maintain a small harem of females for mating.** **2. Individual bulls "tend" cows until allowed to mate, by following them around and chasing away rival males. The tending bull will shield the female's vision with his body so, she will not see any other challenging males.** **3. A challenging bull may bellow or roar to get a female's attention and the tending bull has to bellow/roar back and perhaps fight.** **4. If the female is not interested in the male, she will walk away.** **5.The most dominant bulls mate in the first 2–3 weeks of the season. More subordinate bulls will mate with any remaining cow that has not mated yet.**
MATING SEASON	**July- September**
GESTATION	**9 months**
OFFSPRING BORN	**May - June**
# OF OFFSPRING	**1 every 1 to 2 years**
DEGREE OF INDEPENCENCE	**Precocial-require little parental care**
THE YOUNG	**1. The mothers leave the herd to give birth.** **2. The calves weigh about 65 pounds at birth and can walk within a few hours.** **3. Two to three days later the mother and calf will return to the herd.** **4. The mothers know their calves by their scent.** **5. The newborns begin eating grass at a week, but they will continue drinking their mothers' milk for about 7 months.** **6. For the first three months, the calves will be a reddish-brown color.** **7. They will begin developing their humps and horns at about two months.**
TIME WITH MOTHER	**They nurse for 6 to 7 months. The bulls will leave the herd at about 3 years.**
THREATS	**There are no threats now because they live in national parks, zoos, or on private lands. It is estimated that before settlers began killing bison, there were 30-60 million bison living in North America. By the late 1900's there were only 1,000 left.**
TYPE OF FEET	**Unguligrade**
TRACKS	**They look a lot like deer's hoof track, but are larger and look like a cloven heart.**
OTHER INFORMATION	**1. Both males and females have horns about 10 inches long.** **2. They are the largest land mammal in North America.** **3. A bison wallow is a shallow depression in the soil, which is used either wet or dry. Bison roll in these depressions, covering themselves with dust or mud. This may be a grooming behavior associated with shedding, male-male interaction (typically rutting behavior), social behavior for group cohesion, play behavior, relief from skin irritation due to biting insects and reduction of ticks and lice.** **4 Their short heavy legs and hooves are designed for endurance in traveling.** **5. On May 9, 2016, the bison become the National Mammal of the United States.**
HUMAN USAGE	**1. Native Americans used bison as a source of food, clothing, and shelter.** **2. They used the sinew (tendons that hold muscles together) for thread and rope. Hooves were used in glues, and bones were fashioned into tools.**

	3. The dung provided fuel. **4. Today bison are raised for food.**
WEATHER ADAPTATIONS	**1. During winter, the thick shaggy hair on their fronts provides insulation.** **2. They will face into the winter wind to let the fur insulate them.** **3. They shed their winter fur in the spring to be cooler during the summer.** **4. They will eat snow if they cannot get water.** **5. In the winter, bison use their heads and hoofs to move the snow off the grass and to break through ice to reach water.** **6. They once migrated long distances to find enough food to eat. (Today, they cannot migrate anymore because they are kept in confined places).** **7. Their large bodies conserve body heat.**
DEFENSE ADAPTATIONS	**1. They have a large nose and excellent sense of smell to detect predators.** **2. They have excellent hearing and are always listening for predators.** **3. The guards give a snort sound to warn the rest of the herd of danger.** **4. They keep their defensive horns sharp by rubbing them against trees and rocks.** **5. Their horns make good weapons against predators.** **6. Their large size keeps a lot of predators from attacking them.** **7. They belong to herds, which discourage predator attacks.** **8. They can run up to 35 mph to flee from danger.** **9. The females will surround their babies when they are in danger.** **10. As a defense against attack, the bison might choose to stampede.**

BLACK BEAR (Ursus americanus)
See Mammal Plate 2

FAMILY	**Ursidae (Bears)**
OTHER NAMES	**Cinnamon bear** **Although they are called black bears, they may be black, brown, cinnamon, and occasionally blonde. Different colors may occur within the same litter.**
CALLED	**Female: sow, she-bear male: boar baby: cub; group: sloth**
LIFE SPAN	**15 to 30 years**
SIZE	**5 to 6 feet long**
WEIGHT	**Males: 125 to 500 lbs. Females: 90 to 300 lbs.**
RUNNNING SPEED	**Up to 30 mph for short distances**
TIME OF ACTIVITY	**1. They are diurnal during the fall and spring. They take several naps during the day.** **2. They are nocturnal during the summer.**
HABITAT	**Mountain forests**
SHELTER	**1. They stay in dens (under fallen logs or a rock crevice, or cave) during the winter.** **2. The mothers keep their cubs in trees at night the rest of the year.**
SOCIAL BEHAVIOR	**Solitary except during mating season**
COMMUNICATION	**1. Huffing, puffing or grunts and groans when walking** **2. Loud roars when fighting and occasionally when mating** **3. Motor-like humming when content**
TYPE OF DIET	**Omnivore** **Over half of their diet is made up of plants, while the other half is made up of insects and small mammals. They also eat: nuts- a favorite food, fruit- cherries, strawberries, raspberries, blueberries, plums, berries- a favorite food, succulents- a favorite food, base of sotol plants, grasses, leaves, young plants, flowers, ants, beetles, bees, yellow jackets, lava, caterpillars are favorite food, small mammals such as rodents, fish, carrion, human garbage if the cans are not tightly closed, pet food left out**
PREDATORS	**none**
SEXUAL MATURITY	**Females- 2 to 3 years Males- 3 to 4 years** **If the female does not have enough body fat when she enters hibernation, she will not give birth.**
MATING HABITS	**1. Courtship may include mock fighting, wrestling, biting, barking, head-bobbing, kissing, and roaring.** **2. Males will fight for breeding rights.** **3. The male and female will only stay together for a short time.**
MATING SEASON	**Late May through July.**
GESTATION	**60 to 90 days**
OFFSPRING BORN	**January through February while the mother is hibernating**

# OF OFFSPRING	**1 to 5 (usually 2) every other year or even 3 to 4 years depending on the availably of food**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**The cubs have fine dark fur and weigh about 7 oz. to 1 pound at birth. They open their eyes in 5 to 7 weeks. Newborn cubs do not hibernate-they just eat, sleep, and grow. By April, when they leave the den, they weigh 4 to 10 pounds.**
TIME WITH MOTHER	**1. Cubs stay with their mother for about 18 months during which time she will play with her young and teach them how to hunt.** **2. The mother will allow her offspring to live in her territory, but she will drive her young away from her when it is mating season.** **3. If her territory gets too crowded with her offspring, she will try to take land away from a neighbor rather than force her offspring away.** **4. When males mature at 2 to 3 years, they leave their mothers' territory to find a mate.**
DEGREE OF INDEPENDENCE	**Precocial- need to be cared for by a parent for an amount of time.**
THREATS	**Humans- hunting for fur and meat, getting hit by cars, poaching, and loss of habitat.**
TYPE OF FEET	**Plantigrade with non-retractable claws**
TRACKS	**1. Each broad footprint has 5 non-retractable very long claws.** **2. The fore prints are 4 inches long** **3. The hind prints are 7 - 9 inches long.**
OTHER INFORMATION	**1. The black bear is the state mammal of New Mexico.** **2. Bears see colors.** **3. If they can eat a lot of berries, they don't need to drink as much water.** **4. They are one of the most intelligent North American mammals. They have long term memory. They can generalize to the simple concept level. The mothers spend a lot of time teaching her cubs where and how to find food. The cubs' ability to form mental maps and remember locations may exceed human ability. Their ability to navigate is superior to humans.** **5. Black bears are the smallest of all bears living in North America.** **6. Bears are "scratchers." They will scratch themselves on trees, posts, rocks and with their claws.** **7. Although they seem to shuffle when they walk, black bears can run up to 30 miles per hour when necessary.** **8. Black bears do not often injure humans, but can become dangerous in several situations such as: if their cubs are with them, if they are startled, if they are approached while feeding, fishing, guarding food, hurt, hungry, or breeding. Its best to never approach a bear in the wild! They occasionally kill livestock, and may also cause serious damage to fields, trees, and beehives.**
HUMAN USAGE	**Food, fur, trophy**
WEATHER ADAPTATIONS	**1. In the fall, bears may eat for 20 hours a day.** **2. They are super hibernators that do not eat or drink for months and do not rouse to urinate or defecate.** **3. They have blocky bodies for storing fat that will be needed during hibernation.** **4. They have a dense layer of fur next to their bodies to insulate them from the cold.** **5. If they live in a warm climate where they can easily get food, they will not hibernate.** **6. They cool off by laying in water, panting, and resting in the shade by laying with their sparsely furred bellies on the ground.**
DEFENSE ADAPTATIONS	**1. They make loud blowing sounds and clacks with their teeth when they are frightened.** **2. They prevent attacks from predators by climbing trees.** **3. The mother's bed the cubs at the base of trees with strong, rough bark because it will be safer for the cubs to climb these trees instead of smooth or flaky barked trees when they need to escape.** **4. They have a great sense of smell to detect danger.** **5. Black bears often stand up on their hind legs so they can see, hear, and smell better.** **6. During hunting season they are nocturnal to avoid being killed.**
FEET ADAPTATIONS	**1. Their soft footpads and soft coats let them move about quietly.** **2. They have long sharp claws for climbing trees.**
HUNTING ADAPTATIONS	**1. They have a great sense of smell to find food.** **2. They can swim at least a 1 1/2 miles in fresh water. They have been known to swim to islands where a camp site is located, so they can raid the place of food.** **3. They travel alone (unless it is a mother with cubs) in order to find enough food to eat.** **4. They have great night vision that they use to find food.**

	5. They are good "fishermen" and will often wade in streams or lakes, catching fish with their sharp claws.

BOBCATS (Felis rufus)
See Mammal Plate 1

FAMILY	**Felidae (ocelot, bobcats, jaguar, mountain lions)**
OTHER NAMES	**Wildcat Their name comes from their stubby, bobbed tails**
CALLED	**Female: queen male: tom baby: kittens, cubs group: clowder, clutter, pounce, kindle (young), embarrassment (young)**
LIFE SPAN	**10 to 14 years; up to 25 years in captivity**
SIZE	**17 to 23 in. high; 28 to 49 in. long**
WEIGHT	**Males- 16 to 28 lbs. Females- 10 to 18 lbs.**
RUNNNING SPEED	**Up to 30 mph**
TIME OF ACTIVITY	**Nocturnal**
HABITAT	**Semi-desert, brushland, farmlands, forests, mountainous areas**
SHELTER	**1. Dens are often a hole in a hillside, fallen log, under a tangle of brush, or a rock crevice. 2. Mothers have a primary den where the kittens are born. 3. She also has a secondary den that she will move them to if the primary den is disturbed.**
SOCIAL BEHAVIOR	**1. They are solitary animals coming together only at mating season. 2. Female ranges are almost exclusive of one another, but the males overlap one another's ranges. 3. Bobcats will not move into another's range unless the resident dies. 4. Females mark their territory with urine, feces, scrapes, and gland secretions.**
COMMUNICATION	**Hiss and snarl when threatened**
TYPE OF DIET	**Carnivore: rabbits- 2/3 of their diet, rats and mice, ground nesting birds like quail, young deer or pronghorn, reptiles, ground squirrels, gophers, raccoons, porcupines, skunks, domestic cats, and dogs**
PREDATORS	**Coyotes, mountain lions, wolves The young are prey to: owls, foxes, adult male bobcats**
SEXUAL MATURITY	**Female- 1 to 2 years Males-1 year, but do not usually mate until 2**
MATING HABITS	**Several males may follow a female until she is ready to mate.**
MATING SEASON	**February – March**
GESTATION	**50 to 60 days**
OFFSPRING BORN	**April - May**
# OF OFFSPRING	**1 to 6 (usually 2-3) per year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**The kittens are born with spotted fur. They open their eyes at 9 to 10 days. They are weaned at 8 weeks.**
TIME WITH MOTHER	**1. The mother drives the father away from the babies, so he will not kill the kittens. 2. As the kittens grow, their mothers bring live animals like mice to the dens, so they can learn how to catch their food. 3. They begin traveling with their mother at 3 to 5 months. They follow their mother's ear spots. 4. At 7 months' the offspring begin hunting alone in their mother's home range and will return to her. 5. At 12 months, they leave to find their own territory.**
THREATS	**Habitat fragmentation, trapping for fur, because they kill farmers' animals, starvation, diseases such as mange and rabies**
TYPE OF FEET	**Digitigrades**
TRACKS	**Fore prints and hind prints are each about 2 inches long with four toes and no claw marks because the toes are retractable.**
OTHER INFORMATION	**1. They are very good tree climbers, but they do not climb as much as mountain lions 2. They have an awkward way of running that looks they are wobbling because their back legs are longer than the front legs. 3. They have been highly adaptable to human-caused changes in the environment. 4. They will swim if they must. 5. They communicate mainly with tail movement and body posturing.**

HUMAN USAGE	**Fur**
FUR ADAPTATIONS	**1. They have different fur coloring depending on the seasons.** **2. During summer, the fur is a yellowish tan, and during the winter, the fur is a thick yellowish gray.**
HUNTING ADAPTATIONS	**1. They can run fast for short distances.** **2. They stalk or crouch in wait and ambush their prey by leaping on them.** **3. They use their teeth to kill their prey.** **4. They have been known to go without food for several weeks during times of famine.** **5. Their ear tuffs act as antennas to direct sound waves into the ear.** **6. They have keen eyes and ears for finding prey.**
DEFENSE ADAPTATIONS	**1. If they are approached by a person while they are resting, they will lie perfectly still.** **2. They have well-hidden retreats among rocks or brushy thickets.** **3. When hidden, their growls and snarls sound like a mountain lion to predators.** **4. They are very elusive which helps protect them from predators.** **5. The tufted ears may serve as eye mimics to give the impression of a wider and more formidable head.**
OTHER ADAPTATIONS	**1. The kittens use the spotted ears of their mothers as visual clues when they are following them.** **2. They can adapt to living in different habitats- deserts, grassland, forest.** **3. They will switch their diet when their preferred food is not available.** **4. They rest in trees during the heat of the day.**

COMMON GRAY FOX (Canidae Urocyon cinereoargenteus)
See Mammal Plate 1

FAMILY	**Canidae (foxes, coyote, wolves)**
OTHER NAMES	**Tree foxes**
CALLED	**Female: vixen male: dog, reynard, tod, zero baby: kit, cub, pup; group: skulk, leash**
LIFE SPAN	**5 to 10 years**
SIZE	**40 inches long**
WEIGHT	**7 to 11 pounds**
RUNNNING SPEED	**28 mph**
TIME OF ACTIVITY	**Nocturnal**
HABITAT	**Desert canyons, evergreen forest, rocky areas, bushy areas**
SHELTER	**1. The den is in rocky overhangs, cliffs, or thick brush, a hollow tree, or the vixen may dig her den into soil or enlarge the burrow of another animal.** **2. The den may be as much as 75 feet long and can have 10 or more exits. There are also numerous side chambers used for food storage and for the transfer of young, once a chamber becomes too soiled to inhabit.**
SOCIAL BEHAVIOR	**Solitary during winter**
COMMUNICATION	**Hoarse high-pitched barks, yelps to steady high-pitched screams, mournful cries**
TYPE OF DIET	**Omnivore – they will consume almost everything edible: rodents (most of its diet), rabbits, hares, young birds, eggs, reptiles, fish, insects- grasshoppers, crickets, carrion, berries, cactus fruit, apples, corn, tubers, nuts**
PREDATORS	**Domestic and wild dogs, coyotes, bobcats**
SEXUAL MATURITY	**about 10 months**
MATING HABITS	**1. A male often travels 50 miles to establish a territory.** **2. It is believed that they mate for life.**
MATING SEASON	**February through March**
GESTATION	**51 days**
OFFSPRING BORN	**April through May**
# OF OFFSPRING	**1 to 7 pups (average 4)**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. Pups are born with dark brown fur.** **2. They are helpless and blind for 10 days.** **3. The young venture out of the den after about 5 weeks, and are usually weaned by 10 weeks.**

