## TAKE A HIKE Navigating the trail



2022 Conservation Writing and Jim Claypool Art Contest

### SOIL

## **ARE ALL SOILS ALIKE?**

Sand

Sandy clay loan

Sandy loam

70

60

oamy

80

and

90

Just as humans are a result of genetics and environment, so are soils. While soils don't have parents like we do, they do have parent materials. These materials are like soil's version of DNA. Soils are formed from parent material and by the results of environmental influences that have occurred in their past.

100

Clay

**Clay loam** 

Loam

50

Percent sand

40

Silty

Silty clay

Silt loam

30

20

Parent materials of soils are rocks and minerals that have been broken up into tiny pieces forming sand, silt, and clay. Soils can be many different colors because they can come from many different rocks and minerals.

The composition percentage of sand, silt, and clay determines the soil's texture as we can see with a soil texture triangle. The more sand present will make the soil feel gritty, more clay will feel sticky and elastic, while more silt will feel

velvety and smooth. Each soil forms as a unique expression of five soil-forming factors:

#### 1. Climate

- 2. Vegetation (organic matter)
- 3. Topography
- 4. Parent Material
- 5. Time

People have certain talents and abilities and so do soils. Some soils are deep, well drained, highly productive, and are great for growing the crops that become our food. Others may be shallow and not very fertile, but can be used for other purposes such as forests or recreational areas. When we look at family pictures we see different people with unique talents, and we can certainly do the same Silt with soils. 100 10

> There are over 70.000 different types of soils

in the United States. The next time you travel around Kentucky, notice the different types of plants growing on the different types of terrain and know that there are more than likely different types of soil beneath each section. Just as our Commonwealth is diverse from the mountains in the East to the Mississippi flood plains in the West, take pride in knowing that our soils are also diverse.

### WHAT'S IN DIRT?

The soil ecosystem is made up of the plants, animals, and microorganisms that live together in the soil. The soil itself is a mixture of living and non-living components. A typical topsoil contains about 45 percent minerals, 25 percent air, 25 percent water, and 5 percent organic matter (both living and dead plant and animal life).

Most soils are teeming with life. Decomposers such as earthworms, fungi, and bacteria are busy at work underground breaking down organic matter into the soil. Also living in the soil are animals as large as groundhogs and as small as protozoa. Moles, termites, millipedes, and insect larvae are just a few of the soil's inhabitants. MINERALS 45% of topsoil

AIR 25% of topsoil

WATER 25% of topsoil ORGANIC MATTER 5% of topsoil

### THE WORLD AS AN APPLE

Image the Earth as an apple cut into four quarters. Three quarters represent water. One quarter is land.

Cut one quarter in half again. One piece would represent land that is unsuitable for farming, such as desert or frigid regions. This leaves 1/8 representing land where we can live and grow food.

Cut that 1/8 into four more pieces. Three represent soil too poor to grow food or areas covered by cities.

> That one tiny piece left, 1/32 of the apple, represents the amount of land available for farming. The peel represents the thin layer of topsoil used to produce food.

# 10 hat is soil Conservation?

Soil conservation is when you prevent soil from eroding away from where it was formed. This can be as simple as keeping grass growing on the ground and not having bare spots, planting trees on hillsides and streambanks to hold soil in place, or using contour plowing and strip cropping when we have row crops on our farms. It is important to keep our soil in place and healthy. Otherwise, we wouldn't be able to plant the crops that are necessary to feed all of the people and animals on Earth. It can take up to 1,000 years to form an inch of topsoil and that could be washed away during one heavy rainstorm if we don't do our part to prevent erosion and conserve our soils.

### BEHOLD THE BENEFITS OF ORGANIC MATTER!

Organic matter matters. In fact, there may be no other component that's more important to a healthy soil than organic matter. The tiny fraction of soil composed of anything and everything that once lived organic matter—is more than an indicator of healthy soils.

The carbon in organic matter is the main source of energy for the all-important soil microbes and is also the key for making nutrients available to plants. Here are just some of the positive influences high levels of organic matter have on healthy soils:

- **1.** Provides a carbon and energy source for soil microbes
- 2. Stabilizes and holds soil particles together
- **3**. Supplies, stores, and retains nutrients such as nitrogen, phosphorus, and sulfur
- 4. Improves the soil's ability to store and move air and water
- **5**. Contributes to lower soil bulk density and less compaction
- 6. Makes soil more friable (easily crumbled), less sticky, and easier to work
- 7. Retains carbon from the atmosphere and other sources
- 8. Reduces the negative environmental effects of pesticides, heavy metals, and other pollutants
- 9. Improves soil tilth (how suitable the physical condition of the soil is for growing plants) in surface horizons
- **10**. Increases water infiltration rates
- **11.** Reduces crusting
- **12.** Reduces water runoff
- 13. Encourages plant root development and penetration
- 14. Reduces soil erosion

## THE Sking ON WORMS Earthworms Enrich the Soil

Earthworms work to improve the soil. As earthworms tunnel through the soil, they ingest it and digest the organic matter. They leave broken down organic matter in their tracks, or burrows, which adds to the supply of nutrients available to plants. They also bring rich sub-soil to the surface of the soil, again aiding plants.

These friendly creatures also produce a natural fertilizer, in the form of castings. Castings contain nitrogen, phosphorus, potassium, and many micronutrients in a form plants can use. A soil that is well-managed can support up to 25 worms per cubic foot, which translates to superior-quality fertilizer for plant health.