TIME WITH MOTHER	**1. Both male and female are devoted parents and provide food, care, and training to the young.** **2. Mothers will move their young from one den to another if disturbed.** **3. Kits begin to hunt with their parents at 3 months. By the time that they are four months old, the kits will have developed their permanent teeth and can hunt on their own.** **4. The kits reach their adult weight at five to six months and discover their mother is suddenly snarly and mean, chasing them away to find their own territories. Although it seems cruel, this is, of course, nature's way of preserving the next generation through geographical diversity.**
THREATS	**Humans trap them for their fur.**
TYPE OF FEET	**Digitigrade**
TRACKS	**1. Look similar to a large domestic cat except their claws may show.** **2. When running, claw marks are pronounced.**
OTHER INFORMATION	**1. They climb trees to use as safe places to rest and eat.** **2. In summer, grey foxes will move to mountain slopes to try to stay cool. In winter, they will move to a lower altitude where it is warmer.** **3. Foxes have a reputation for slyness and often show up in fairy tales and folk stories as very clever characters.**
HUMAN USAGE	**Fur for clothing**
FEET ADAPTATIONS:	**1. Gray foxes are the only members of the dog family (Canidae) that can climb trees.** **2. Their very strong, non-retractable hooked claws allow them to scramble up trees to escape predators, eat, and rest.** **3. They can climb branchless, vertical trunks to heights of 18 feet and jump from branch to branch.** **4. They shinny up trees by pivoting their front legs at the shoulder joints to grab the trunk and then pushes with their hind feet. They can rotate their front legs more than other canids.** **5. They descend by jumping headfirst from branch to branch or slowly descend backwards as a domestic cat would do.**

COYOTE (Canis latrans)
See Mammal Plate 5

Family	**Canidae (foxes, coyotes, wolves)**
OTHER NAMES	**Brush Wolf, Prairie Wolf, song dog, melon dog** **Scientific name means "barking dog."**
CALLED	**Female: bitch male: dog baby: pup, puppy, whelp group: pack, rout**
LIFE SPAN	**6 to 10 years**
SIZE	**3 to 3.5 feet long 18-24 inches tall**
WEIGHT	**20-40 pounds**
RUNNNING SPEED	**1. Cruising- 25 to 30** **2. Short distances- 40 mph** **3. They can jump an 8-foot-high fence.**
TIME OF ACTIVITY	**Anytime of the day or night.**
HABITAT	**They can live in almost any habitat and any terrain, from urban to suburban to rural areas, deserts, forests, fields, and mountains.**
SHELTER	**1. The mother coyote will keep her pups in a den that is 5 to 30 feet long and ends with a enlarged nesting chamber.** **2. The mother may dig the den, take over and enlarge a fox or badger's burrow, or use a cave or log.**
SOCIAL BEHAVIOR	**1. Often solitary, but they do join with other coyotes to catch larger prey.** **2. They may also belong to a loosely structured pack consisting of the breeding pair and their young.** **3. It is thought that coyotes might breed for life, but it is hard to know because of their wild lifestyle.**
COMMUNICATION	**Vocal Communication** **1. Coyotes sometimes yap when alarmed.** **2. Pups learn to whine and growl and snarl ferociously at each other over food and playthings. Pups will even growl at their parents over food.**

	3. Howling helps coyotes locate each other and let other packs know that a territory is occupied. They will also howl just for the fun of it. They can be heard howling in a chorus to each other. **4. Barking alone seems to be a warning to stay away from a den or a kill.** **<u>Scent Communication</u>** **1. Coyotes sometimes urinate on their food, possibly to claim ownership over it.** **2. They use urine to mark their territory.** **<u>Body Language</u>** **1. Body language is very important in asserting and accepting dominance among siblings and pack members. Dogs in submission often roll over to expose their throat and stomach.** **2. The position of their ears shows what mood they are in and their social rank.**
TYPE OF DIET	**Omnivore- but about 90% is meat: rodents, carrion- when necessary, birds and bird eggs, snakes, lizards, amphibians (except frogs), fish, rabbits, skunks, insects old, weak deer, elk, pronghorn, bison, garbage, fruit- watermelon, cantaloupe, peaches, pears, apples, prickly pear, persimmons, juniper berries, plants- corn, sorghum, wheat, beans, carrots, peanuts, grasses (large quantities during winter and early spring), leaves, succulent roots, domestic animal droppings- when necessary**
PREDATORS	**Coyotes are prey to these predators:** **Bears, wolves, mountain lions**
SEXUAL MATURITY	**Females- 1 year, but most will not at that time**
MATING HABITS	**1. Male often courts for 2 to 3 months before mating.** **2. Monogamous- with pairs staying together for life or many years.**
MATING SEASON	**January - March**
GESTATION	**63 days**
OFFSPRING BORN	**April to May**
# OF OFFSPRING	**2 to 12 usually 6 every year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. They are born blind. Their eyes open after about 14 days.** **2. They are completely dependent on milk for their first 10 days.** **3. They are walking by 20 days and running by 6 weeks.**
TIME WITH MOTHER	**1. The father brings food to the mother while she is in the den with the pups.** **2. The parents begin supplementing the pups' diet with regurgitated solid food after 12 to 15 days.** **3. They emerge from their den at about 3 weeks.** **4. By the age of 6 weeks , the pups' teeth are fully functional, and they are given small food items such as mice, rabbits, and pieces of ungulate carcasses to eat. As they grow, the parents begin to bring them live rats and rabbits to chase and kill themselves. Soon they begin accompanying the adults on hunts.** **5. By fall the pups are ready go off on their own.**
THREATS	**Humans- killed because they are considered to be a nuisance.**
TYPE OF FEET	**Digitigrade (walks with only its toes touching the ground)**
TRACKS	**The hind prints fall near or directly over the front prints.**
OTHER INFORMATION	**1. Unlike dogs (tail held up) and wolves (tails held straight), coyotes run with their tails down.** **2. A pair of experienced coyotes can kill porcupines by using their paws to flip the rodents on their backs and then attacking the soft underbelly. Young coyotes are injured by the porcupines' quills.**
HUMAN USAGE	**None today.** **Many Indians told stories about the coyote that was considered to be a trickster.**
HUNTING ADAPTATIONS	**1. They have acute senses of hearing and smell so they can find their prey.** **2. They are fast runners.** **3. They have a lot of stamina to chase prey until the animal becomes tired and then they attack.** **4. They also know another coyote's territory by the urine scent they leave which helps them avoid problems.** **5. They are opportunists that will eat almost anything.** **6. They will hunt food whenever available (day and night).** **7. Sometimes a badger will dig for a rodent at one end of a burrow, and a coyote will stand at the prey's escape hole and catch the prey that is trying to escape from the badger.**

	8 Coyotes usually hunt singerly, but when hunting large prey, they may work with one or two other coyotes. 9. Like other canids, the coyote caches excess food, so it can come back later to finish eating. 10. Coyotes catch mouse-like rodents by stalking, freezing, and then pouncing. 11. When hunting larger prey like rabbits, they will chase it. 12. They are good swimmers and will enter water to catch their prey. 13. They have strong jaws for eating a variety of foods.
WEATHER ADAPTATIONS	1. They have long thick fur to keep them warm in winter. 2. In dry seasons, they will dig to find water. 3. They can get some moisture from the food they eat. 4. They will get water from swimming pools, animal water dishes, cattle tanks, ponds and even from golf courses. 5. They have light fur for camouflage and coping with the hot sun.
DEFENSE ADAPTATIONS	1. The female will move her pups from its den if she thinks it has been discovered. 2. They hold their tails out straight and make them very bushy when they are threatened to show they are aggressive. 3. They use a bark to protect their dens or they will kill the predators.
ADAPTABILITY ADAPTATIONS	1. They are very adaptable-they can change their breeding habits, diet, and even their social behavior so they can live in different habitats including suburbs.

DESERT COTTONTAIL (Sylvilagus audubonii)
See Mammal Plate 5

FAMILY	Leporidae (hares, rabbits)
OTHER NAMES	Cottontail- because of the pure white undersides of their fluffy tails, which they flash when fleeing. Prairie dog rabbit- because they shared the short grasses that grew there.
CALLED	Female: doe, Jill male: buck, Jack baby; kitten, bunny, kit, nestling group: colony, drove, nest, husk
LIFE SPAN	1 to 2 years Average life span is 12 - 15 months.
SIZE	13-17 inches long Their ears are about 3 to 4 inches long.
WEIGHT	2-3 pounds
RUNNNING SPEED	15 to 20 mph
TIME OF ACTIVITY	1. Crepuscular, nocturnal 2. Generally nocturnal, being most active at dusk and throughout the night, but sometimes are active in the day, if it is not too hot.
HABITAT	Desert grasslands, shrublands, especially in areas where there are creosote bushes
SHELTER	Burrows dug by other animals, cavities in brush or woodpiles
SOCIAL BEHAVIOR	Solitary
COMMUNICATION	Loud high-pitched screaming or squealing when caught by a predator
TYPE OF DIET	Herbivore: lechuguilla- if other food is scarce, leaves and green pods of mesquite, grasses- 90% of their diet, bark and twigs of shrubs, pads of prickly pear, flowers, many types of vegetables They get most of their water from the plants they eat or the dew on the plants. In order to get all the nutrients from the grass they eat, they will eat their own scat.
PREDATORS	Golden eagles, bald eagle, Swainson's hawks, horned owls, barn owls, gray foxes, gopher snakes, badgers, coyotes, bobcats, rattlesnakes
SEXUAL MATURITY	3 months
MATING HABITS	1. The males will fight to breed with the females. 2. They chase each other, face off, kick with front feet, and jump high in the air.
MATING SEASON	year round
GESTATION	28 days
OFFSPRING BORN	Year round
# OF OFFSPRING	1. 3-6 bunnies 3 to 5 times a year, thus a female can have 20 to 35 babies in a year.
DEGREE OF INDEPENDENCE	Altricial- helpless at birth
THE YOUNG	Born blind, hairless, and totally dependent on their mother for the first two weeks.
TIME WITH MOTHER	1. Mothers make a nest lined with grass and fur from her belly. 2. She nurses the babies at dawn and dusk, but may stay away for up to a day at a time. 3. Once the bunnies open their eyes and are moving around outside the nest, they are on their own (about 3 weeks).

THREATS	**Humans hunt them.**
TYPE OF FEET	**digitigrade**
TRACKS	**Front paw 1 inch long; rear paw 3 to 4 inches long**
OTHER INFORMATION	**1. Desert cottontails molt (or lose their hair) twice a year, but still remain the same color when the new hair comes back.** **2. Desert cottontail is one of the most important primary consumers because it provides food for many predators. It is said that every carnivore of at least half the size of the cottontail, as well as snakes and large predatory birds, will choose the cottontail as a food source.** **3. They can be a real pest to people because they damage and destroy gardens, young trees and shrubs.**
HUMAN USAGE	**The desert cottontail can be both a pet and a pest to humans. Many people raise cottontails as pets to keep in their backyard or to breed. People also raise them or hunt them for their tasty, white meat.**
DEFENSE ADAPTATIONS	**1. They have been known to swim and climb trees to get away from predators.** **2. They raise their tails to show their white bottoms as a way of warning other rabbits of danger.** **3. If cornered by a small predator, they may leap over the animal and give it a powerful kick with their hind legs.** **4. Sometimes when they see a predator, they will freeze, scrunch down, and flatten their ears to blend in with their surroundings.** **5. They run up to 20 mph in a zigzag pattern to escape predators until they come to a burrow or bush to hide in.** **6. They can leap up to 12 to 15 feet in a single bound and jump sideways while running to break the scent trail.** **7. They have large eyes on opposite sides of the head for more field of vision.** **8. They have large ears to better hear their predators.** **9. They use well-worn trails in winter, usually under thick cover of brush.**
WEATHER ADAPTATIONS	**1. When the temperature rises above 80 degrees, they rest instead of being active.** **2. They are active at night when it is hot during the day.** **3. Their light-colored fur prevents them from absorbing too much solar heat.** **4. They have large ears with blood vessels just below the skin that release heat quickly into the air.** **5. On hot summer days, they will stretch out in shady areas to cool off.**

ELK (Cervus elaphus)
See Mammal Plate 3

FAMILY	**Cervidae (deer, moose, elk, caribou)**
OTHER NAMES	**Wapiti – a Shawnee name for white (referring to their white rump)**
CALLED	**Female: cow male: bull baby; calf, spike, yearling-yearling bull elk group: herd, gang**
LIFE SPAN	**12 to 15 years in captivity: 18-20 years** **Bulls generally do not live as long as cows, rarely surpassing 12 years.**
SIZE	**Female: 4 1/2 ft. tall, 6 1/2 ft. long Male: 5 ft. tall, 8 ft. long** **Their antlers may reach 4 feet above their head, so that the animal towers 9 feet tall.**
WEIGHT	**Female: 450-650 lbs. Male: up to 600- 800 lbs.**
RUNNNING SPEED	**35 mph**
TIME OF ACTIVITY	**Crepuscular**
HABITAT	**In summer, they live in woodlands to mountain forests with riparian areas. In the winter, the elk will go down to the desert grasslands where it is warmer and food more abundant.**
SHELTER	**none**
SOCIAL BEHAVIOR	**1. Herding behaviors vary from season to season.** **2. Adult elk usually stay in single-sex groups for most of the year.** **3. During calving season, the cows are scattered widely in small groups. Once the spotted calves can walk, the females assemble into larger groups (25 or more) that include cows, calves, and yearlings. The herd is matriarchal (dominated by an older experienced single cow).** **4. Mature bulls stay away from cows and calves most of the year. They will live in bachelor groups or alone.** **5. During the fall rut, a bull lives in a herd with several cows (ranging from 3 to 4 to as**

	many as 20 to 25) called "harems." 6. After breeding activities cease, the bulls usually move to separate wintering areas.
COMMUNICATION	**Body Postures** 1. When alarmed, elk raise their heads high, open their eyes wide, move stiffly, and rotate their ears to listen. 2. If a harem cow wanders, a bull stretches his neck out low, tips up his nose, tilts his antlers back and circles her. 3. Elk threaten each other by curling back their upper lip, grinding their teeth, and hissing softly. 4. Agitated elk hold their heads high, lay their ears back and flare their nostrils, sometimes even punch with their front hooves. 5. An elk will raise its head high to display dominance. **Vocalizations** Elk are among the noisiest ungulates, communicating danger quickly and identifying each other by sound. 1. High-pitched squeal: Newborn to its mother, who recognizes her calf by its voice. 2. Bleat: Calves bleat for their mothers when they are in distress. 3. Whining: Cows whine softly to their calves. 4. Bark: Cows bark to warn of danger. 5. Chirps, mews, and miscellaneous squeals: General conversation among the group and to keep track of each other. 6. Bugling (bellow escalating to squealing whistle ending with a few repetitive low-toned grunts): Bull advertising his fitness to cows, warning other bulls to stay away, or announcing his readiness to fight. 7. Grunt: bull grunts at cows straying from the harem
TYPE OF DIET	Herbivore- grazer and browser grasses- year-round, leaves, twigs, dandelion, violets, clover
PREDATORS	Wolves, mountain lions The young are killed by: black bears, coyotes, bobcats.
SEXUAL MATURITY	Males: 2 years, but are not usually large enough to fight until later. Females: 2 years
MATING HABITS	1. In late summer the bulls' antlers stop growing and the elk rub the velvet off them and sharpen their tines. The males will make loud "bugle" sounds that can be heard for miles to announce the "rut," or mating season, has begun. Females are attracted to the males that bugle more often and have the loudest call. The bulls dig holes in the ground, in which they urinate and roll their body. This gives them a distinct smell which attracts cows. 2. Dominant bulls follow groups of cows and compete for the attention of the cows. Rival bulls challenge opponents by bellowing and by paralleling each other, walking back and forth. This allows potential combatants to assess the other's antlers, body size and fighting prowess. If neither bull backs down, they engage in antler wrestling, and bulls sometimes sustain serious injuries or even death. The winning bull will stay with his harem during the mating season.
MATING SEASON	Late August through November They will only breed if there is enough food.
GESTATION	About 9 months
OFFSPRING BORN	May–June
# OF OFFSPRING	1 to 2, once a year
DEGREE OF INDEPENDENCE	Precocial- little parental care
THE YOUNG	1. They weigh 25 to 40 pounds at birth. 2. They can stand in about 20 minutes. 2. The calves are born spotted and remain that way for 3 months. 3. They lay perfectly still while their mother is away.
TIME WITH MOTHER	1. The mother will leave the herd to give birth to her offspring. 2. She keeps it (them) hidden for at least 10 days until returning to the herd. 2. The calf drinks only milk for the first month of its life. Then it begins to graze on vegetation, but it will continue to nurse on its mother's milk for up to nine months. 3. The calf will leave its mother in about a year, which is about the time she will give birth to her new offspring.
THREATS	Hunting (meat, trophy) habitat loss, automobiles
TYPE OF FEET	Unguligrade

TRACKS	**The elk's feet are shaped like cloven hearts that are like a cow but much larger and rounder. When it walks, the tracks of the feet may be 5 feet wide.**
OTHER INFORMATION: ANTLERS	**1. Only the males have antlers, which start growing in the spring and are shed each winter. The largest antlers may be about 4 ft. high and weigh 40 lbs. Antlers are made of bone which can grow at a rate of about 1 inch per day. While actively growing, the antlers are covered with and protected by a soft layer of highly vascularized fuzzy skin known as velvet. In late summer, the bull's antler growth ceases and finishes calcifying to bone while the blood supply to the velvet begins to deteriorate. This causes the velvet covering to dry up and shed. As the velvet dies, bulls begin to vigorously rub their antlers on shrubs and trees to help remove the velvet. In March, the bulls will lose their antlers and begin growing them again.** **2. A bull elk may have eight or more tines (points) on each antler; however, the number of tines on an elk's antler is a poor indication of the animal's age. Older bulls usually have more tines than younger bulls, but poor food or mineral supply may retard antler development.** **3. A mature bull elk with six points on each side is known as a "royal bull." A bull with seven points on each side is called an "imperial bull," and one with eight points per antler is called a "monarch bull."**
OTHER INFORMATION	**1. They are good swimmers.** **2. Elk meat is leaner and higher in protein than beef or chicken.** **3. An elk's stomach has four chambers: the first stores food, and the other three digest it.** **4. Prior to European settlement, more than 10 million elk roamed nearly all the United States and parts of Canada. Today, about one million elk live in the western United States.** **5. Beginning in 2010, some Rocky Mountain elk have been diagnosed with a serious disorder called Chronic Wasting Disease that affects the brain tissue and leads to death.**
HUMAN USAGE	**Hunted for meat and as trophy game**
DEFENSE ADAPTATIONS	**1. They hide in thick brush and trees.** **2. Both males and females use their strong front hoofs to fight off predators.** **3. Males use their antlers for defense. After bulls lose their antlers, they tend to form bachelor herds that will provide them more protection.** **4. They make a barking sound to warn others of danger.** **5. Sometimes a herd of elk will panic and suddenly stampede when they sense some sign of danger.** **6. Herds tend to have one or more scouts that watch while the remaining members eat and rest.** **7. The calves spend their first few weeks hiding motionless while their mthers feed them.** **8. Calves are born spotted and scentless to camouflage them from predators.** **9. The newborn calves are kept close to the herd by a series of vocalizations. These guttural grunts and the mothers' posture drive predators away.** **10. With a superb sense of sight, smell, excellent hearing, and a top silent running speed of 35 mph, elk are well equipped to avoid the few predators capable of bringing them down.**
WEATHER ADAPTATIONS	**1. They have different coloration based on the seasons- copper brown in summer and light tan the rest of the year.** **2. They grow a thick coat of fur for the winter.** **3. Elk in mountainous regions migrate into areas of higher altitude in the spring, and the opposite direction in the fall.** **4. During the winter, they favor wooded areas and sheltered valleys for protection from the wind and availability of tree bark to eat.**

JAVELINA (Pecari tajacu)
See Mammal Plate 3

FAMILY	**Tayassuidae**			
OTHER NAMES	**Collared peccary, musk hog, skunk pig (Spanish name javelina means spear or javelin)**			
CALLED	**Female: sow**	**male: boar**	**baby: reds**	**group: herd**
LIFE SPAN	**13 years in wild**	**18 – 20 years in captivity**		
SIZE	**3 to 4 feet long**	**about 2 feet high**		
WEIGHT	**35 to 50 pounds**			
RUNNNING SPEED	**22 mph**			

TIME OF ACTIVITY	**Activity time depends on temperature - diurnal during winter, crepuscular during summer when the air temperature is cooler.**
RANGE	**Mexico, Arizona, Texas, New Mexico**
HABITAT	**1. Brushy desert and semi-desert canyons, along arroyos that provide watering holes near cacti, chaparral, oak, and mesquite.** **2. They use washes and areas with dense vegetation as travel corridors.**
SHELTER	**Hollow areas on the ground under shade; cavities in steep banks of washes, under foliage or hollow logs**
SOCIAL BEHAVIOR	**1. Javelinas form family herds of 5 to 20 (average 8 to 12) animals and rely on each other to defend territory, protect against predators, regulate temperature and interact socially. The members eat, sleep, and forage together.** **2. Javelinas are not rigidly organized like a pack of wolves. Juvenile or non-dominant boars are not driven out of the herd by the dominant boar. Neither adult boars nor sows seem to serve as permanent leaders. There is some squabbling, but dominance and status appear to be of relatively small concern.** **3. Only rarely do aged or injured animals become solitary.**
COMMUNICATION	**<u>Vocalizations</u>:** **1. Purring- usually between mother and young to keep them together** **2. Low grunt- when herd members become separated from each other or often individual animals will make constant low-volume grunts while feeding or engaged in herd activity** **3. Loud, sharp doglike bark- when herd members are trying to locate each other and regroup** **4. Continuous grumble or growl- important in establishing dominance order in crowd situations often when several herd members gather around a food source** **5. Tooth clicking- sounds like two bones clicking at a machine gun rate. It is used as aggression to establish dominance or if cornered, wounded, or in distress.** **6. Loud, sharp squeal- a reaction to danger and used to establish dominance order in the herd** **7. Woof- to warn other herd members when they are startled, spooked, or disturbed. The herd will either cease all activities and freeze or run away from danger.** **8. Squealing- piglets will often squeal when separated from a sow or harassed** **<u>Olfactory</u>:** **Javelinas have a gland at the base of the tail that gives off a strong musky odor used to communicate with other peccaries:** **1. mark home territory** **2. share a group scent for identification of their herd** **3. warning to others when frightened** **4. a way of greeting each other** **Javelinas will leave their scent on rocks and tree stumps but also on each other by two of them standing facing in opposite directions with sides touching while each vigorously rubs the side of its head against the other's hindquarters and scent gland.** **<u>Body Language</u>: fend off attackers by squaring off, laying back their ears, raising their bristle hair, and clattering their canines. In fight, they charge head-on, bite, and occasionally lock jaws.**
TYPE OF DIET	**Primarily herbivore and frugivore (preferring fruit), but they occasionally eat small animals or insects; prickly pear pads and fruit- about 1/2 of its diet, hedgehog cactus, cholla. May push over a barrel or prickly pear plant to eat the roots; sotol, lechuguilla, agave, roots, tubers, grass shoots, shrubs, mushrooms, acorns, mesquite beans, seeds, berries, fruit, beetles, worms, grubs, caterpillars, occasionally small reptiles, eggs, some carrion like dead birds and rodents**
PREDATORS	**Bobcats, mountain lions, bears, coyotes occasionally kill a lone peccary, but they are usually safe when traveling in herds, young javelinas may be killed by golden eagles.**
SEXUAL MATURITY	**Males: 46 weeks Females: 33 weeks**
MATING HABITS	**The dominant boar does virtually all the breeding. Subordinate males do not have to leave the herd, but they are not allowed to approach the females in estrus. There is no male-female bond.**
MATING SEASON	**Year round, but peaks in January, February, and March**
GESTATION	**5 months**
OFFSPRING BORN	**Can be any month, but mostly in June, July, and August**
# OF OFFSPRING	**1-3 (usually 2) per year**

	Mortality rate studies indicate 25 percent at 4 months, 46 percent at 8 months, and 55 percent at 12 months-less than half make it to the first year.
DEGREE OF INDEPENDENCE	**Precocial- require little parental care**
THE YOUNG	**1. They are born with teeth and can follow their mother in a few hours.** **2. They weigh about 1 pound at birth.** **3. At birth they are tan to brownish with a reddish "collar." Their coloring will change to the salt and pepper appearance with the white "collar" of the adults at 3 months.** **4. While the adults take their afternoon nap the young javelinas climb on top of them and slide down them until the adults get tired of their playing.**
TIME WITH MOTHER	**1. The female leaves the herd to give birth to her reds. She rejoins the herd a day later.** **2. Mother nurses the babies for 4 to 6 months.** **3. Both parents care for their young by providing food, and slonh herd helps to protect them from predators.** **4. They young will follow their mothers for more than 1 year.**
THREATS	**1. Disease- distemper, salmonella** **2. Cold weather- they lack an inner layer of hair, so they can freeze** **3. Humans - loss of habitat, hunted for meat and their tusks, killed because some believe they hurt their crops.** **Note: Some ranchers like having peccaries on their property because they help keep the prickly pear cactus from growing out of control.**
TYPE OF FEET	**Unguligrade- 4 toes on front feet, 3 toes on rear feet.** **They normally walk on 2 toes on each foot.**
TRACKS	**Four toes on its front feet and only three toes and split hooves on its hind feet.**
OTHER INFORMATION	**1. They can move with ease on land and in water.** **2. Because they have heavy heads and necks, they drop to their knees when digging deeply for roots.** **3. They have small and nimble hoofed feet that help them move through their habitat.** **4. The young are often born during the rainy season, so there will be more food to eat.** **5. They are neither a ruminant (chews its cud) nor a pig. Though some people think javelina are a type of wild pig, they are actually members of the peccary family, a group of hoofed mammals originating from South America.** **6. Their kidneys are capable of concentrating nitrogenous wastes more efficiently than most mammal kidneys, thereby reducing loss of water.** **7. Each time they open and close their mouths, they are sharpening their teeth.**
HUMAN USAGE	**The peccary is also a source of economic income for humans, who hunt them.**
DIET ADAPTATIONS	**1. They have a much-varied diet (including some small animals)** **2. Their digestive system is nearly indestructible.** **3. The cacti they eat provides moisture needed during times of drought and allows them to survive several days before they need free water.** **4. Their pointy snout can root out small reptiles, insects, and tubers from down in the earth.** **5. They have an excellent sense of smell for locating food (especially tubers and bulbs).** **6. They have unique adaptations of the lips, gums, and tough mouths that allow them to eat prickly pear. They break off a single prickly pear pad, scoot it along the ground to break off some of the spines, hold it down and break it open with their feet and peel back the covering on one side, and then proceed to eat the insides of the pad.** **7. Their kidneys have a modification that allows them to excrete oxalic acid which allows them to have a diet mainly of cactus.**
DEFENSE ADAPTATIONS	**1. They travel in herds so they can protect themselves from predators and defend their territory from other javelinas.** **2. They have sharp two-inch long canine teeth (tusk) for defense (used for cutting and slashing.)** **3. If they threatened, they will clack their teeth together.** **3. They rub their tusk together, making a chattering noise, to scare predators away.** **4. They will make a "woof, woof" sound to warn predators to leave them along.** **5. Both the males and females have musk scent glands on their backs near their rumps to help them identify members of their herd. The scent also is a warning to scare predators.** **6. If cornered, they might charge the predator, but more often they will run away.** **7. Although they cannot see very well, they have a keen sense of smell and hearing. They can smell a predator from 300 yards away.**

	8. Their lighter color acts as camouflage and for coping with the hot sun. **9. When excited, the adult peccaries make their bristles on their backs stand straight up.** **10. The babies will "freeze" and hide on the ground while the herd and mother will run away.**
WEATHER ADAPTATIONS	**1. They cannot cool their bodies off by panting, so during the mid-day heat, they bed down in the shade to stay cooler, and tend to build their homes near water.** **2. They will roll in water and mud to cool off.** **3. In the winter they lay down next to each other to keep warm and for protection.** **4. During the winter, they have dense dark hair and lay in the sun, and during the summer, they shed their dark hair and get shorter lighter hair.** **5. They are crepuscular to avoid the hot summer days and diurnal during the cold winter months.**
COMPARISON OF PIGS AND JAVELINAS	

	Pig	**Javelina**
FAMILY	**Suidae**	**Tayassuideae**
ORIGIN	**Europe**	**South America**
TUSKS	**Most males have tusks that are curved and point upward**	**Males and females have a total of 4 tusks (2 on the top and 2 on the bottom) that are short and straight**
SCENT GLANDS	**None**	**Musky smelling scent gland on back near rump**
TAILS	**Long, curly, naked**	**Short, straight with fur**
# OFFSPRING	**8 to 11**	**Up to 2**
# of TEETH	**44**	**38**
TOES	**4 hoofed toes on each foot**	**4 hoofed toes on front feet and 3 toes and split hooves on the hind feet**
DEW CLAW	**2 per hind foot**	**1 per hind foot**
GALL BLADDER	**Has**	**Does not have**
ADULT WEIGHT	**300 to 700 pounds**	**35 to 50 pounds**

MEXICAN GRAY WOLVES (Canis lupus)
See Mammal Plate 3

FAMILY	**Canidae (foxes, coyotes, wolves)**
OTHER NAMES	**Lobo**
CALLED	**Female: bitch, she-wolf male: sometimes called sire baby: pup, puppy, cub, whelp group: pack- if they are moving, they are called route, rout**
LIFE SPAN	**6 to 10 years; up to 16 in captivity**
SIZE	**4 to 7 ft. long They are the smallest subspecies of the Gray Wolves- about the size of a German shepherd.**
WEIGHT	**Female: 60 to 80 pounds male: 70 to 90 pounds**
RUNNNING SPEED	**About 25 to up to 30 mph**
TIME OF ACTIVITY	**Nocturnal in winter and crepuscular during the rest of the year**
HABITAT	**Mountain forest, grasslands, shrub lands**
SHELTER	**1. The pack stays in a rendezvous area, which is usually a grassy opening.** **2. Pups are born in a den. The den is usually a burrow dug in the side of a hill, but it can be in a rock cave, a hollow log, or a hole in the ground. Wolves often reuse a former den.**
SOCIAL BEHAVIOR	**1. Wolves live in small family packs of up to 15 members.** **2. They have a complex social structure made up of one alpha male, one alpha female, beta, omega, and juvenile members.** **3. At 2 to 3 years of age the offspring leave the pack and look for a mate and start their own pack. If they do not find a mate, they live alone.** **4. They love to play tag and push and shove games with each other.**
COMMUNICATION	**Verbally** **1. Howls: Wolves use howling to locate each other and other packs. The members of the pack can identify each wolf from its howl. When wolves howl together, they harmonize, which sounds like there are more wolves than there actually are.** **2. Growls: Wolves growl to show they are dominant.**