Worms make other contributions, such as adding a compound to the soil to regulate pH levels, and they loosen and aerate the soil, allowing in much needed oxygen. Their tunnels also provide access to deeper soil levels for other smaller organisms that promote the health of plants.

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## CRIDER SOIL

### Kentucky's State Soil Represents the Best



#### STATE BIRD: Northern Cardinal

Our state soil is not only a state symbol, but also, the focal point for important issues such as the conservation of soil and water, agricultural production, water quality, and land management. The Crider soil series was chosen as the state soil because it was established in Kentucky and occurs on nearly a half-million acres in 35 counties. It's widely distributed throughout the state with diverse geology, and it's one of the state's most productive agricultural soils.

> The Crider series consists of very deep, welldrained moderately permeable soils on uplands. These soils were formed in a mantle of loess (a fine-grained silt or clay) and in the underlying limestone residuum. Slopes can range from zero to 20 percent.

Many people assume that all soils are more or less alike. They're unaware that there are often great differences in soil properties within even short distances. For most uses, the ideal soil would be nearly level and easy to work. But most soils fall short of that. Many are shallow, stony, wet, dry, sandy or clayey, or have other adverse features. Some of these differences can be seen by almost anyone, but others can only be seen by those trained in the field of soil science.

Crider soils typically occur in the Pennyroyal and outer Bluegrass regions of Kentucky. Soil is one of Kentucky's most important natural resources. Livestock, tobacco, grain, pasture, hay, and timber are all marketable agricultural products derived either directly or indirectly from the soil.

However, the value of Kentucky's soil resources aren't limited to agricultural production. Soil is also used as a foundation for houses , as building material for roads and dams, as a storage area and filter for groundwater, and as a disposal area for waste. Even our state tree and state flower need soil to grow.



STATE FLOWER: Goldenrod **STATE TREE:** Tulip Poplar

**STATE DRINK:** Milk

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## FARMERS FIGHT

Many of the best management practices (BMPs) that our county conservation districts, state, and federal agencies encourage farmers to adopt involve the prevention of soil erosion. Soil is one of our most important natural resources. Soil and water are two essential components of our environment. Without protection and conservation, these cornerstones of our natural systems would be broken. This is also true to the livelihood of farmers. Farmers depend on these two natural resources for their very existence. As with any natural system, there are intricate relationships when these two essential resources interact. Each needs the other to be effective,

but too much of one with the other can throw off the natural balance. Too much rain (water) on the land will cause the soil to erode away. If too much soil enters the water (streams and groundwater), it is a pollutant and is bad for water quality and natural aquatic habitats. So, farmers have a huge responsibility when working with the land and water in unison.

In nature there is balance. Vegetation typically covers the soil, allowing moisture content to remain in the proper amounts and protecting the soil by supporting it with root systems and breaking the fall of raindrops with its foliage. If the plant life keeps erosion at bay, then nutrient and solid (soil) levels in the water remain in normal ranges. That is why it is very important for farmers to respect that balance that is needed to keep their natural resources in check.

Even the simplest things that farmers do can make big differences. Selecting the proper fields for planting crops can make a huge difference in how water interacts with the soil. The more slope there is to the land (hillsides), the more probable that soil may be lost. When planting on slightly sloped ground, the farmer should plant in rows horizontal with the hillside in order to prevent runoff from going straight downhill, thus gaining erosive force. There is also a practice to plant a cover vegetation in low areas or drainage ditches to prevent soil erosion. These are commonly referred to as grassed waterways.

Traditionally, land was tilled and broken up, exposing soil to weathering and removing old vegetation. Farmers now plant crops using no-till methods, which prevents

> that ground from being broken and leaves remnant vegetation for soil protection. It is also good practice to rotate crops among different fields in different years. Overusing fields year after year depletes nutrients that are essential for good soil health.

Livestock operations can also affect soil erosion. By rotating cattle among different fields, it ensures that they will not

overgraze the vegetation, thus keeping some vegetative cover to prevent erosion. New fencing might be installed to achieve this purpose and to prevent the livestock from directly entering streams and rivers. When cattle do have to cross streams fencing and stabilization materials such as fabric and rock are used to prevent soil from eroding into the water body. Cattle feeding areas make sure that the heavily used areas are contained in a way that the heavy trampling of the ground does not lead to erosion.

These are just some of the many practices that can be utilized by farmers to remain at the forefront of conserving Kentucky's soil and water resources.

#### In nature there is balance.

## Try this on a Rainy Day\_

After a rain shower, go out and observe three different types of trees. Find trees with different types of leaves, such as oak leaves and pine needles. Use a journal to record the soil conditions under those trees.

- How moist is the soil?
- What types of plants grow there?
- Is there standing water under the trees?

Use your observations to make conclusions.

- How much water reaches the ground through each kind of tree?
- Which types of trees allow more or less rainwater to directly hit the ground?
- How does that affect the plants that grow there?
- How does each type of tree protect or not protect the soil underneath?

### WHEN WATER POUNDS THE GROUND

Trees are the best way to naturally limit water runoff and soil erosion. Less soil erodes from forests than from any other place.