	3. Barks: Wolves bark when playing or to tell another wolf to back off. **4. Whimpers: Wolves whimper to show they are submissive and when they need help.** **Scent** **Wolves have a remarkable sense of smell, so they communicate by leaving their scent. They are telling other animals that the marked area is their territory.** **1. They mark their entire territory with their urine.** **2. They rub their lips and necks against trees and ground.** **3. They often scrape their paw pads on the ground to release odors from paw glands.** **Facial Expressions** **Facial expressions show if they are ready to fight, are afraid, or are happy.** **Body Language** **Body language shows fear, defense, ready to attack, wanting to play. The position of the wolf's tail shows if it is the dominate wolf (uplifted) or a subservient (between the hind legs.)**
TYPE OF DIET	**Carnivore :deer- about 20% of their diet, elk- about 80% of their diet, bison, pronghorn** **Lone wolves (adult wolves without a pack) usually cannot catch the larger animals by themselves, so they eat: rabbits, mice, squirrels, bobcats**
PREDATORS	**Wolves are at the top of the food chain; however, they can be killed by an elk's hoof.**
SEXUAL MATURITY	**Males: 3 years Females: 2 years**
MATING HABITS	**The alpha male and female are the only ones that mate in the pack. Usually, the male and female keep the same partner for life. If there is not enough food in an area, the mating pair will not breed.**
MATING SEASON	**January through March**
GESTATION	**63 days**
OFFSPRING BORN	**April through June**
# OF OFFSPRING	**1 to 11 (average 6) pups per year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. They weigh about one pound and cannot see or hear for about three weeks. Between 8 to 16 weeks, their blue eyes will turn to a yellow-gold.** **2. The pups are weaned at 3 to 5 weeks and then begin eating regurgitated solid food that the mother provides.** **3. At four weeks, the pups leave the den and meet the pack (brothers and sisters). Members of the pack soon begin to take turns bringing food to the pups, playing with them, and guarding them from danger.** **4. Wolf pups play by stalking and pouncing on each other and their older brothers and sisters. They play with "toys" like bones, feathers, and skins of dead animals. They "kill" their "toys" repeatedly and then proudly carry them around. This type of play will help them when they are older and go hunting.** **5. At 12 weeks, the pups start going out with the adults on hunts and will begin to explore their surroundings on their own. As the pups begin to mature, they begin to learn about potential prey, scents and trails, and hunting strategies. At 8 months, they will begin hunting with the pack.**
TIME WITH MOTHER	**1. Pups stay with their mothers for at least 7 months.** **2. She disciplines them with stares, woofs, and growls. If these do not work, the mother may grab the pups by the scruff of their necks and shake them, or she may cuff the pups with her paw.**
THREATS	**Persecution by humans; loss of habitat**
TYPE OF FEET	**Digitigrade**
TRACKS	**Front paws about 5 ½ inches, rear paws slightly smaller. Claw marks are visible.**
OTHER INFORMATION	**1. Wolves are a keystone predator (an animal that has a huge effect on its environment.) When wolves were removed from Yellowstone Park, the elk over populated and changed the vegetation and even the landscape of the park.** **2. Usually only the alpha pair breed, which helps to limit the size of their pack.** **3. Wolves only catch 1 of every 10 animals they chase.** **4. Mexican gray wolves are afraid of humans, and no documented accounts exist of Mexican gray wolf attacks on humans. Nevertheless, humans should be aware and cautious when traveling in wolf range, as they should when near any wild predator.**
HUMAN USAGE	**They are an endangered species and are protected by law.**
FUR ADAPTATIONS	**1. They have two layers of fur. The outer fur repels water and dirt. The inner undercoat is very dense and insulates the body.**

	2. They shed their winter fur, so they can be cooler in the summer.
TEETH AND JAWS ADAPTATIONS	**1. They have 42 strong teeth that make it easier for them to attack, kill, and eat their prey.** **2. They have powerful jaws, with a bite pressure of 1,500 pounds per square inch.**
SIGHT ADAPTATIONS	**1. They have excellent peripheral vision (what they can see from the sides of their heads).** **2. They have outstanding night vision, which helps them when they are hunting.** **3. While their eyesight is not adapted to pick up fine details, they can detect movement up to 100 yards away.**
HEARING ADAPTATIONS	**1. Wolves' ears are cupped which helps direct sound for better hearing.** **2. They can hear up to 6 miles away in the forest and 10 miles in open country.** **3. Their great hearing helps them keep track of where the individuals of their pack are located, if another wolf pack is in their territory, and to locate prey.**
SMELLING ADAPTATIONS	**1. They can smell 100 times better than people can. If the wind is right, they can smell up to 1 ½ miles away.**
FEET ADAPTATIONS	**1. Their large feet help them run quickly while chasing prey.** **2. Their feet have slight webbing between each toe, bristle fur, and blunt claws so they can run better on snow and ice.** **3. Their paws are kept from freezing during the winter by a unique circulatory adaptations: the blood is pre-cooled before it reaches the outer layer of tissue thus reducing the temperature difference between the paw and the air.**
TAIL ADAPTATION	**1. They use their tails to keep insects off them.** **2. They wrap their tails around their faces to keep them warm in the winter.**
HUNTING ADAPTATIONS	**1. They travel in packs, which allow them to hunt larger animals.** **2. They make seasonal migrations to follow their prey.** **3. They are nocturnal during the winter and mostly crepuscular during the rest of the year because their prey has those habits.** **4. They are built for long distance stamina with their narrow chest and powerful backs and legs. They can travel 8-10 hours a day and travel up to 30 miles while searching for food.** **5. Their powerful, long legs let them run 24 to 40 miles an hour with the ability to chase their prey for 20 miles.** **6. The lead hunting wolf will drop back at times to let a fresher wolf do the chasing.** **7. They form a semicircle around their prey, so they can catch the animal if it changes directions.** **8. Can go up to 2 weeks without eating, but will eat up to 3 to 5 lbs. of meat per day when food is available.** **9. In order to catch larger prey, they chase animals that are weak, ill, young, or old and will tire easily.**
HISTORY	**1. At one time, the Mexican gray wolf lived in parts of Arizona and New Mexico. When settlers moved into the Southwest, they killed so many deer and elk that the wolves' food source was taken from them. When the wolves began eating cattle, ranchers and trappers killed most of them.** **2. By the 1950's most Mexican gray wolves were gone. In 1977, people realized that if something was not done, the Mexican gray wolves would become extinct, so they were placed on the Endangered Species List.** **3. By 1980, only 5 wolves were found and captured in the wilderness. These 4 males and 1 female were the beginning of the "Mexican Wolf Recovery Program."** **4. Today, there are about 300 wolves living in 47 zoos and sanctuaries. In March 1998, the first 11 Mexican Gray Wolves were release into national forests. Today there are over 100 wolves living in the Blue Ridge Recovery Area.**
IMPORTANCE OF WOLVES	**Wolves are an important part of the ecosystem. They help keep the number of deer and elk from becoming overpopulated. If there were too many deer and elk, they would overeat their food supply and starve to death. Often, overgrazing by deer and elk will kill the plants and cause soil to erode. Thus, wolves help keep the ecosystem balanced.**

MOUNTAIN LION (Felis concolor)

See Mammal Plate 2

FAMILY	**Felidae (ocelot, bobcats, jaguar, mountain lions)**
OTHER NAMES	**Puma, panther, cougar, painter, catamount**
CALLED	**Female: lioness, queen male: Tom baby: cubs, kittens**

LIFE SPAN	**8 to 15 years 20 years in captivity**
SIZE	**Female: 7 ft. long male: 8 to 9 ft. long**
WEIGHT	**Female: 65-125 lbs.; male: up to 160 through 200 lbs.**
RUNNNING SPEED	**They can run up to 42 mph, but because of their small hearts and lungs, they can only maintain that speed for about 300 yards.**
TIME OF ACTIVITY	**Nocturnal, can be crepuscular to catch deer, and sometimes diurnal**
HABITAT	**Rugged mountain forest, valleys, grasslands, brush country, desert edges**
SHELTER	**Den (for the kittens) in a cave, rock crevices, pile of rocks, secluded area in thick brush or tall vegetation.**
SOCIAL BEHAVIOR	**1. They are solitary and very territorial . They actively avoid other cats except during a two-week courtship.** **2. Their ranges can vary in size from 10 square miles to around 370 square miles.** **3. Females tend to have smaller ranges than males.**
COMMUNICATION	**1. They purr when content.** **2. They will growl, hiss, and snarl when they feel threatened.** **3. They can't roar.**
TYPE OF DIET	**Carnivores: mostly deer, but also elk, pronghorn, rabbits, raccoons, birds, insects, porcupines- quills included, foxes, mice, coyotes, skunks, bobcats, squirrels, bears, bison, javelinas**
PREDATORS	**None, but young ones may fall prey to adult male mountain lions**
SEXUAL MATURITY	**Females- 1 1/2 to 3 (typically 2) years of age**
MATING HABITS	**1. They are polyestrous. The males breed with several females that have home ranges within the male lion's larger home area.** **2. Female signals her estrus with scent of her urine and by caterwauling (making sounds like a woman's scream).** **3. When a male lion encounters a female lion without kittens, he remains with her for four to six days, during which time courtship and breeding occur. The male leaves the female after breeding.**
MATING SEASON	**Commonly from December to March, but can happen at any time during the year.**
GESTATION	**82 to 95 days**
OFFSPRING BORN	**Year-around**
# OFFSPRING	**1-6 kittens (usually 3-4) every 2 to 3 years**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. Usually born in a cave or concealed area.** **2. They weigh 6 to 15 ounces at birth and are born blind. They open their eyes at 2 to 3 weeks.** **3. They have spots for the first 3 months.** **4. They will reach adult size by the time they are three to five years old.**
TIME WITH MOTHER	**1. When the kittens are young, the female moves them frequently to new den sites to provide protection and to improve access to prey.** **2. Once the kittens are weaned, the mother will regurgitate food to feed her kittens. At 2 months, the kittens begin to accompany their mother when she hunts. At 6 months, the kittens begin to hunt small prey on their own.** **3. The mother must teach the cubs how to hunt larger prey such as elk because elk have thick neck muscles and outweigh them.** **3. The kittens stay with their mother for 18 to 22 months. Often the siblings will stay together for a while to improve their hunting skills before becoming solitary.**
THREATS	**Persecution by ranchers, loss of habitat, automobiles, legal hunting**
TYPE OF FEET	**Digitigrade**
TRACKS	**Large, rounded and cat-like, with 4 toes and no claw marks. Tracks in a straight line, back foot possibly overlapping the front.**
OTHER INFORMATION	**1. They are extremely secretive and thus rarely seen. Because mountain lions usually know you are in the area well before you know they are there, sightings of lions are very rare.** **2. They help keep the deer population healthy by killing the weak, sick, old, and injured ones** **3. They have flexible spines so they can change directions quickly and maneuver around things.** **4. They can jump 18 feet from the ground into a tree.** **5. They are good swimmers even though they do not like water.**

	6. A pack of coyotes is sometimes able to steal a kill from a lion, harassing the cat until it gives up and retreats. 7. Only females are involved in parenting. Female cougars are fiercely protective of their cubs, and have been seen to successfully fight off animals as large as American black bears in their defense. 8. A single adult lion without kittens usually needs to make a kill every 6 to 10 days. 9. Because mountain lions prey on porcupines, they often have quills in their paws and faces. This occasionally causes some fatalities when the quills prevent the lion from being able to eat or drink.
HUNTING ADAPTATIONS	1. They can travel up to 25 miles to find prey. 2. They can outrun deer for short distances (300 ft.) 3. They stalk their prey and sneak up as close as they can to ambush the animal to knock it off its feet, so they do not have to chase it for very long. 4. They have very sharp teeth and short, powerful jaws to break the necks of their prey. 5. They have long hind legs and powerful hindquarters so they can leap up to 23 feet to catch prey. 6. They are excellent at climbing and jumping from trees. 7. They are nocturnal, but will hunt in the day if their prey is scarce. 8. Their highly developed sight is extremely critical for hunting success, and it includes both diurnal and nocturnal vision. 9. They have excellent depth perception which enables them to attack their prey extreme accuracy. 10. After killing their prey, they will bury it with leaf litter or debris and leave it, coming back to feed on it when hungry. This helps prevent scavengers from feeding on the carrion. 11. They can go up to 6 to 10 days between kills. Once they have eaten about 70 % of a carcass they will begin hunting again.
DEFENSE ADAPTATIONS	1. The kittens will have spotted coats for three months to provide camouflage for them. 2. They have camouflage coloring that helps them blend into their surroundings. 3. Most people will never see a mountain lion in the wild because it is a master of camouflage, slipping behind a bush or rock or scrap of shadow and disappearing.

MULE DEER (Odocoileus hemionus crooki)
See Mammal Plate 1

Family:	Cervidae (deer, moose, elk, caribou)
OTHER NAMES	Mulie, burro deer, jumping deer Their name comes from their large ears
CALLED	Female: doe, cow male: buck, stag, bull baby: fawn, calf group; herd, gang, mob, leash, bunch
LIFE SPAN	10 to 11 years in the wild; up to 25 years in captivity
SIZE	Length- 3.5 to 7 ft. long Height- 3 ½ to 4 ft. tall at the shoulder
WEIGHT	Males: 110-300 lbs. (a few may reach 400 lbs.) Females: 70-160 lbs.
RUNNNING SPEED	Up to 45 mph for a short time
TIME OF ACTIVITY	Crepuscular- summer Nocturnal on summer moonlit nights Diurnal- winter – they may feed at mid-day Most of the year they hide in the shade of large rocks and mesquite trees until late afternoon.
HABITAT	Grasslands, scrublands, woodlands, desert- if there is enough vegetation to hide and eat
RANGE	Southern half of New Mexico, northern Mexico
SHELTER	On ground- males prefer rocky ridges; female and young bed down in washes under mesquite
SOCIAL BEHAVIOR	1. The males and females live together in small herds during the winter. 2. When males begin to grow their antlers in the spring, they go off alone or in twos or small herds. 3. The usual social group consists of a doe with her fawn or a doe with twin fawns and a pair of yearlings. 4. When does encounter each other, they often fight, so family groups space themselves widely, thereby helping to ensure food and cover for all.
COMMUNICATION	1. The mule deer has glands on the hind legs above the hooves. A fawn seems able to recognize its mother by the odor from these glands, and when deer are in groups, they frequently sniff these glands.

	2. The long hairs around the glands usually become erect when aggressive confrontations between bucks begin.
TYPE OF DIET	**Herbivore- browsers (feed mainly on leaves, fruit, high-growing woody plants) not grazers (feed on grass and other low -lying vegetations). Leaves, twigs and lower branches of trees, grasses-especially in the winter when there is not much food, fruit of cactus using their lips to strip the edible portion away from the spiny plant, berries (juniper) and fruit, soto, lechuguilla, spineless prickly pear, weeds, acorns, mistletoe, mushrooms, shrubs (skunkbush, Apache plume, mescal bean**
PREDATORS	**mountain lions, wolves The young: eagles. coyotes**
SEXUAL MATURITY	**1 ½ to 2 years**
MATING HABITS	**1. Bucks grow antlers from May – July in preparation for rut (mating season). The antlers grow up to ¼ inch a day. During this time the antlers are soft and tender, with a blood supply and covered with velvet. The antlers can be easily damaged at that time.** **2. During pre-rut, males will spar with each other by pushing and shoving. This is the time when bucks will size each other up, which can help prevent weaker bucks from confronting stronger males later.** **3. When the antlers lose their blood supply, they stop growing and the velvet falls off. Thus begins the rutting season. The male will rub his antlers against a tree and scrape the ground with his hooves to mark his territory.** **4. Stronger males may fight for dominance by enmeshing antlers to try to force the other buck's head down. Injuries are rare, but if the antlers become locked, both deer will die from starvation.** **5. Bucks usually battle males with similar size and build. Smaller, younger bucks will often leave the dominant deer's territory to avoid fights.** **6. A male will round up a group of does, fight for them and breed with most of the does in the area.** **7. A doe may breed with several different males.** **8. The males begin losing their antlers from January-February marking the end of the rutting season.** **9. The males and females stay together until spring.**
MATING SEASON	**November- January**
GESTATION	**6 to 7 months**
OFFSPRING BORN	**May through August**
# OF OFFSPRING	**1 to 3 (usually 2) every year . If it is a doe's first time having a baby, she often has only one fawn.**
DEGREE OF INDEPENDENCE	**Precocial- require little parental care**
THE YOUNG	**1. Born with white spots for camouflage and no scent.** **2. They weigh about 6 pounds at birth, and can stand within the first 12 hours.** **3. By winter, the fawns have lost their spots.**
TIME WITH MOTHER	**1. Mother keeps her fawns hidden in tall vegetation for the first month. She returns every evening to nurse them.** **2. The offspring stay with the mother for 1 year.**
THREATS	**Humans- loss of habitat, lack of food usually because of drought, getting hit by cars. They are protected by law, and humans are only allowed to hunt them at certain times, but poaching occurs.**
TYPE OF FEET	**Unguligrade**
TRACKS	**The fore print and hind print look like narrow split hearts with a pointed toe.**
HUMAN USAGE	**Hunted for meat**
OTHER INFORMATION	**1. Bucks will continue to grow bigger antlers each year until they are 6 to 7 years old. After that age, the bucks will often have atypically shaped antlers.** **2. Males develop forked antlers that consist of 8 to 10 points and can spread up to 4 feet.** **3. Mule deer have a dark V-shaped mark, extending from a point between the eyes upward and laterally. This V mark is more conspicuous in males.** **4. Mule deer do not have front teeth in their upper jaw, only a hard palate.**
WEATHER ADAPTATIONS	**1. They will move to higher elevations during the hot summer and to lower elevations during the winter months. This allows them to have better food sources.** **2. They migrate in response to rainfall patterns to find food.** **3. They sweat and pant to keep cool.** **4. They find cool places to bed down during hot days.**

	5. They change their time of activity depending on the time of year. 6. The deer's metabolism slows and individuals become less active to survive in an environment with less food. 7. During the summer, the mule deer has less hair that is light brown or reddish-brown. During the winter, they have thicker grey hair. 8. Their large ears help disperse their body heat.
LEGS & FEET ADAPTATIONS	1. They have large feet, which they use to dig up to a two-foot hole to find water. 2. They use their sharp hoofs as weapons. 3. Their long legs keep their bodies off the hot ground. 4. They can turn or completely reverse the direction they are running for a quick escape. 5. They can run up to 45 mph for a short time which allows them to outrun a predator. 6. They can jump stiff legged and bounce high which allows them to see the location of their predators and to outrun the predators that must go through the terrain. This bounding leap (stotting) allows them to cover distances up to 8 yards and reach a height of 8 feet high. All four of their feet hit the ground at the same time.
SMELL ADAPTATIONS	1. They use their great sense of smell to find underground water. 2. They can smell predators.
HEARING ADAPTATIONS	1. Their large ears can move independently from each other, so they can listen for predators from both sides. 2. They have acute hearing which helps them hear predators coming.
EYE ADAPTATIONS	1. Mule deer have excellent night vision and the ability to detect movement of predators at 600 meters. 2. They have 310-degree vision because their eyes are located on opposite sides (monocular vision) of their heads which allows them to see two objects at once. That allows them to detect movement of predators better. 3. They are always looking for predators while they eat.
ADAPTATIONS: DEFENSE	1. They are excellent swimmers so they can escape predators. 2. They can lie for hours without moving except for the flickering of their ears. 3. They nibble a little food and then move on. Their stomachs store food that can be chewed later as cud. This constant wandering makes it harder for predators to find them. 4. The newborns are hidden until they are large enough to follow the herd. 5. Mule deer have long ears that move independently and constantly, so they can listen for predators. 6. Their sense of smell is 1,000 times more accurate than the sense of smell in humans.

NORTH AMERICAN PORCUPINE (Erethizon-dorsatum)

See Mammal Plate 3

FAMILY	Aystricomorpha
OTHER NAMES	Prickle pig, quiller
CALLED	Female: sow male: boar baby: pup, porcupettes group: prickle
LIFE SPAN	15 years in the wild, 20 or more years in zoos
SIZE	25 to 36 inches long
WEIGHT	10 to 35 lbs.
RUNNNING SPEED	2 mph
TIME OF ACTIVITY	Nocturnal
HABITAT	Coniferous forest, desert grasslands
SHELTER	When not in trees they prefer dens in a cave, rock crevices, or hollow tree; the babies are born in burrows.
SOCIAL BEHAVIOR	Solitary- even if they den with other porcupines in the winter, they will ignore each other.
COMMUNICATION	1. It is a very vocal animal and has a wide-variety of calls including moans, grunts, coughs, wails, whines, shrieks and tooth clicking. 2. Mother makes grunts and groans to communicate with her baby.
TYPE OF DIET	Herbivore: leaves, twigs, buds, roots, stems of green plants, berries, seeds, tree bark and pine needles in winter, woody shrubs, wooden objects, such as old boards and even houses, salt- they are attracted to canoe paddles, wooden handles of gardening tools, etc. for the salt from human sweat.
PREDATORS	fishers (small carnivorous mammal)- by flipping the animal on its back, great horned owl, coyote, bobcats, bears, mountain lions, wolves

SEXUAL MATURITY	**2 ½ years**
MATING HABITS	**1. Males find females during mating season by sniffing the base of trees and rocks where a female might have passed. 2. The males are very vocal and will fight over females. 3. The male performs an elaborate dance and sprays urine over female's head before mating. 4. The female will relax her tail, which allows her to raise her tail letting the male know she is ready to mate.**
MATING SEASON	**November – December**
GESTATION	**7 months**
OFFSPRING BORN	**May or June**
# OF OFFSPRING	**1 per year**
OFFSPRING DEPENDENCE	**Precocial-require little parental care**
THE YOUNG	**1. Their eyes are open at birth and the teeth have already erupted. 2. The babies are born with soft quills that begin to harden within an hour. 3. They weigh about 1 to 2 pounds at birth. 4. The babies begin to forage for food after only a week and are weaned after 1 month.**
TIME WITH MOTHER	**1. The young stays close to its mother for the first 6 weeks because it can't travel far. 2. The mother goes into trees during the day to feed and descends to the ground to spend the night with her kit, who follows her to night-time feeding trees. 3. At 3 months the kit may begin spending a few nights away from the mother. 4. The baby will stay with its mother for about 6 months.**
THREATS	**Loss of habitat**
TYPE OF FEET	**Plantigrade**
TRACKS	**The foreprint is 2.5 inches long and the hindprint is about 3 inches long with very long claw marks.**
OTHER INFORMATION	**1. Porcupines do not see very well. They can see movement, but that is about all they can see. 2. The have a good sense of hearing and smell. 3. They are excellent climbers and spend much of their time in trees. 4. They don't hibernate, but they may stay in their dens during bad weather. 5. Porcupines don't move quickly. They don't need move quickly because most animals will not try to attack them because of the quills.**
HUMAN USAGE	**1. Native Americans have used quills and guard hairs for traditional decorative clothing. 2. Porcupine quills have recently inspired a new type of hypodermic needle. Thanks to backward-facing barbs on the quills, when used as needles, they are particularly good at two things -penetrating the skin and remaining in place.**
QUILL ADAPTATIONS	**1. Porcupines have quills on all parts of their body except for their stomach. They have bristles, underfur, and soft hair on their backs, sides, and tail, but it is mixed with sharp quills (spines). 2. The quills are modified hairs coated with thick plates of keratin. They are solid at the tip and base and hollow for most of the shaft. The longest quills are on its rump. The shortest quills are on its cheeks. 3. A porcupine may have 30,000 or more quills. 4. Porcupines do not shoot quills. Quills are very loosely attached to the skin, so they are easily released. These quills typically lie flat until a porcupine is threatened. Then the porcupine raises its quills, turns its back to the predator, and strikes the animal with its tail to dislodge the quills. Porcupines are not aggressive animals and only strike the predator to defend themselves. 5. Each quill has hundreds of barbs or hooks that work their way deep into the attacker's skin. If the quills get into the predator, the heat of the animal makes the quills expand and the quills become even more embedded. 6. The most reliable way to remove the quills is to cut the end of the hollow quill, which will release air pressure. This helps to collapse the quill, making it smaller, so it comes out a more easily. 7. Predators can die as a result of infections from quills. 8. New quills grow to replace the lost ones. 9. Porcupines are good swimmers because their hollow quills help keep them afloat.**
DEFENSE ADAPTATIONS	**1. It will chatter its teeth to sound fierce as an early warning to an intruder. 2. Next, it will produce a pungent smell from the base of its tail.**

	3. It assumes a defensive posture—head and shoulders lowered, back turned to face the threat, every quill erected, and the tail thrashing back and forth. 4. Lastly, it will use its quill-laden tail to strike the predator, releasing the quills into the predator.
CLIMBING ADAPTATIONS	1. They use their long, curved claws for climbing trees. 2. The soles of the feet are naked and deeply wrinkled to help them climb trees. 3. Stiff bristles on the underside of the tail help them climb.

BLACK-TAILED PRAIRIE DOGS (Cynomys ludovicianus)

See Mammal Plate 2

FAMILY	Sciuridae (squirrels, chipmunks, prairie dogs)
OTHER NAMES	Settlers called them "dogs" and "sod poodles" because of their high-pitched, bark-like call.
CALLED	Female: sow male: boar baby: pup group: town, coterie
LIFE SPAN	Male: 5 years Females: 8 years
SIZE	12-16 in length (with tail)
WEIGHT	1.5 to 4 pounds
RUNNNING SPEED	Up to 35 mph for short distances
TIME OF ACTIVITY	Diurnal, but during the hottest part of summer days, they will remain in their burrows
HABITAT	Desert grasslands, prairies, open plains
SHELTER	1.Their burrows are 6 to 10 feet deep and 16 to 33 feet long. There are side chambers for storage, nurseries, sleeping, escape (from predators and flooding) and even toilets. 2. Prairie dog burrows can have up to six entrances, so they have many escape options. The entrances have mounds that serve as an observation post for the "guards" that watch for predators. 3. The mounds help protect the burrows from flooding. 4. The holes possibly provide ventilation as the air enters through the mound. 5. Prairie dogs spend a lot of time building and rebuilding their dwellings. 6. Deserted burrows provide homes for snakes, black-footed ferrets, tiger salamanders, and burrowing owls.
SOCIAL BEHAVIOR	1. Prairie dogs have the most complex social structure of any rodents in America. They are very social and live in closely-knit family groups called "coteries." 2. Coteries usually contain an adult male, one or more adult females and their young offspring. Each coterie lives in their burrow, share food, chase off other prairie dogs, groom each other, and greet their family members with a kiss. This is done by touching noses, then turning their heads sideways and touching teeth! 3. Interactions are friendly between members of a coterie. However, from February through April, pregnant and lactating females defend their nursery burrows by engaging in hostile interactions such as fighting, staring, tooth chattering, and bluff charges. 4. The coteries are grouped together into wards (or neighborhoods) and several wards make up a colony or town. 5. Towns can cover less than ½ square mile to the largest one covering 25,000 square miles at Oakley, Kansas .
COMMUNICATION	1. Prairie dog language may be only second to humans in its complexity. They have words for different predators and features of predators which helps them communicate quickly when under attack. 2. Studies have shown that not only do they have a sound for humans, but they can also communicate the person's size (tall/short), shape (fat/thin), and even what color shirt is being worn.
TYPE OF DIET	Herbivore: grasses, roots, seeds, weeds, blossoms, forbs (flowering plants), sometimes insects Two hundred fifty prairie dogs can eat as much grass and vegetation as one cow. They acquire all of their water from the food they eat.
PREDATORS	Hawks, owls, ravens, eagles, coyotes, badgers. Snakes, bobcats, foxes, black-footed ferrets
SEXUAL MATURITY	2 years
MATING HABITS	1. During a 4 to 5-hour estrus, a female prairie dog may mate with as many as 5 different males, allowing pups from the same litter to have different fathers.

	2. To guard against inbreeding, young males leave the coterie before reaching sexual maturity. If adult males do not leave before their daughters are sexually mature, their daughter's estrous is suppressed.
MATING SEASON	**February through March**
GESTATION	**34 to 37 days**
OFFSPRING BORN	**March through April**
# OF OFFSPRING	**3 to 8 (average 5) each year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. The young are blind and hairless. Their eyes do not open for 33 to 37 days.** **2. At about 6 weeks, they begin to appear above ground and are ready to be weaned. They are fully grown by fall.** **3. Young pups are very playful and can often be seen romping near their burrows. As they get older, they start to explore fields further away.**
TIME WITH MOTHER	**1. The babies stay with their mother underground for the first 30 days.** **2. Communal nursing occurs once pups have emerged from their natal burrows.** **3. They will stay with their mother for 1 year until they are full grown. The males then leave to establish their own territories. The females stay in their birth neighborhood.**
THREATS	**Humans- loss of habitat for farming and ranching. Many have been and continue to be killed because the burrows they dig are dangerous to cattle and horses. More prairie dogs have been exterminated than remain, inhabiting only about 2 percent of their former range.**
TYPE OF FEET	**Plantigrade**
TRACKS	**Hind print has 5 toes and is about 1 1/4 inches long. The fore print is a little smaller and has only 4 toes.**
OTHER INFORMATION	**1. Prairie dogs are considered a "keystone" species because their colonies create islands of habitats that benefit approximately 150 other species. They are a food source for many animals. Many species use their burrows as homes. Prairie dogs even help aerate and fertilize the soil, allowing a greater diversity of plants to thrive.** **2. Due to high population density, infanticide (females kill the pups of other females while they are still in the burrow) is frequent. This is a major source of juvenile mortality accounting for a total loss of nearly half of all litters born.**
HUMAN USAGE	**None**
DEFENSE ADAPTATION	**1. They have eyes on the side of their heads (monocular) so they have a wider view of approaching predators.** **2. They live in burrows with many entrances so they can quickly duck in them when predators come.** **3. They keep the vegetation trimmed near their burrows to keep predators from sneaking up on them.** **4. They have buff color fur for camouflage and for coping with the hot sun.** **6. Their burrows have listening posts near exits, so animals can safely keep tabs on the movements of predators outside.** **7. When a predator approaches, the first alert prairie dog gives a sharp warning call, bobs up and down in excitement, calls again and then plunges below. Other sentinels farther from the danger zone take up the watch, monitoring the course of the predator. A second "all-clear" call alerts the community when the danger has passed.**
WEATHER ADAPTATION	**1. In the fall, they add as much fat to their bodies as possible to get ready for winter.** **2. Although they do not hibernate, they become torpid, and spend many days underground. However, they will usually come out of their burrows for some time during every month of the year.**

PRONGHORN (Antilocapra americana)
See Mammal Plate 2

FAMILY	**Antilocapridae (pronghorn) (2 toes on each foot)**
OTHER NAMES	**pronghorned antelope, American antelope, antelope** **(But they are not antelopes)** **The pronghorn gets its name from its slightly curved, black horns.**