When bare ground is exposed, raindrops run freely over unprotected soil. Each raindrop lands like a tiny bomb, splattering soil particles, and allowing them to be carried away to nearby creeks or streams. In one season, an inch or more of exposed soil can be lost, but this doesn't happen where there are trees! Leaves slow falling rain. On the forest floor, leaves, twigs, and decaying matter absorb the raindrops' remaining force. The forest floor acts as a sponge, and porous underlying soil layers and animals' burrows help soak up water and prevent soil from being carried away.

Tree and shrub roots form a dense mat in the forest soil. Besides transporting water to the tree, the roots keep soil in place. They also pry soil apart so water can move through easier, which is important in soils that are packed down. When trees die, their roots decay underground, creating openings for a filtering system that delivers clear, unpolluted water to streams, rivers, and lakes.

### SO LET'S MAKE SOME SOIL

First, we need some mineral particles. Let's start with some bedrock - limestone is a common one here in Kentucky, but any bedrock will do. This will be the parent material. We'll grind it down through physical weathering windstorms, streams running through or maybe just run a glacier over it. Add freezing and thawing, and eventually the rock will become fine particles.

This produces two bigger types of particles: sand and silt. You can easily see a single particle of sand. The light-colored sand feels gritty and doesn't hold water well because it has large spaces between particles. The darker silt is a tinier particle than you find at the beach. It feels smooth and can hold water better.

The tiniest particles though, are clay. You'd need a microscope to see them. Darker still, clay feels sticky and holds lots of water. Clay minerals come from chemical weathering (Basically water running over rock or the rock's exposure to air changes the minerals into a different substance).

Then in will move some lichens, often the first to settle in such an attractive new neighborhood. Next come microscopic decomposers including bacteria, fungi, and protozoa. They use the parent material and turn decomposed organic matter into humus to make nutrients for plants.

With plants, we'll also soon have earthworms, gophers, and moles. Their burrowing helps stir the mixture, which helps us gain a balance of water and air. Soil with too



much air and too little water will blow away and be inhospitable to plants. Too much water and too little air will drown plants, and we'll see all our worms gasping at the surface.

> But we've just made a soil that's just right, with a rich blend of pulverized rocks, organic material, water, and air.



#### Ingredients

- 1 tall clear glass jar with a lid
- 1 cup of soil
- 1 cup of sand
- Water

**Directions:** Fill the jar with soil and sand then mix well. Add in enough water to fill the jar and screw on the lid. Shake the jar with the mixture and water until all the water is clouded. Allow the jar to sit overnight and then observe its condition. Take out your journal and answer these questions:

- What was the condition of the water immediately after being shaken?
- After leaving the water overnight, what is the condition of the water now?
- 3. What has happened to the mud shake overnight?
- 4. How is this connected to soil conservation and wildlife?

### **Ever Eat A Dirt Sandwich?**

Have you ever eaten ice cream through a straw? How would you eat sand and grit if you had no teeth? Thank goodness we have spoons and ice cream cones to eat frozen treats and I'm glad that we do not have to eat sand and grit. These are a couple of problems that face our plants. Plants may not have to eat ice cream through a straw, but they are faced with trying to eat minerals, many of which are in rock form, without the aid of teeth and chewing. Everything we eat has nutrients. Nutrients are needed for strong bones and teeth, strong heart and blood vessels, and to help your brain and nerves work. These nutrients come from the food we eat. Soils need to be healthy to grow large quantities of plants and animals need plants to grow strong.

Plant roots take in most of their food, in the form of nutrients, through tubes much like we would drink through a straw. Most of these nutrients are minerals. Most minerals are in solid form much like rocks and sand. But how do plants get gritty, sandy minerals to flow through a straw? Well, it is like us making Kool-Aid. If we take the sandy sugar, with the powdery flavor, and mix it with water, we get a very tasty treat that can easily be drunk through a straw. Most soils have a large supply of nutrients in them, and they get taken up by plants when plants absorb water. This is how the nutrients get into the plants. The nutrients are naturally found in the soil or they can be added

> through fertilization. Nutrients get into the soil many ways: from decomposed animal waste and dead plants, the

atmosphere, weathering of rocks, and bacteria conversions. This process needs good water to work. When nutrients dissolve in the water, the plants can absorb them Nutrients get into the soil many ways: from decomposed animal waste and dead plants, the atmosphere, weathering of rocks, and bacteria conversions.

through the tubes in their roots much like we would use a straw. When soils are used to grow foods, the soils need to be kept healthy and have adequate water, as a lot of nutrients are taken up by plants and not replaced. Nutrients need to be added to replace what is taken out, and the best way to do this is test the soil to see what nutrients are needed and at what levels are needed to be added back to the soil. Too many nutrients and it pollutes the streams and groundwater, and too little, the plants may die.

All plants need nutrients and water to grow and reproduce. When animals or people eat plants, we get the nutrients that the plants took from the soil. The soil serves as a reservoir for holding the nutrients and water, as well as, providing a base to hold the plant roots in place. When plants are eaten by animals and humans, the animals and humans get all the nutritional benefits from this process. Plants can get the nutrients from the soil water solution and convert them into nutritious green leafy food for cattle. Most soils have a large supply of nutrients in them, and they can be recycled. Cows eat the grass and cows make "cow pies." "Cow pies" feed the soil, the soil feeds the grass, and the grass feeds the cows. Cattle can take the energy from eating the plants and turn them into milk and meat. From that we can drink milk, make butter, cheese, and ice cream. We even get steaks,

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#### **EVER EAT A DIRT SANDWICH?**

hamburgers, and hot dogs from the meat. Did you ever stop to think that our cookout treats of hot dogs and ice cream are all from minerals from the soil? Can you think of other plants and animals in food chains?