CALLED	**Female: doe male: buck baby: fawn group: herd**
LIFE SPAN	**7-10 years in wild 12 years in captivity** **About 60% of fawns born in June will only live until mid-July.**
SIZE	**3 1/2 feet tall; 4-5 feet long**
WEIGHT	**Male: 90 to 140 pounds Female: 75 to 105 pounds** **They are the smallest of the hoofed animals.**
RUNNNING SPEED	**1. They can sprint at 60 to 70 mph for a short time and keep up a speed of 30 mph for several miles.** **2. They are the fastest land animal in North America.**
TIME OF ACTIVITY	**Diurnal, but they are most active at dawn and dusk (crepuscular)**
HABITAT	**Desert flats, open plains, and prairies**
SHELTER	**None**
SOCIAL BEHAVIOR	**1. Following mating, the herds break up in early spring. Young males live together, females form groups, and adult males live alone.** **2. In the summer some females may share the same grazing area. Dominant females will aggressively force other females from feeding sites. Dynamics of the female changes as they challenge each other for the leadership role. The dominant female decides when the herd will move to a new location in search of food.** **3. The males and females form herds of around 100 in the winter.**
COMMUNICATION	**1. When a pronghorn detects danger, it raises the white fur on its rump as a danger signal, which can be seen by other pronghorns up to 2 miles away. Even the babies a few days old can signal danger with their white rumps.** **2. They can warn other pronghorns of danger by giving off a musky smell from scent glands located on either side of the jaw, between the hooves, and on the rump.** **3. They use vocalization to find mates and communicate with their young.** **4. They snort loudly to show aggression toward another pronghorn.**
TYPE OF DIET	**Herbivore: Mostly browse on sagebrush-and twigs of other shrubs** **grasses (small amounts), forbs (non-woody flowering plants) such as globe mallow, rabbit brush, prickly pear, junipers, weeds**
PREDATORS	**Pronghorns are prey to these predators (mostly in winter when they cannot run through snow as quickly) wolves, coyotes** **The young are prey to: bobcats, golden eagles**
SEXUAL MATURITY	**1. They are sexual mature by 15 to 16 months for both sexes, but they rarely mate until they are about 3 years old.** **2. Only dominant males breed, which usually delays a male's first breeding until about 5 years of age.**
MATING HABITS	**1. The males have two strategies for mating:** **2. In drier winters, the males will defend a harem of females.** **3. In wet winters, a buck tends to claim a territory and protect it from other males with vocalization, scent marking and challenging intruders.** **4. "Sampling" females will enter the male's territory and stay for a short time before leaving and going to another male's territory, thus inciting conflicts between males. If the males cannot intimidate each other, they lock horns and try to hurt each other. The female then mates with the winner. The female will move on to other males.** **5. "Quiet" females will remain with 1 male in an isolated area for a few weeks.** **6. Before mating, the male makes soft sounds, waves his head from side to side, displays his cheek patches, and releases a musky scent. The female waits motionless as the male approaches and sniffs his scent glands before allowing him to mate.**
MATING SEASON	**September- October**
GESTATION	**7 to 8 months**
OFFSPRING BORN	**late May- early June**
# OF OFFSPRING	**1-3; usually 2**
DEGREE OF INDEPENDENCE	**Precocial- require little parental care**
THE YOUNG	**1. The fawns weigh 5-7 pounds at birth and do not have spots.** **2. They are odorless when they are first born and can lie quietly in tall grasses for long periods of time to prevent detection by predators. They can walk within an hour of birth, but they are still wobbly for the first few days.** **3. At four days old, they can run 25 mph.** **4. In 3 to 4 weeks, the fawns are ready to join the herd, but will not be weaned until they are 4 to 5 months.**

	5. At about 15 months, the males will join the male herd.
TIME WITH MOTHER	**1. The mother spaces the babies in high grass several hundred feet from each other, and grazes a distance away from the babies so predators will not know where they are hidden.** **2. The mother usually nurses her fawns about 3 times a day for 20 to 25 minutes. Besides nursing her young, she also grooms them, and she will lead them to water.** **3. After 3 to 4 weeks the fawns will become a part of a nursery group that cares and protects them. They will continue to have contact with their mothers.**
THREATS	**Fences, loss of habitat, cars hitting them**
TYPE OF FEET	**Unguligrade**
OTHER INFORMATION	**1. They are the fastest long-distance land mammals in the world. The cheetah is faster if running a few hundred yards, but the pronghorn can run the fastest over a long distance.** **2. They have large windpipes, huge lungs, and large hearts that let them consume large amounts of oxygen. They also run with their mouths open so they can take in more air. All these things allow them to run for longer period of times at fast speeds.** **3. They can go without water for days because they eat moist green vegetation.** **4. They can eat plants like thorny cactus that other grazing animals would not touch.** **5. They migrate from summer to winter rages to find food. They can scratch through a light snow, but they prefer uncovered plants. They are very good at knowing where to find food depending on the season.** **6. Only the males have black on their faces and a black patch on their necks.**
HUMAN USAGE	**None**
HORNS ADAPTATIONS	**1. Pronghorns are the only animals in the world to have branched horns, and the only animals in the world that shed the outer part of their horns once a year.** **2. They have a true horn made of bone, but the outer sheath (made of keratin) is shed each year after mating season and regrown by July.** **3. The females' horns are 3 to 4 inches long and do not get any longer than their ears. They are not pronged. The males' horns, about 12 to 20 inches long are forked (pronged) with the single point curving inward and the small tine about half way up the horn.**
EYES ADAPTATIONS	**1. Their eyes are located on opposite sides (monocular vision) of their heads which allows them to see two objects at once. That allows them to detect movement of predators up to 4 miles away even while they are eating.** **2. Their eyes are as large as a horse's eyes, providing them with good vision.** **3. Their vision is thought to be 8 times better than humans.**
HAIR ADAPTATION	**1. They have camouflage coloring.** **2. Their outer long course hairs are hollow and filled with ai which provides insulation. The inner hairs are flat against the body and hold in the heat. In the summer they shed the outer hair and can ruffle up their inner hair to provide ventilation.** **3. Their hair allows them to live in temperatures from 130 degrees to 50 degrees below zero.**
ADAPTATION: LEGS & FEET	**1. Their hooves are padded to minimize shock while they run.** **2. Their leg bones are extremely powerful which allows them to run with great strides of 14-20 feet.** **3. When they come to fences, they rarely jump over them. They usually crawl under them. Fences have hindered the migration of the herds to their feeding grounds.** **4. With a good start, a pronghorn can leap across a 27-foot gully.** **5. No other land mammal can keep up with a pronghorn over a long distance.**
DEFENSE ADAPTATION	**1. The leader of the herd makes sure the rest of the pronghorn do not have conflicts, which would distract the herd from watching out for predators.** **2. When being chased by a predator, the herd runs in unison in a very tight oval shape formation to make it harder for the predator to single out one pronghorn.** **3. They avoid muddy soil because they cannot run as fast in it.** **5. Pronghorns can raise the white rump hairs to signal the herd of danger. This signal can be seen miles away.** **6. If a pronghorn cannot flee, it uses its sharp hoofs to drive off the predator.** **7. If trapped, a buck will drop back from the herd and use his horns and feet to fight a predator.**

RACCOON (Procyon lotor)
See Mammal Plate 4

FAMILY	**Procyonidae (ringtail, raccoon, coati)**
OTHER NAMES	**Coon, masked bandit** **1. Their name comes from the Algonquain Indian word, "arakum" which means "scratches with his hands."** **2. Their scientific species name, "lotor" is Latin for "washer."** **3. Early Spanish used an Aztec name that meant "[the] one who takes everything in its hands."**
CALLED	**Female: sow male: boar baby: kit, cut group: troop, gaze**
LIFE SPAN	**1 to 3 years 8 to 13 years in captivity** **It is not unusual for only half of the young born in one year to survive a full year. After this point, the annual mortality rate drops to between 10% and 30%. Young raccoons are vulnerable to losing their mother and to starvation, particularly in long and cold winters.**
SIZE	**2-3 feet long**
WEIGHT	**10 to 30 pounds**
RUNNNING SPEED	**10 to 15 mph** **Raccoons can swim with an average speed of about 3 mph and can stay in the water for several hours.**
TIME OF ACTIVITY	**Nocturnal, but some will be active during the day when food is available**
HABITAT	**Wooded streams, open woodlands or mountain forest, deserts, shrub lands, grasslands, marshes, coasts, cities**
SHELTER	**Hollow trees or logs, rock crevices, burrows, caves, deserted buildings, and house attics. They will use burrows dug by other animals or even dense undergrowth.**
SOCIAL BEHAVIOR	**1. Some live alone and some live-in small family groups.** **2. Related females often share a common area and may meet at feeding or resting places.** **3. Unrelated males often form loose male social groups of up to 4 members to maintain their position against foreign males during the mating season—or against other potential invaders.**
COMMUNICATION	**Makes low twittering sounds, growls, snarls, hisses, whistles, purr, scream, and even whinny.**
TYPE OF DIET	**Omnivore: termites, ant larvae, grubs, worms, salamanders, frogs, acorns, nuts, mesquite beans, berries, fruit, corn, eggs, snakes, fish, shellfish, turtles, clams, birds, rodents, carrion, human garbage they get from opening trash cans, pet food** **Because raccoons need sodium, they look for natural salt licks, the glue on plywood, and road salt.** **Because raccoons need calcium, they gnaw on dead animals' bones and shed antlers.**
PREDATORS	**Young are sometimes eaten by:** **bobcats, mountain lions, foxes, coyotes, wolves, great-horned owl, red-tailed hawks, eagles, large snakes, roadrunners**
SEXUAL MATURITY	**Male yearlings usually reach their sexual maturity only after the main mating season.**
MATING HABITS	**1. During the mating season, males restlessly roam their home range in search of females to court them during the three- to four-day period when conception is possible. These encounters will often occur at central meeting places.** **2. Both males and females can mate with more than one mate.** **3. If a female does not become pregnant or if she loses her kits early, she will sometimes become fertile again 80 to 140 days later.**
MATING SEASON	**Raccoons usually mate in a period triggered by increasing daylight between late January and mid-March.**
GESTATION	**65 days**
OFFSPRING BORN	**March through May**
# OF OFFSPRING	**2 to 5 kits each year**
DEGREE OF INDEPENDENCE	**Altricial- helpless at birth**
THE YOUNG	**1. Kits are blind and deaf at birth, but their mask is already visible against their light fur.** **2. They weigh between 2.1 to 2.6 ounces.** **3. Their ear canals open around 18 to 23 days, with their eyes opening a few days later.**

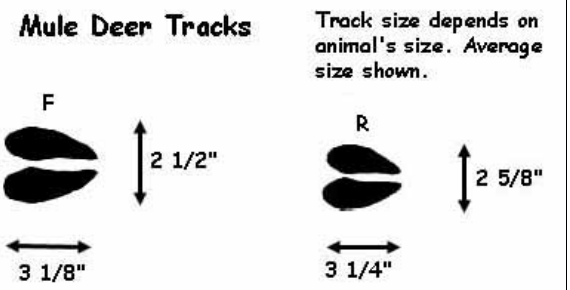
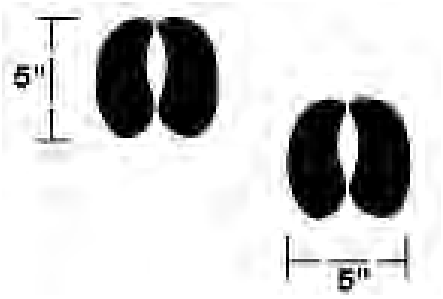
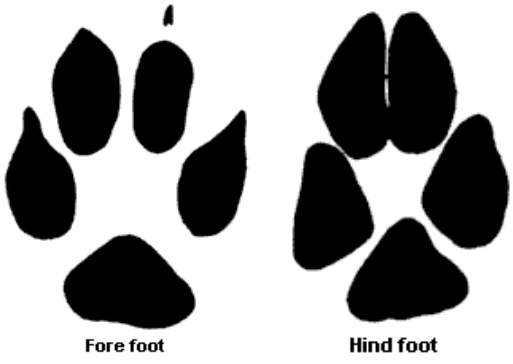
	4. The young raccoons often spend the first two months or so of their lives high in a tree hole. **5. They are weaned at 4 months.**
TIME WITH MOTHER	**1. Since some males show aggressive behavior towards unrelated kits, mothers will isolate themselves from other raccoons until their kits are big enough to defend themselves.** **2. Once the kits weigh 2 pounds, in about 2 months, they move to the ground and begin to explore outside. The mother teaches them how to hunt and climb up and down trees (headfirst) by rotating their hind legs 180 degrees°.** **3. In the fall, after their mother has shown them dens and feeding grounds, the juvenile group splits up. In very cold areas, the offspring might share a den with their mother.** **4. While many young females will stay close to the home range of their mother, males can sometimes move more than 12 miles away. This is instinctive behavior, that helps prevent inbreeding.**
THREATS	**Hunters, vehicles, rabies, distemper, farmers because raccoons will eat chickens**
TYPE OF FEET	**Plantigrade with non-retractable claws**
TRACKS	**The hind foot looks like a small human footprint.**
OTHER INFORMATION	**1. Raccoons often search for underwater food near the shore-line. They then often pick up the item with their front paws to examine it and rub the food, sometimes to remove unwanted parts. This gives the appearance of the raccoon "washing" the food.** **2. Even without water, raccoons will rub their front paws together to “feel” their food.** **3. Raccoons are often called “masked bandits” because of their facial markings and because they will raid chicken coops, corn crops, garbage cans, etc.** **4. They can stand on their hind legs to examine objects with their front paws.** **5. Raccoons are very intelligent. They have been able to remember how they solved problems (like opening locks) years later.** **6. They have sharp canine teeth for eating animals and molars for eating plants.**
HUMAN USAGE	**1. In the early1800s, “coonskin” was used for clothing.** **2. The Whig Party used the raccoon as an emblem. Because the Whigs were sympathetic to African-Americans their opponents began using the ethnic slur “coon” to describe African-Americans.** **3. Many Native Americans told myths about the raccoon “trickster.”** **4. Several cultures believed that the raccoons had some kind of spiritual powers and many raccoons appeared in petroglyphs.**
FEET ADAPTATIONS	**1. They have long, thin dexterous fingers, which they use to dunk food, open shellfish, feed themselves, open door latches and trashcans, untie knots, turn doorknobs, unscrew jars, strip husks from ears of corn, pick fruit and nuts, and grasp small branches.** **2. They “wash” and squeeze their food to enhance their sense of feel, so they can soften it to determine if the food has something in it that they should not eat.** **3. For climbing down a tree headfirst, a raccoon rotates (180 degrees) its hind feet so they are pointing backwards.** **4. They use their lightning-quick paws to grab aquatic creatures (crayfish, frogs, etc.) and pluck land animals (mice, insects, etc.) from their hiding places and raiding nests for eggs.**
	1. They have razor sharp teeth that cause other animals to leave them alone. **2. If threatened, they will puff up their fur and make a growling sound.** **3. They are ferocious fighters. They can kill a dog.** **4. They can elude predators by doubling back or climbing.**
WEATHER ADAPTATIONS	**1. Raccoons have a dual cooling system to regulate their temperature- they can both sweat and pant.** **2. They do not hibernate, but sleep a lot during the winter and live off stored fat in their tails.** **3. They have a thick undercoat to insulate them in the winter.** **4. They can double their weight before winter in preparation for the cold weather.**
FUR ADAPTATIONS	**1. Their camouflaged fur helps them blend into their environment.** **2. Their black mask reduces glare so they can see better at night.** **3. Their outer fur can shed water.**
HUNTING ADAPTATIONS	**1. They will eat just about anything.** **2. They are very adaptable. They have learned to live near people so they can get food**

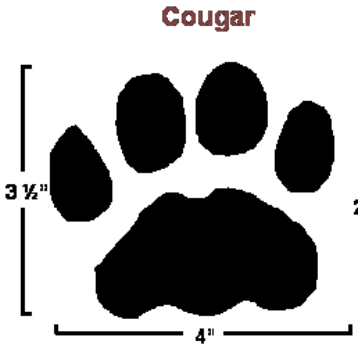
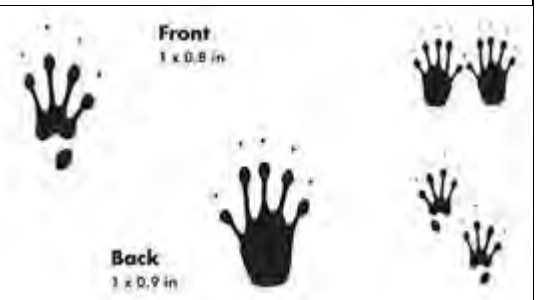
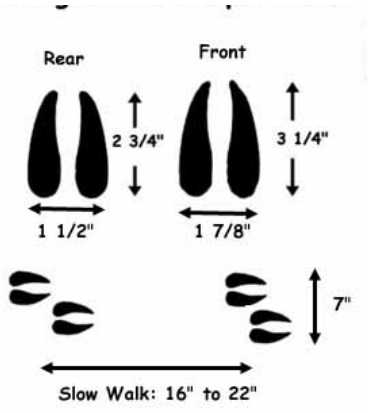
	from trashcans and pet food dishes. 3. They have keen senses of smell, hearing, night vision, and touch.
TAIL ADAPTATIONS	1. They use their tails for balance when climbing trees. 2. They use their tails as a brace when sitting upward and standing. 3. They store fat in their tails to be used in winter.
CLIMBING ADAPTATIONS	1. They can climb quickly when they feel they are in danger. 2. They are very agile- they can climb down a tree headfirst. 3. They can drop unharmed from a height as much as 35-40 feet.