What about people? Do we fit into this food chain? We sure do. Did you ever eat dirt? Let's take a look. Healthy bodies need lots of nutrients. That is why we need to eat a variety of foods. Let's look at what makes a hamburger and where did it come from? Everything in that juicy burger came from the soil. The beef and the cheese came from cows that ate the plants. The tomatoes, onions, and lettuce were grown in the soil. The wheat made the bread for the bun and even the sesame seeds came from the soil. Oh, and the ketchup, mustard, and French fries came from tomatoes, mustard seeds, and potatoes. So, we can say that we did eat the dirt, or at least the minerals and nutrients that came from the soil because we are all a part of the food chain. We need to always remember that if we are going to grow and be strong, we need to let our soils be healthy and strong, our water clear and clean, because we really are what we eat!

## HELPING HANDS

#### Conservation Offices Ready to Advise Farmers, Urban Residents on Land Use

For more than 70 years, Kentucky's 121 conservation districts have been working to conserve and develop the natural resources of the commonwealth. These districts are a subdivision of Kentucky state government, and each is governed by a locally elected seven-person board of supervisors. The supervisors plan and carry out conservation programs aimed at helping communities grow and at the same time protect their natural resources.

#### **Everyone Benefits**

Helping landowners and managers plan and carry out permanent conservation practices on their land is the backbone of the conservation district program. These programs involve many areas of natural resources including: water quality, forestry, fish and wildlife, and, to a limited degree, air pollution.

Conservation district supervisors promote soil-saving practices such as no-till farming, which helps protect streams from sediment and pesticides. Using notill practices lowers the number of times that farm equipment is used, which saves nearly two million gallons of petroleum products in Kentucky annually.

#### The Urban Focus

Even in urban areas, conservation districts have agricultural customers. But they also assist units of government and community groups, to protect the environment and improve the standard of living for the people they represent in urban and suburban areas.

Urban conservation focuses on bringing the community together to look at and discuss the impact of growth and development in an area. Generally, natural resource problems in urban or suburban settings affect many people in a community. A development's erosion problem can affect all the immediate downstream property owners in an adjacent subdivision or run tons of sediment into a public park.

Soil erosion can threaten both water quality and the delicate balance of the ecosystem. Your local conservation district is involved in numerous educational programs to ensure the conservation and wise use of our natural resources. The district is always ready to assist all landowners and land users in the development of conservation programs.

## Animals Are What They Eat ...and good soil means good food \_\_\_\_\_

Healthy wildlife depends on healthy soil. Scientists can tell a lot about an area's soil quality by looking at the size, babies, fur quality, health, or antler size of animals that live there.

Wildlife is more abundant in areas with fertile, healthy soil, which grows more food for them. Herbivores that eat plants are more varied and healthier. Carnivores that eat the herbivores are also healthier. Nutrientrich soils produce bigger and stronger animals.

Studies have shown a connection between soil fertility and the litter size in animals such as rabbits and squirrels.

Although animals are affected by the available food, if there are soil problems, wild animals adapt different behaviors to avoid those problems.

When changes such as erosion occur rapidly, animals have trouble adapting. Sediment in streams depletes the oxygen supply, killing fish and other aquatic organisms and muddying the water for other wildlife.

### **START AN ENVIROTHON TEAM!**

If you really dig environmental issues; grab your like-minded friends and form an Envirothon team. The statewide competition allows high school students to team up on a series of hands-on outdoor contests to solve environmental problems and test their knowledge of natural resources.

The event is made up of a team of five high school students competing in five different areas: aquatics, forestry, soils, wildlife, and a current issue. At each site, students will use their knowledge to participate in hands-on activities to complete a test.

The Kentucky Envirothon consists of two regional competitions. Top scoring teams from each of the regional competitions will move on to the state competition. The regional competitions are held in April of each year, and the state competition is held in May. Registration for next year's competition will begin in December.

CONTACT YOUR LOCAL CONSERVATION DISTRICT FOR DETAILS.



Plants can remove 400 to 2,000 pounds of water from the soil for every two pounds of plant material.



#### TAKE A HIKE

2022 Conservation Writing and Jim Claypool Art Contest

### Importance of Forest Soils to Deciduous Forested Ecosystems

Written by: Pam Snyder Forest Management Chief Kentucky Division of Forestry

A forested ecosystem can be best described as an ecological community home to various flora and fauna distinctive to an area covered with trees and has existing multiple canopy layers. Forested ecosystems are broadly divided into three major types (tropical, temperate, and boreal) based on the climate conditions and other biotic and abiotic factors. A forested ecosystem provides oxygen for humans to breathe and balances carbon dioxide in the atmosphere (carbon sequestration). In addition, it can act as a natural forested buffer to prevent soil erosion and filter rainfall to enhance water quality.

Temperate forested ecosystems are found mostly in North America, Europe, and Japan. They receive between 30-60 inches of rainfall per year and encounter all four seasonal changes. Winters can reach below freezing and summer conditions are often hot and humid. Temperate forested ecosystems are divided further into deciduous and coniferous forest types. Various deciduous forests types cover approximately 49% of the Commonwealth of Kentucky. These are the Mixed Mesophytic Forest Region, Oak-Hickory Forest Region, and the Southern Floodplain Forest Region.

The Mixed Mesophytic Forest Region, which includes the eastern third of Kentucky, is characterized by a rich overstory dominated with deciduous tree species including American beech, cucumber magnolia, oaks (northern red and white), sugar maple, yellow-poplar, white ash, and the evergreen eastern hemlock. Big-leaf and umbrella magnolias are often present in the understory. White basswood and yellow buckeye serve as indicators of this forest type due to their consistent presence.

The Oak-Hickory Forest Region includes the greater part of Kentucky from the Appalachian Plateau in the east to the uplands of the Jackson Purchase. The forests are characterized by a wide number of overstory species, especially oaks (black, northern red, southern red, and white) and hickories (bitternut, pignut, and shagbark), but also American elm, American basswood, black cherry, black walnut, and white ash. Because of the limestone present in this area, species such as bur oak, chinkapin oak, Kentucky coffeetree, and rock elm are found in this forest type.

The Southern Floodplain Forest Region occupies only the small region along the floodplains of the Mississippi River and its tributaries. Amidst the few extensive forests in this region, bottomland hardwoods including oaks (cherrybark, overcup, swamp chestnut, and willow), sugarberry, and sweetgum are common. Scattered swamp communities dominated by bald cypress and water tupelo are found in this region.

Forest soils are substantial contributors to a forested ecosystem and its forest health. The locations of soil types within Kentucky are shown in the figure below. Soils in southern and eastern forests of Kentucky are primarily classified as Ultisols, which are often too nutrient poor to sustain agricultural production, but are well suited for forestry because of the leaf litter and woody detritus nutrient input. Alfisols are the primary soils in the northern and western forests of Kentucky. They are highly fertile, naturally forested soils that are often cultivated for agriculture, but also support broadleaf deciduous and mixed evergreen forests. The ability of the soil to hold nutrients tends to be greatest in the Bluegrass and Pennyroyal regions, and lowest in the Western and Western Coalfield regions. Limestonederived soils tend to support more plant species and be more productive than sandstone soils. Most soils in Kentucky are fairly compacted indicating that root growth and exchange of water and air may be difficult

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in much of the state (Kentucky Forest Action Plan – 2020-Turner et al., 2004).

Because a forested ecosystem consists of aboveground and belowground components, the relationship between soil health and forest health is interactive. Trees depend on the soil for stability, nutrient cycling and intake, and water. Soils are composed of numerous components including organic and inorganic materials, microorganisms such as bacteria and fungi, insects, and burrowing animals, which are all affected by the growth of roots, organic inputs, and the transpiration

SOIL EROSION

Think about a freshly tilled field just prior to planting, where there are no plants to be seen. Only the soil is visible. Now imagine a hard rain on that freshly tilled field. The rain hits the soil fast and hard causing a splash with each drop. Pounding of the drops on the soil causes the particles to break apart, making them vulnerable to erosion, which is the movement of soil from place to place.

There are four types of erosion. One is wind erosion, which causes the soil to be blown to a different place, like in the Dust Bowl. The next type is rill erosion, which is caused by moving water forming small channels in the soil. Another type of erosion is sheet erosion, which is the movement of a layer of soil by water. The last type of erosion is gully erosion, which is the movement of soil caused by running water which also forms channels in the soil. Gully erosion is a lot like rill erosion, except that gully erosion forms large, deep channels in the soil.

A lot of soil erosion can be prevented by maintaining a cover on the soil consisting of plants or crop residue. Just like us, soil needs a cover. Think of it like a blanket for the soil. The plants and residue help to cushion the rain drops as they fall onto the soil. Many farmers use specialized equipment, like no-till grain drills to plant their crops into fields that maintain a cover. These drills plant the seed into a shallow channel in the soil. Minimal or no tillage is necessary for this type of farming, which helps prevent soil erosion. of water associated with the surface vegetation. As such, changes to the forest surface have effects on the soil and the soils have long-term effects on the forests above. Thus, differences in soil moisture levels have been found to affect the rate of soil nitrogen cycling, and thus the productivity of the site. Therefore, soil health is an important factor to consider when evaluating forest health (Kentucky Forest Action Plan 2020).

#### Careers in the World of Soil

Soils play an important role in the quality of life around the world. Healthy soils help reduce negative impacts on water resources, maintain healthy crops, and can even capture carbon from our atmosphere. Many career opportunities are available in soil science. Soil scientists are needed to work with people to assess the productive capabilities of their land. This includes the treatment of the land, natural resource management, crop advising, and conservation practices needed for efficient production and maintenance of the productive capacity of soil. Job opportunities for soil scientists are many and varied, including:

- Cooperative Extension Service
- Teaching in high schools, colleges, and/or universities
- Natural Resources Conservation
  Service
- United States Department of Agriculture
- State Agencies
- Various agribusinesses
- Consulting (agronomic or environmental)
- Landscape Design or Architecture

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### **RAIN GARDENS**

Rain gardens are becoming increasingly popular as a natural way to use storm water as a resource rather than a waste. When storm water runs across hard surfaces, it picks up whatever is in its way – oil, salt, fertilizer, pesticides, pet waste, transportation chemicals, sediment, and litter – and eventually carries it into a storm drain. Unlike sewer pipes, which carry household wastewater to a treatment center, storm water pipes empty directly into streams, rivers and lakes. Too much stormwater from developed areas can erode stream banks, pollute drinking water sources, and harm aquatic life.