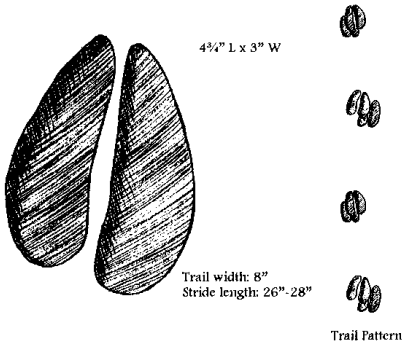
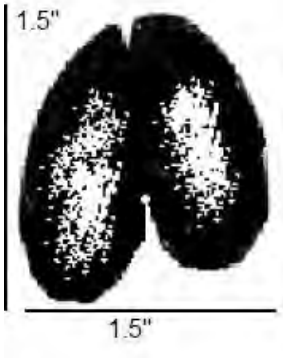
RINGTAIL (Bassariscus astutus)
See Mammal Plate 4

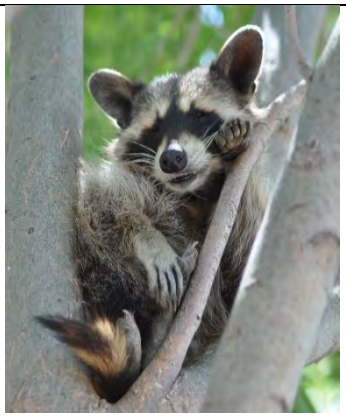
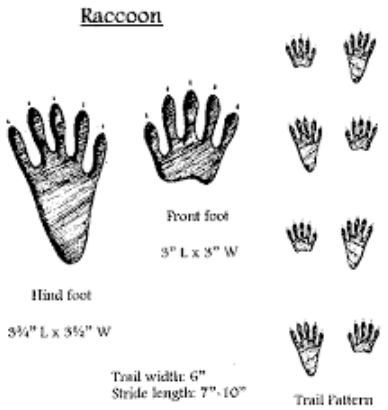
FAMILY	Procyonidae (ringtail, raccoon, coati) They all have a ringed tail and masked face.
OTHER NAMES	Ringtail cat, coon cat, civet cat, miner's cat Ringtails were kept in mines to control the rodent population because they love to chase and eat mice, and do a better job than a house cat! The scientific name of the ringtail translates as "cunning little fox"
CALLED	Baby: cubs
LIFE SPAN	6 to 9 years
SIZE	Up to 2 ½ feet long, half of which is tail
WEIGHT	1 ½ to 2 pounds
TIME OF ACTIVITY	Nocturnal
HABITAT	Desert regions, rocky canyons and ridges, rock piles, and boulders. Likes to be near water, so may be found in riparian areas.
SHELTER	1. Dens in hollow trees, rock piles, caves, rock crevices along cliffs, abandoned dens, or in unused buildings. 2. Sometimes they sleep high up in trees. They prefer a narrow den padded with moss, leaves, or grass. 3. They change their dens frequently.
SOCIAL BEHAVIOR	Solitary except during mating season, when pairs mate and jointly raise their young.
COMMUNICATION	1. As babies, they make squeaking sounds. 2. As adults, they can make metallic chirps, squeaks, whimpers, grunts, growls, screaming, chitters, loud howls, and snarling sounds depending on its situation at the time. 3. Upset ringtails will make a coughing sound that is similar to a fox. 4. They produce clicks, hisses, and chatters reminiscent of raccoons. 5. A typical call is a very loud, plaintive bark.
TYPE OF DIET	Omnivore, but mostly carnivorous and insectivorous: mice and rats, squirrels, rabbits, grasshoppers, crickets, spiders, centipedes and scorpions, birds and their eggs, snakes and lizards, toads and frogs, fruit, cactus flowers and fruit, juniper berries, mistletoe, corns, carrion
PREDATORS	Hawks and great-horned owls, foxes, coyote, bobcats
SEXUAL MATURITY	About 10 months
MATING SEASON	February to May
GESTATION	45 to 50 days, during which time the male will procure food for the female
OFFSPRING BORN	April to July.
# OF OFFSPRING	1 to 5, but usually 2 to 4
OFFSPRING DEPENDENCE	Altricial- helpless at birth
THE YOUNG	Born blind and their ears are closed. The eyes open at about 30 days and the ears about a week later. They are covered with short, whitish hair, but at six weeks they are fully furred with their adult coloration. Their tails are stubby, but begin to grow longer. They begin eating solid food at about 7 weeks old and are weaned by 8 to 10 weeks. They can walk at 6 weeks and climb at 8 weeks. They will have their permanent teeth by 20 weeks. They are almost full grown at 4 ½ months, and will go off on their own at 6 to 7 months old.
TIME WITH MOTHER	1. The male may stay with the female until about 3 to 4 days before the babies are delivered. 2. He will return in about 3 weeks and help to provide for the babies for about two months, when the babies begin to leave the den to forage with their parents.

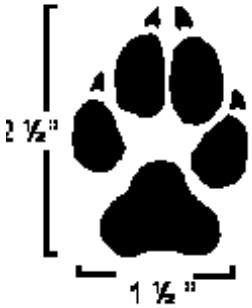
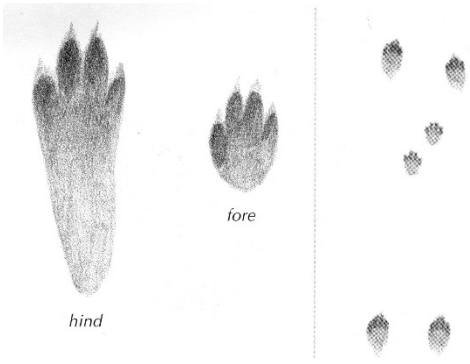
	3. The mother may move her babies from den to den while they are young. **4. In late fall, they leave their parents.**
THREATS	**1. Humans kill them because they raid hen houses.** **2. They are killed by vehicles.** **3. Infectious diseases such as rabies and canine parvovirus kill them.**
TYPE OF FEET	**Plantigrade- 5 toes on front and rear feet with retractable claws**
TRACKS	**Foot prints have no heel marks, but have 5 toes on each foot. They are about 2 inches wide and 1 - 2.75 inches long, with no claws showing.**
OTHER INFORMATION	**1. They have a body like a cat, face and ears like a fox, a tail like a raccoon, and jumps across great distances like a squirrel.** **2. They clean themselves by licking their fur, and use their moistened forepaws to clean their ears, nose, and cheeks.** **3. Their tails are as long as their bodies.** **4. They are the state mammal of Arizona.**
HUMAN USAGE	**None, but they were once used as mousers in mining communities.**
CLIMBING ADAPTATION	**1. They use their tails to balance as they climb along ledges and branches. Their tails help them reverse the direction they are going by doing a cartwheel.** **2. The rear feet ankle joint is flexible and able to rotate over 180 degrees, so they can go down cliffs, trees, and cactus quickly.** **3. Ringtails also can ascend narrow passages and vertical walls by stemming (pressing all feet on one wall and their back against the other or pressing both right feet on one wall and both left feet on the other).** **4. For wider cracks they can ricochet from wall to wall along cliffs and ledges.** **5. Their feet have 5 toes with sharp curved partially retractable claws that help them climb in difficult places.**
DEFENSE ADAPTATIONS	**1. When threatened, they will bristle their tails' fur and arch it over their backs to appear larger.** **2. If they are caught, they will let out a high-pitched sound and release a foul smell from their anal glands.** **3. Their tails help distract a predator.**
HUNTING ADAPTATIONS	**1. They have large eyes for excellent night vision.** **2. The white ring around each eye helps reflect the moonlight and starlight into their eyes.** **3. Their whiskers help them feel.** **4. They have camouflaged fur.** **2. Its upright ears can rotate independently from each other so it can hear its prey and possibly a predator at the same time.** **3. They are silent hunters which helps them close in on their prey. Then they pounce on the prey, use their front paws to hold it down, and kill it by biting the base of the neck.**
WEATHER ADAPTATIONS	**1. During the winter, it will wrap its tail around its curled-up body.** **2. During the summer, it will lie on its back to keep cool.**

		Mammal Plate 1
Mammal	**Picture**	**Footprint**
Bobcat		
Mule Deer		
American Bison		
Common Gray Fox		

		Mammal Plate 2
Black Bear		
Mountain Lion		
Black - Tailed Prairie Dog		
Prong-horn		

		Mammal Plate 3
North America Porcupine		
Mexican Gray Wolf		
Rocky Mountain Elk		
Javelina		

		Mammal Plate 4
American Hog-nosed Skunk		
Raccoon		
Ringtail		
American Badger		 Badger

		Mammal Plate 5
Coyote **Photo:** **Wikipedia**		
Kangaroo Rat Photo: Unknown		
Desert Cottontail **Photo:** **Livestockpedia. com**		

GLOSSARY

GLOSSARY

A

achene- a small, dry one-seeded fruit that does not open to release the seed. One example is the sunflower seeds that are inside an achene.

adaptation - The evolutionary process by which an organism adjusts to its environment by changes in its physiology, anatomy and/or behavior.

altricial - (pronounced al-tri-shul) Helpless, usually naked and totally dependent on parent(s) during infancy.

amphibian - An ectothermic, usually egg-laying vertebrate with smooth, moist skin. The larval stage is aquatic and the larva breathes with gills. Adults have lungs and breathe air. Frogs, toads and salamanders are amphibians.

annual plant - A plant with a life span (seed to seed) of less than one year.

anthropomorphism - Assigning human characteristics to non-human organisms.

arachnid - A class of animals in the phylum Arthropoda, which is characterized by having 8 legs and a fused head and thorax (cephalothorax). Spiders, scorpions, solpugids, uropygids and amblypygids are arachnids.

arboreal - Pertaining to trees; tree-dwelling.

areole - (pronounced air-ee-ole) In cacti, a clearly defined small area that may bear felt, hair, spines, glochids, flowers, fruit or new branches.

arid - Lacking moisture, water is a limiting factor.

arthropod - The largest group of animals characterized by having jointed appendages, exoskeleton and segmented body.

autotomy – The automatic "voluntary" breaking off of a part of the body (a lizard's tail breaks when a predator grabs the tail, and the lizard can then escape).

axillary - In plants, growing from the axil or angle between leaf or branch and stem. In birds, the feathers located between the body and flight feathers.

B

biennial plant - A plant which normally takes 2 years to complete its life cycle, then dies.

binocular vision - Both eyes see an object simultaneously, imparting a sense of distance and depth perception. Achieved by the position of the eyes in the head or by adapted behavior.

biodiversity - Biological diversity. Broadly, the full variety of life on earth. More narrowly, the species richness inherent in a community or ecosystem.

biology - The science which deals with life forms, comprising botany, zoology and all their divisions.

biomass - The total mass of organic material of a species per unit of area or volume, as 100 lbs. of perch per acre of pond surface.

biome - A major community of organisms characterized by the distinctiveness of the life forms of the common species; the grassland biome, the tropical rainforest biome, the desert biome.

biosphere - The zones of air, land and water at the surface of the earth occupied by living things.

botany - The science which studies plants.

brood patch - A highly vascularized area of skin on the belly of a bird, applied to the surface of eggs during incubation.

browser - Broadleaf-eating animal (deer).

brumation - Hibernation.

buteo - (pronounced boo-tee-oh) Any heavy bodied, broad-tailed, broad-winged hawk (red-tailed hawk, Harris's hawk).

C

caliche - (pronounced cal-ee-chee) Relatively impermeable soil layer consisting of various sized particles cemented together by calcium or magnesium salts.

camouflage - Coloration or pattern which serves to hide an animal in its natural habitat.

canid - Any member of the dog family (wolf, coyote, fox).

canine tooth - The "eye tooth." The tooth found on either side of the jaw between the incisors and premolars, greatly enlarged in canines and some other mammals.

carapace - A hard dorsal covering - the portion of the exoskeleton covering the cephalothorax of various arthropods; the convex portion of a turtle's exoskeleton.

carnivore - Meat-eating animal.

carrion - Dead animal material.

carrying capacity - The largest number of organisms of a particular kind that can live on the land without damaging it at its most critical period.

catalyst - A substance which enables or increases the rate of a chemical reaction, but is not itself consumed in the process.

cephalothorax - A body region consisting of the head and thoracic segments in arachnids and some other arthropods.

chapparal – A plant association or vegetation type composed of mixed populations of dense, low-growing shrubs and dwarf trees, mostly evergreen with small, thick, leathery leaves that reduce water loss. Chapparal plants tolerate extreme conditions of shallow soil, steep slopes, rapid moisture drainage, long, hot, dry seasons, and periodic fires. It is usually found between a lower zone of grassland and an upper zone of mixed woodland.

Chihuahuan Desert - One of the North American deserts located in northern Mexico, southern New Mexico, Texas, and southeastern Arizona.

chilopod - (pronounced ki-lo-pod) Elongated, many segmented animal in the arthropod class characterized by having one pair of legs per body segment. Centipedes are chilopods.

chitin - (pronounced ki-ten) The material of which arthropod exoskeletons are made (nitrogenous polysaccharide).

chlorophyll - The green pigment in most plants which captures solar energy in the process of photosynthesis.

chordate - Any animal having at some stage of its development a notochord, gill slits, and a dorsal tubular nerve cord.

cleavage - A tendency to split along planes determined by crystal structure.

cloaca - (pronounced klo-a-ka) The pocket which receives material from the lower intestine, urinary system and reproductive system. This material is then emptied to the outside through the anus or vent. Monotremes, birds, reptiles, amphibians, and fish have a cloaca.

clutch - Group of eggs.

community - The organisms inhabiting a common environment and interacting with one another.

compaction - Reduction in bulk, volume or thickness of sediments. A process in conjunction with cementation whereby sediment is converted to consolidated rock.

conservation - The wise use, without abuse, of natural resources.

consolidation - Any process whereby loosely aggregated, soft or liquid earth materials become firm and coherent.

continental crust - That part of the earth's crust which comprises the continents and continental shelves, anywhere from 10 to 60 km thick. Composed of granitic (granite-like) rocks.

core - Layers underlying the mantle of the earth. The outer core is liquid nickel-iron; the inner core solid.

crepuscular - Pertaining to animals active at dawn and dusk.

crust - The outermost layer or shell of the earth.

crustacean - A class of animals, mostly aquatic, in the phylum Arthropoda. Includes crabs, shrimp and crayfish.

Cryptic pattern or coloration- Camouflaging pattern or coloration.

D

deciduous plant - A plant which is leafless part of the year.

decomposers - Organisms (bacteria, fungi) in an ecosystem or community which convert dead organic material into plant nutrients.

dendrite - A leaf-like or fossil-like pattern found on rock surfaces, often mistaken for fern fossils, usually black and composed of manganese oxide that precipitated into a crack, forming the leaf-like pattern as mineral-bearing water seeped into the crack.

deposition - The layering, placing or throwing down of any material. An accumulation of loose material, such as sediment in a basin.

desert - An area in which water is deficient most of the year and in which the lack of water is severely limiting to life; potential evapotranspiration is much greater than rainfall.

digitigrade - Walking on digits (toes) with the heel more or less raised.

dimorphic - Having two different forms in individuals of the same animals or plant species. Many species have dimorphic male and female forms.

dioecious - (pronounced die-ee-shuss) Plants with the male and female flowers on separate plants.

diplopod - Elongate, many segmented animal in the phylum Arthropoda, characterized by having two pairs of legs per body segment. Millipedes are diplopods.

diurnal - Active during the daylight hours.

dormant - Inactive.

dorsal - Situated on the back; opposite of ventral (situated on the front.)