Studies have shown that up to 70 percent of the pollution in our streams, rivers and lakes is carried there by stormwater. Rain gardens can cut down on the amount of pollution reaching creeks and streams by up to 30 percent. A rain garden is a natural or dug shallow depression designed to capture and soak up runoff from hard surfaces such as a roof, sidewalk, or driveway. The plants, mulch, and soil in a rain garden combine natural physical, biological, and chemical processes to remove pollutants from runoff. It serves as a small holding pond in which potentially harmful pollutants are broken up and made harmless as the water filters into the ground.

Native plants are the best choice for a rain garden since they generally do not require fertilizer and are more tolerant of the local climate, soil and water conditions. Their deep root systems enhance infiltration and moisture redistribution. The plants also return oxygen and water vapor into the atmosphere through transpiration. Rain gardens provide other benefits as well. They can provide valuable habitat for birds, butterflies, and many beneficial insects while enhancing the beauty of the landscape. Rain gardens also help protect from flooding and drainage problems on the property and surrounding area.

An effective rain garden depends on water infiltrating into the soil of the garden. Water should stand in a rain garden no longer than 24 hours after the rain stops. Mosquitos cannot complete their breeding cycle in this length of time, so the rain garden should not increase mosquito populations at all.

#### SOIL ON THE LAND GOOD, SOIL IN THE WATER BAD

On land, soils serve many functions like filtering water and holding nutrients for plants. Once soil washes off the land and erodes from stream banks it can become pollution. In fact, sediment is the biggest contributor to nonpoint source pollution

in Kentucky. Nonpoint source pollution results from runoff and comes from many different sources.

How can sediment be pollution? Look at streams and rivers after a rain. What color are they? Usually brown from the sediments turning rivers to mud. Muddy water isn't just ugly, it contains pollution such as excess nutrients. Sediments cloud the water making it difficult for organisms that live there to see, breathe, and feed. Some organisms, like mussels that live on the bottom of rivers, can be buried in sediment.

Something else to consider is the cost. Soil washed into streams is precious fertile land lost that we need to grow crops. Sediments from eroding stream banks damage homes and other structures. Sediments fill ponds and lakes and increase the cost of treating water for drinking.



### THE LOWDOWN ON SOIL – A New Layer of Life Emerges from a Rocky Beginning

It took Mother Nature thousands of years to make soil. Forces such as the sun, time, wind, water, temperature, and gravity took turns blasting rocky material. Then when it was combined with decaying leaves, plant roots, twigs and dead organisms – voilà, we get soil!

#### The Forces are with Us

After nature's forces are at work for a while, big changes occur in the earth. Natural erosion, for example, can produce such breathtaking features as the Red River Gorge and Natural Bridge in Kentucky. However, other results, while less spectacular, are more important to us. For example, the breaking of rock into smaller particles of sand, silt and clay, produces the soil that we need and depend on.

Life and death are also key factors in the process. Live mosses attach to rock and plant roots grow with incredible force toward water and nutrients. Earthworms rearrange particles – just like farmers and builders do with their plows, shovels, and bulldozers – moving and breaking down the rock and fragments. As nutrients absorbed by living things are returned to the soil, the surface layers are enriched for another generation of life.

#### **On the Move**

Many soil materials stay where they're formed and are similar in size. These are usually smaller pieces of the rock that lie below. If you know something about the rocks of an area, you probably know something about the soils. For example, the limestone in the Bluegrass area is rich in calcium and phosphorus. This lets us know the soils in this area will probably be rich in these elements as well.

On the other hand, some soils travel, mixing with other (Continued on next page)



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### **THE LOWDOWN ON SOIL –** A New Layer of Life Emerges from a Rocky Beginning

elements along the way. When Daniel Boone climbed Pilot Knob to look out over Kentucky, he crossed a zone of sandy soil that had slid down from the slope from a zone of conglomerate rock. That was the soil that had formed near the top of the Knob. You'll find the same situation on the sides and bottoms of many slopes,



where the soil is the product of rocks and particles from higher up the slope.

#### **Soil Erosion**

Soil particles have tiny spaces between them that allow water to trickle down into all of the soil's layers. When it rains, these spaces fill with water, and the excess water (called surface water) runs over the top of the soil. When water causes soil to move, that's called erosion.

Soil erosion is a naturally occurring process. It becomes a problem when human activity (land clearance, agriculture, forestry, construction, surface mining, and urbanization) causes it to happen much faster than under natural conditions. Man-made or accelerated soil erosion started in Kentucky soon after the first settlers arrived. Trees were cut and burned to make a place to grow crops.

In time, much of the fertile topsoil nature provided was washed away from sloping crop fields. As gullies ate through clay or rock, farmers moved to new fields. And so the process continued. No one in those days knew about soil conservation, so millions of tons of soil were lost.

#### Wind, Water, and Woes

Erosion stems mostly from wind and water. Erosion caused by water is called sheet, rill, gully, or stream bank erosion, depending on the type of movement that occurs. The amount of soil that can be carried away is influenced by two factors:

**SPEED –** the faster the wind and water move, the more soil they erode.

**PLANT COVER -** without protective plants, the wind and water can do much more damage.

#### Plants prevent soil erosion by:

- Slowing down water as it flows over the land (runoff), allowing much of the rain to soak into the ground.
- Holding the soil in position and preventing it from being washed away
- Breaking the impact of a rain- drop before it hits the soil, thus reducing its ability to erode.
- Slowing down the flow of water in wetlands and on riverbanks, and using the plants' roots to bind the soil.