E

ecological pyramid - A graphic representation of the quantitative relationships among the trophic levels of a food chain. Because large amounts of energy and biomass are dissipated at every trophic level, these diagrams nearly always take the form of pyramids.

ecology - The study of the interrelationships between plants, animals and their physical environment.

ecosystem - All organisms in a community plus the associated abiotic (non-living) environmental factors with which they interact.

ectotherm - An animal having little or no internal ability to maintain its body temperature; the animal adjusts its body temperature by moving within its environment. Common term for this is a cold-blooded animal.

element - Any one of more than 100 fundamental substances which consist of atoms of only one kind and which singly, or in combination, constitute all matter.

embryonic - Related to embryo; early stage of development.

endemic - Peculiar to a particular region or locality.

endotherm - An animal which has the internal ability to maintain its body temperature at a fixed level despite variations in temperature of its environment. Common term for this is a warm-blooded animal.

epiphyte - A plant that grows upon another plant or object.

erosion - The general process or group of processes whereby the earth and rocky materials of the earth's crust are loosened, dissolved, or worn away and simultaneously moved from one place to another by natural agencies.

estivate – To pass the summer in a state of sluggishness. Compare with hibernate. Estivation allows mammals to save energy when food availability is low during drought or in arid regions.

evapotranspiration - The process by which water is lost from the surface of the earth through evaporation of free water and transpiration of water through plants.

evolution - The change in the genetic composition of a population in response to environmental pressures selecting for naturally occurring mutations within that population. The gradual development of organisms from pre-existing organisms since the dawn of life.

exoskeleton - The chitinous external skeleton which provides support for the internal body structure in arthropods. This term also applies to the protective covering of some vertebrates as in dermal plates or scales.

extirpation - Eradication of a species from a given area.

extinct - No longer existing. An extinct species exists nowhere.

F

falcon - A bird of prey, with large head, broad shoulders, long, pointed wings, and a long tail. Wing strokes are strong, rapid and shallow (kestrel).

fault - A natural break in the Earth's crust where movement takes place of one body of rocks relative to another.

fish - An ectothermic vertebrate which breathes with gills and has fins. The body is usually covered with scales.

fledgling – A bird that recently has left the nest or will soon leave the nest to live on its own.

food chain, food web - A set of interactions among organisms, including producers, herbivores and carnivores, through which energy and materials move within a community or ecosystem.

forb - A broadleaf flowering plant as distinguished from grasses, sedges, etc.

fossil - Any remains or trace of an animal or plant of a past geologic period.

G

gene - A unit of heredity in the chromosome.

genus – the major subdivision of a family or sub-family, usually consisting of more than one species, essentially very similar to one another.

gestation period - Period between conception and birth.

glochid - Small, hair-like barbed bristles found only on opuntioid cactus (prickly pear, cholla)

H
habitat - The area in which a given species lives.

hare – any rodentlike mammal of the genus Lepus, with long ears, divided upper lip, short tail, and lengthened hind limbs adapted for leaping. Young hares are born fully furred and sighted.

heat - Energy in transit from a higher-temperature system to a lower-temperature system.

herb - A seed plant without woody stems.

herbivore - A plant-eating animal.

hibernation - A winter dormancy during a season of reduced environmental temperature and/or lack of food.

hybrid - An offspring of two animals or plants of different races, breeds, varieties, species or genera.

hydrosphere - The waters of the earth.

I
ichthyology - The study of fish.

igneous rock - A rock type that solidified from molten or partly molten material.

incisor - The flat, front teeth in mammals necessary for cutting and pulling away of food material.

indigenous - Native to a particular region.

inorganic - Not of plant or animal origins.

insect - A class within the arthropod group characterized by having six legs, three body parts, antennae and compound eyes.

insectivore - Insect eater (woodpecker).

interspecific - Between members of different species.

intraspecific - Between members of the same species.

intrusion - The process of emplacement of magma in pre-existing rock.

invertebrate - An animal without a backbone (all animals except chordates).

J
Jacobson's organ – A pair of openings in the roof of a snake's mouth where particles of dust, pollen, etc. are smelled.

K
keeled scales - Scales which have a ridge down the middle.

keratin - Material of which horns, hooves, hair and nails are composed.

L
larva - An immature stage in some animals (tadpole, caterpillar).

lateral - Situated on the side or sides.

lava - Igneous rock that erupts at the earth's surface.

leaching - The continual removal of soluble matter by water.

legume - Any plant in the pea family, often having nodules on the roots containing bacteria which fix the nitrogen from the atmosphere.

lichen - (pronounced like-en) Algae and fungi living together in symbiotic mutualism.

life zones – Vertically arranged areas of similar plant and animal communities that are often shown graphically as a chart or diagram by altitude, latitude, or annual precipitation.

M
magma - Naturally occurring mobile rock material, generated within the earth.

mammal - An endothermic vertebrate with mammary glands and hair.

mandible - In general, a jaw, either upper or lower. In vertebrates, the lower jaw. In arthropods, one of a pair of mouth parts for cutting, crushing or grinding.

mantle - The layer in the earth between the crust and core.

marsupial - A group of mammals in which the young begin development in the womb but are still embryonic when born. After birth the young move to the mother's pouch (marsupium), attach to a nipple and continue development within the pouch.

metabolic - Referring to the chemical changes occurring in living organisms.

metamorphic rock - A rock type derived from pre-existing rocks in response to marked changes in temperature and/or pressure.

metamorphosis - A change in shape or form which an animal undergoes from egg or birth to adult.

microhabitat - The local environmental conditions immediately surrounding an organism.

mineral - A naturally-occurring, solid, inorganic chemical element or compound having a definite atomic structure and chemical composition.

molar - One of the cheek teeth in mammals. In herbivores, they are flat for grinding. In carnivores, they are sharp for slicing and cutting. In omnivores, they may be intermediate between herbivores and carnivores.

mollusk - The phylum of animals including snails, slugs, clams, oysters, octopi, squids and others.

molten - Reduced to the fluid state as a result of heating or reduction of pressure.

monoecious - (pronounced moan-ee-shuss) Plants on which the male and female flowers are separate but growing on the same plant (such as four-winged saltbush).

monocular vision - Seeing an object with only one eye at a time.

monoestrus - One mating cycle per year (wolf).

monsoon - From the Arabic mawsim - seasonal wind. In the southwestern United States, the term is applied to the season of sometimes violent rainstorms of summer.

morphology - The study of forms and structures of organisms.

mutation - A sudden change in the characteristics of an organism which can be transmitted to offspring, as that which results from a change in the structure of a gene or changes in the number and structure of chromosomes.

N

natural selection - The differential reproductive success of individuals within a population which occurs because of hereditary differences among them.

niche - A place or position occupied by, or a type of activity engaged in, an organism with reference to other organisms. The ecological role of an organism in its community, especially in regard to food consumption.

nictitating membrane - A thin membrane found in many animals at the inner angle or beneath 260 the lower lid of the eye and capable of extending across the eyeball.

nocturnal – Active at night

O

oceanic crust - That part of the earth's crust located beneath the sea. Usually basaltic in composition.

olfactory – Pertaining to the sense of smell.

omnivore - An animal which feeds on both animal and plant material.

ore - Any natural deposit of economically valuable non-fuel earth materials that can be mined at a profit.

organic - Any compound containing carbon and produced by living organisms.

ornithology - The study of birds.

oviparous – (oh-rip-ar-us) Egg-laying.
ovoviviparous – (ō͵vōvəˈvip(ə)rəs) Eggs which develop within the maternal body and hatch from a transparent membrane sac immediately after extrusion from the parent. The umbilicus is attached to a yolk sac as in oviparous species - no placenta is formed.

P

Pangaea - the "supercontinent" formed 200 million years ago by the collision of all continents on earth.

parasite - Any species that lives in or on a host organism and gains most or all of its sustenance from the host organism.

pedipalp - Modified appendage, usually resembling a leg or claw, as seen in spiders, scorpions and other arachnids.

pediment - A tilted planar bedrock surface which lies under and supports a bajada. It is often exposed upslope from a bajada. While a bajada is a depositional feature, a pediment is an erosional feature.

perennial plant - A plant with a life span of two or more years.

pheromone - A chemical given off by one animal which acts as a signal to another animal (a sexual attractant or a substance signaling danger).

photoperiodism - The responses of an organism to changes in light intensity or length of days.

photosynthesis - The chemical process in plants whereby carbon dioxide and water, in the presence of sunlight and using chlorophyll as the catalyst, are combined to produce basic sugars. Its function is to convert solar energy to stored chemical energy (sugar and starch).

phylum - Taxonomic grouping of related classes of plants and animals; a high-level category beneath kingdom.

pinion – To remove the end portion of a bird's wing in order to prevent flight.

placental mammal - A mammal in which the development of membranes (the placenta) which are fused to the walls of the womb enables the fetus to draw nourishment directly from the mother.

plantigrade - Walking on the flat or plantar surface (the sole) of the foot, with the heel touching the ground (e.g. bears, humans).

plastron - The lower or ventral portion of a turtle's shell. Also, a thin film of air held by hydrofuge hairs or scales of an insect.

plates - Large, nearly rigid but still mobile Earth segments or thin blocks with a thickness that includes both crust and a part of the upper mantle.

playa - The flat bottom of an undrained desert basin that becomes, at times, a shallow lake. The Spanish word "playa" means "beach."

poison - A chemical with injurious or deadly effects if ingested.

pollen - The male fertilizing element of seed plants produced by the male portions of the flower (the stamens) which is essential in fertilization for the production of seeds.

population - Any group of individuals of one species that occupy a given area at the same time; in genetic terms, an interbreeding group of organisms.

precocial - Alert, fully developed and mobile almost immediately after hatching or birth.

predaceous - Having predatory habits.

predator - Any organism which kills other animals to obtain food.

preen - Cleaning of feathers by birds with the beak using a specialized oil secretion or material resulting from the disintegration of powder down.

prehensile – Grasping.

premolars - The anterior cheek teeth. Like the molars, they are flat in herbivores, sharp in carnivores and a combination of the above in omnivores.

primary consumer - An animal which eats plant material.

producers - Flora; organisms which create their own food.

pseudopods - The leg-like appendages on the abdomen of a caterpillar.

pupa - The stage between larva and adult, found only in insect species which undergo complete metamorphosis. After metamorphosis occurs the pupa often goes into a nesting stage. (plural = pupae)

pups (offsets)- A small, virtually complete daughter plant that has been naturally and asexually produced on the mother plant. They are clones, meaning that they are genetically identical to the mother plant.

Q

R
raptor - A bird of prey.

reducers - Bacteria or fungi which decompose plant debris and animal carrion and waste.

reptiles - A class of ectothermic, scale-covered, air-breathing vertebrates.

respiration - 1. The interchange of gases between an organism and its environment. 2. The act of breathing or drawing in and expelling air from a cavity, as the lungs--external respiration. 3. The liberation of energy within, and its utilization by, a cell--internal respiration.

reticulation - A lattice or network pattern as on leaves or insect wings.

riparian habitat - An area where plants and animals live and grow along the banks of rivers and streams.

rock - An inorganic, solid substance made up of minerals.

rookeries - Nesting colonies of birds or breeding colonies of pinnipeds(seals and walruses).

rudimentary body parts - Body parts incompletely or imperfectly developed. Also, remains of a structure which was functional at an earlier stage of development.

rufous - A reddish-brown color.

ruminant - A "cud-chewing" mammal with a four-chambered, or in some cases three chambered, stomach. Partially chewed food is swallowed and later regurgitated and chewed again.

S

scavenger - An animal which habitually feeds on carrion (e.g. vulture).

scute - An external bony or horny plate or large scale in reptiles.

sebaceous glands - Glands associated with hair which secrete an oily substance necessary to condition each hair shaft.

secondary consumer - An animal which eats animal material or animal and plant material.

sediment - Solid fragmental materials which usually originate from the weathering of rocks and are transported and deposited by the actions of wind, water, gravity, and ice.

sedimentary rock - A rock resulting from the consolidation of loose sediment.

seismology - The study of earthquakes.

species (singular or plural) - A group of genetically similar isolated animals or plants which freely interbreed and produce viable (fertile) offspring.

spermatophore - A compact mass or packet of spermatozoa which is transferred to the female, as in various invertebrates and some vertebrates (salamanders).

speleothem - Cave decorations.

stomata or stomates - Minute openings in the surface of a leaf, usually on the underside, or a stem through which gaseous exchange occurs between the plant and the atmosphere. (singular = stoma)

subduction zone - An elongate region of the earth's crust along which a crustal block descends relative to another crustal block.

subterranean – Living mostly underground (prairie dogs).

succulent - A plant which stores moisture in its leaves, stems, or roots.

symbiosis - "Living together" of two unrelated organisms with varying degrees of benefit:

parasitism: All sustenance is taken from another organism. The parasite returns no benefit to the host (tapeworm)

partial parasitism: One organism taking some of its sustenance from a host

with little apparent harm to the host (mistletoe).

mutualism: The intimate coexistence of two species in which both derive equal benefit and no harm from the association. Both species require the presence of the other to survive (lichen).

communalism: Two species living in close association where one benefits and the other does not.

synthesize - To combine parts or elements so as to form a whole.

T

tap root - A large anchor root which extends deep into the soil.

taxon - A taxonomic group of any rank or size. (pl. taxa)

taxonomy - The science of classification of plants and animals.

terrestrial - Living on land.

territory - An area defended against other organisms of the same or different species.

tetrapod – A four-footed animal; includes all vertebrates that are not fish.

thorax - The region behind the head of an insect. The legs and wings are attached to the thorax.

transpiration - The process in plants whereby water is released through the stomata into the air.

transportation - A phase of sedimentation concerned with the actual movement, shifting, or carrying away by natural agents of sediment or of any loose, broken or worn away material from one place to another.

trilobites - An extinct marine arthropod of the Paleozoic Era, distantly related to the horseshoe crab.

tympanum - The middle ear; eardrum.

U

ungulate - Any hoofed animal.

unguligrade - Nail walker (deer, bighorn, javelina).

uplift - A raising of the land mass. A structurally high area in the crust produced by movements which raise or upthrust the rocks.

urticating - Stinging or irritating, as in the hairs of the tarantula and nettles (on some plants). Prickly pear and chollas have glochids which are urticating.

V

venom - A biologically produced toxin which is introduced into the system through injection (bite or sting).

vent – The opening of the cloaca to the body surface; used to refer to the anus.

ventral - The underside of an animal (opposite of dorsal).

vertebrate - An animal with backbone and spinal cord (mammals, birds, reptiles, amphibians, and fish).

vestige/vestigial - Generally used to describe an imperfectly developed body organ which remains from a fully developed one in past generations (the pelvic bones in boas).

viable seed - A seed capable of germinating.

viviparous - Live bearing reproduction in which a placenta develops, enabling the transfer of gases and nutrients from the mother to the embryo.

volcanism - The process by which magma and its associated gases rise into the crust and are exposed to the earth's surface and its atmosphere.

W

weathering - Collective term for combined effects of all the processes which physically and chemically break down and transform rock materials on the earth's surface.

X

xeric - Pertaining to arid or dry conditions.

xerophyte - A plant adapted for life and growth under arid conditions.

Y

yoke- the nutritive contents of an egg (ovam)

Z

zygodactyl - A toe configuration in birds; two toes pointing forward and two toes pointing backwards, like the letter X (woodpecker, roadrunner)