### **FARMING FOR THE MICROBES**

Estimates vary, but if you could weigh all the organisms in the top six inches of soil on an acre of land, you'd find they would weigh between 2,500 pounds to more than 5,000 pounds, depending on how healthy the soil is. That is a LOT of life. What these low-lying creatures lack in size, they make up for in numbers. Consider bacteria, the soil microbes with the highest numbers, for example. You can fit 40 million of them on the end of one pin. In fact, there are more soil microorganisms (microbes for short) in a teaspoonful of soil than there are people on the earth.

For those producers who understand the benefits of healthy, living soil, farming centers around feeding the organisms that build healthy soils. These farmers understand that tillage, the turning of the soil that has been the standard for growing crops for years and years, is disruptive to soil microbes and destructive to the soil system.

Instead, they disturb the soil as little as possible. And they grow a diversity of living plants in the soil as much of the time as practical, covering the soil and offering food to soil microbes through living roots. Those soil organisms, in turn, cycle nutrients back to the plant, allowing it to grow and flourish.

It's a natural symbiotic system that leads to healthy soils and more sustainable and profitable agriculture.

### KEEP IT COVERED

If you're trying to make your soil healthier, you shouldn't see it very often. In other words, soil should always be covered by growing plants, their residues, or a combination of the two. Keeping the soil covered all the time makes perfect sense when you realize that healthy soils are full of life and that the microorganisms living in the soil have the same needs as other living creatures. They need food and

cover to survive.

When you have a vegetative cover on the soil, especially a living cover, you offer those microbes both food and shelter. Some scientists say when you till the soil and remove crop residues, the effects are as devastating to soil microbes as a combination of an earthquake, hurricane, tornado, and forest fire would be to humans.

From the perspective of the living creatures within the soil, a tillage tool like a chisel shank has the effect of ripping the ground like an earthquake; removing residue is like a tornado ripping the roof off a house; uncovered soil can be drenched and whisked away by gushing water and wind like that of a hurricane—or scorched in the hot sun like an out-of-control fire. About 85% of carbon dioxide (the air you breathe out) in our atmosphere comes from the action of soil microorganisms (small living things) feeding on the organic matter in the soil.

FUN FACT!

Did you know that some plants can actually clean up pollution? Bulrushes and cattails can draw polluting heavy metals such as arsenic, copper, and zinc out of soil up through their roots.

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### THE DUST BOWL and Soil Conservation

The term "The Dust Bowl" refers to a period of time that occurred primarily in the 1930's in the central area of the United States commonly referred to as the Great Plains. This time period was characterized by large dust storms that significantly impacted over 100 million acres in both the central United States and Canada. These storms displaced thousands of farming families and negatively affected the economy of the entire nation for years afterward.

The Dust Bowl was caused by several factors, including a very severe, naturally occurring drought that struck the nation at this time. Also, people did not have a good understanding of conservation and its effects on the land. Farming technology was rapidly progressing in the 30's. Better machines allowed people to clear more land faster, to plow deeper, and to farm areas that they may not have farmed before.

> As the drought worsened, it became drier, and more vegetation was lost. As more vegetation was lost, more soil was exposed. It was a difficult cycle that once started, only continued to worsen. As the drought conditions worsened, the exposed soil was dry. With no plants to retain moisture and roots to hold the soil in place, it would simply dry completely out, turn into dust, and blow away when strong, dry winds would occur. These dust storms were referred to as "black blizzards," and would completely remove soil from some areas, while depositing feet of dust in areas

downwind. These storms were so strong, and the dust so fine, that some of it was carried all the way to east coast, over 1,000 miles away.

So, how did we break this cycle? Obviously, nature had to help some when the rain slowly started to return. But the human response was much more important. Soon after this disaster, people realized that they had to learn from this, and local counties in these affected areas began to form local conservation districts. These districts were developed to discuss, research, educate, and help local landowners to farm in new ways to avoid a dust bowl from happening again. These districts also worked with landowners to restore the natural balance that was lost during the Dust Bowl. Conservation districts then began to spread to all areas in our nation that had a farming community.

By the mid 1950's, each Kentucky county had its own local conservation district. These districts were charged with helping their communities grow while protecting and conserving their natural resources. From the lessons learned from the Dust Bowl many years ago, today our conservation districts help landowners in various ways. The erosion that happens in Kentucky is typically from too much water, instead of too little like during the Dust Bowl. Many of the Best Management Practices (BMPs) that are offered by the state and federal governments through our conservation districts are to prevent the erosion of soil into our waterways. Some examples of these are no-till planting, strip cropping, rotational grazing, planting vegetative buffers along streams, etc. The conservation districts offer help to farmers in planning these practices, providing equipment to rent, hosting educational programs, and other similar activities.

While we have come a long way in this effort, there is still work to be done. We have not resolved all issues with conserving our important natural resources, and we continue to learn more effective techniques to try to work with nature. Even with all the lessons learned



2022 Conservation Writing and Jim Clavpool Art Contest

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#### **THE DUST BOWL and Soil Conservation**

from the Dust Bowl, we have seen dust storms on the increase in the Great Plains in recent years. Studies have even shown that this increase in dust storms could be affecting things like glaciers melting at a fast rate in the Rocky Mountains (the dust is dark in color, and when it is deposited on top of the ice, it absorbs sunlight, thus increasing temperature and making the ice melt faster). Dust from these storms also decreases

visibility. On October 29, 2013, there was a traffic pileup on an interstate in Arizona in which 19 vehicles were involved due to a dust storm and decreased visibility. Examples such as this show that, even though we have made great progress, we still have work to do with our conservation districts helping landowners resolve these natural resource issues.

### SOIL HORIZONS

A soil horizon is a layer of soil. A soil profile has five horizons: O, A, B, C and R. Only well-developed or healthy soil has all of these layers.

- **(Usually about 2 inches deep)** is the organic layer, present when forest litter is decomposing on the surface. Forest litter (fallen leaves, twigs, limbs, and decomposing plants and animals on the forest floor) cushions the blow of falling raindrops, slows runoff, and filters out pollutants. The humus (residue formed by these decomposing materials) is full of important nutrients.
- A

(About 10 inches deep) is the topsoil layer. If plants and animals are in the soil, topsoil is formed. Minerals dissolve or leach here as water passes through. This layer is usually the most productive – plowed and planted for crops. Tree roots help hold the soil in place and filter pollutants from the water passing through. When the roots die, air, and water can take over their spaces. Tree roots also break up rock, so it can weather into new soil. Other plants (grasses, mosses, and shrubs) also hold soil in place and help filter out contaminants.

- **B** (About 30 inches deep) is the subsoil layer where most of the minerals collect from the topsoil. Creatures on the move (burrowing animals, rodents, insects and earthworms) create air and water spaces in the soil and help mix the soil. When these creatures die, they get "recycled" into organic material to enrich the soil. Microbes are examples of the many types of microscopic plants and animals (such as bacteria, algae, fungi and protozoa) that live in the soil. They break down organic matter into simpler nutrients so plants can grow.
- **C** (About 48 inches deep) is a transition layer between soil and the minerals that will eventually become soil. Partially disintegrated mineral particles (parent material) are found here.
- **(About 60 inches deep)** is the bedrock layer (the solid layer of rock on top of or beneath the soil). Over a very long period of time, this rock fractures and weathers, making new soil.

### **2022 TAKE A HIKE** Navigating the trail

Conservation Writing and Jim Claypool Art Contest | RULES

#### **STATE WINNERS:**

First: \$250; Second: \$150; Third: \$50

#### REGIONAL WINNERS:

\$50

#### **COUNTY LEVEL WINNERS:**

\$25

\* State/Regional winners will receive a personalized certificate. County winners that win regional or state awards will only receive one check for the top prize.

#### RULES

- 1. Kentucky students grades 6-12 are eligible to compete in the writing contest. Students up to grade 5 may compete in the art contest.
- 2. A student may not enter both the art contest and the writing contest during the same contest.
- 3. An entry must be created by one and only one student. Any entry submitted by more than one student will be disqualified.
- 4. All entries become the property of the contest sponsors. The decisions of the judges at all levels of competition are final.
- 5. Top three writing entries and/or artworks from your school must be submitted to your local county conservation district by Dec. 2, 2022.
- 6. ARTWORK: Student entries shall be 8 ½" X 11". Entries may be digital or submitted on any color or thickness of art board (poster board, mat board, etc.) or may be on art paper, which is firmly affixed to art board. All artwork must be two-dimensional (2-D). Three-dimensional (3-D) artwork will not be accepted. Artwork may be rendered in any medium: pencil, ink, charcoal, pastel, crayon, paint, photography, etc. Mixed media and collage work is acceptable as long as all pieces are securely glued to the surface of the work. All entries must convey at a glance an accurate understanding of the information provided in the tabloid, the theme of the competition, and persuade the viewers of the need for good soil conservation practices. All entries must be the original work of the student.
- 7. WRITING: Entry may not exceed 800 words and must be written in ink or typed on one side of paper only. No photographs or artwork may be included with the written work. The written entry should demonstrate an accurate understanding of the information provided in the tabloid and inform the reader about soil conservation and persuade the reader to appreciate how farmers and conservation districts are helping to implement sound soil conservation practices. Students should write from the perspective of an informed writer to a less informed reader and may be in the form of a letter, article, editorial or speech. The work should be from the student author and avoid plagiarism from this source or other sources. External sources should be reputable and cited appropriately.
- 8. The entry form to the right must be completed and attached to your entry.

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#### POINT SYSTEM FOR ART

- 30 points: Composition/Creativity/Craftsmanship (layout, originality, and quality of work, such as neatness)
- 20 points: Language/Correctness (word choice, usage, spelling, punctuation, capitalization)

#### POINT SYSTEM FOR WRITING

- 30 points: Purpose/Audience (establishes and maintains a purpose, communicates with audience, employs a suitable tone)
- 20 points: Organization (logical order, coherence, transition organizational signals)
- 20 points: Idea Development/Support and Evidence of Research (student's original work shows sources of research)
- 30 points: Correctness (spelling, punctuation, capitalization), Language (word choice, usage), Sentences (varied in structure and length, constructed effectively, complete and correct)

#### TAKE A HIKE ENTRY FORM

Conservation Writing and Jim Claypool Art Contest
Name (Miss, Mr)
Parent's Name
Home Address
CityZip
Home Phone ( )
Age Grade Teacher
County
School
School Phone ( )
□ I hereby certify that I have read the rules and helpful hints and this entry is the original work of:
Student Signature
Parent/Guardian Signature (required)
Teacher or Principal Signature (required)