ASPEN RESTORATION: BUCK AND POLE FENCE SPECIFICATIONS

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This document describes one method for constructing buck and pole fences or exclosures. It includes information on the materials, equipment, personnel and NEPA documentation needed (for Federal Agencies).

The Need

On many areas of public land, the population and density of large herbivores, both domestic and wild, are often higher than what the ecosystem evolved to provide for. In areas such as this, hardwood species are often browsed to the point where reproduction and spread are greatly reduced. In the Blue Mountains of eastern Oregon, quaking aspen, black cottonwood, mountain mahogany, bitterbrush, and a variety of willows, are in decline over much of their range.

Stands of quaking aspen and black cottonwood provide unique habitat for a variety of wildlife species and birds. They also benefit fish by providing shade, streambank stability, and nutrients at time of leaf fall. Currently, many of these stands exist as overmature, decadent individuals with little or no healthy reproduction present in the understory.

One Solution

One way aspen regenerates is through root suckering. Aspen roots contain numerous primordia, analogous to tiny buds. These buds send up new shoots that will eventually grow into trees if unbrowsed. Constructing fences, or "large ungulate exclosures", around aspen stands has proven successful in preventing browse from large herbivores. Once young trees have achieved at least 4 inches in diameter and over 5 feet in height, the fences may be removed, relocated, or reconfigured to increase the spread and survival of new plants. However, young stands that are unprotected will continue to have their new suckers browsed by large ungulates.

What is Buck and Pole?

Buck and pole is best described as a three-dimensional, A-frame, rail fence. A section of buck and pole fence consists of two A-frame "bucks", spaced an average of 10 feet apart, with 4-7 "poles" attached perpendicular to the standing A-frames. The number of poles or rails needed for each section depends on how tall you need the fence to be. If the intent is to exclude only cattle or sheep, then a 4-rail fence, 4-feet in height, will be sufficient. To exclude big game, such as deer and elk, a taller and tighter fence is needed. This requires an exclosure at least 6 to 7 feet tall, using 6-7 rails spaced no further than 12-inches apart. A two-dimensional fence constructed of wire would need to be 9 to 10 feet tall to be "deer proof". However, the 3-dimensional configuration of the buck and pole design discourages big game from trying to jump over the fence.

Why use Buck and Pole Fences?

Buck and pole fencing is not cheap. In 1995, the average cost per foot was around $4.00. The same fence in 2001 would cost around $6.00 per foot. However, for big game exclosures, buck and pole fences can be more economical than New Zealand woven-wire or high tensile wire fences. Our costs were based on having a good supply of local native lodgepole pine at our disposal.

Buck and pole fences are easy, if physically demanding, to build. Since the fence sits on top of the ground, there is no need to dig post holes. This is particularly helpful when constructing fences on shallow, rocky soil.

Buck and pole fences are friendly to other species of wildlife. Woven wire fences prevent access of many non-target species into aspen stands. The relatively open design of buck and pole fences allows most other species to pass under or over the fence. Wire fences also exclude people. Buck and pole fences are easy to climb over. It is usually not necessary to exclude people to have successful regeneration.

Buck and pole fences are pleasing to the eye and appear far less intrusive on the landscape than wire fences. Over time, buck and pole fences naturally breakdown and decay on site.

Project Planning

There are a number of things to consider when planning a buck and pole exclosure:

1. site selection
2. materials and equipment
3. labor
4. contracting
5. funding
6. NEPA (for federal agencies)

1. Site Selection

   a. Accessibility

   Locate sites near roads when possible. Depending on total fence perimeter, a great deal of material will need to be transported to the worksite.

   b. Stand Priority

   Survey stands and prioritize treatment needs. A high priority stand may be one that is small and decadent, with little successful regeneration. You may choose stands that are genetically unique or highly visible.

c. Size of Fence

Stands that require large fences may be too costly to construct. It may be more economical to construct a series of small fences over several years. This approach is actually advantageous since animals tend to walk around small exclosures but will often try to break through larger fences. This is especially true in the winter when animals must expend greater stores of energy to walk around a barrier in deep snow.

2. Materials and equipment

Post and pole material is available commercially. However, all of the buck and pole fences built to date on the North Fork John Day Ranger District have been constructed from lodgepole pine growing on the District. Posts and poles can be green or dry, but should be sound and free of rot. There is no need to peel the poles or use treated poles. We have experimented with different lengths and diameters and the following seem to work the best:

- **Posts**--The posts for the A-frames should be 5 to 8 inches in diameter and 7 to 8 feet long, depending on desired height and the number of rails you plan to use.

- **Poles--**The cross pieces for the bottom of the A-frames should be 2 to 3 inches in diameter and 6 feet long.

- **Rails**--Rails should be 3 to 5 inches in diameter and 12 feet long. Rails could be made as long as 15 feet, allowing for 1 foot of overhang on each end. This would leave 13 feet of rail supported between the A-frames. If the spacing between A-frames is much greater, there will be considerable sagging mid-rail, especially if you use green poles. The advantage of using longer rails is a reduction in total number of A-frames needed around the fence perimeter.

The number of posts, poles, and rails needed is easily calculated. When using 12-foot rails, the spacing between A-frames is 10 feet. Using 6-7 rails and 1 6-foot pole per section, the calculations would be as follows:

- 2 - 7-foot posts (A-frame)
- 1 - 6-foot pole (cross-piece for A-frame)
- 6 (7) - 12-foot rails
- 0.5 - 12-foot rail for support on inside of fence, every other section, is optional

Extrapolating these figures for 100 feet of fence:

- 20 - 7-foot posts
- 10 - 6-foot poles
- 60 (70) - 12-foot rails
- 5 - 12-foot rails (optional)

Three sizes of nails are needed to construct the fence:

- 60D common nails - Used to nail rails on fence
- 70D-80D spikes - Used to nail posts for A-frames together, 70D spikes are often used for nailing larger diameter rails to the fence.

A 750-foot fence built in 1994 used the following:

- 1.5 boxes (75 pounds) - 60D common nails
- 1.0 box (50 pounds) - 70D spikes (editors note: we use larger diameter rails than were used in 1994. I would increase the number of 70D spikes to 1.5 boxes and add .5 boxes of 80D spikes).

Equipment:

- 24 to 28 ounce, steel-neck, waffleboard-face framing hammers
- Small, "one hand" sledgehammers (for driving spikes into A-frames)
- Quality leather or cordura nail belts
- Plywood and 2 x 4 lumber for constructing A-frame pattern
- Chainsaws, long and short bars (for clearing fenceline and notching posts for A-frames)
- 4-wheel drive or 6-wheel drive ATV with heavy-duty, 6 to 8 foot trailer
- 2-ton stake-side or similar vehicle for hauling post and poles
- Crew vehicles
- Safety goggles
- Leather gloves

3. Labor

The construction of buck and pole fences is a labor-intensive project. If you are planning a small project, consider using volunteer groups such as scouts, sportsman's groups, or environmental organizations. A buck and pole exclosure is a good "on-the-ground" project that allows people to see results and enjoy a sense of accomplishment. For larger projects, it is more efficient to hire seasonal employees. At least some of these employees need to have or gain experience in the use of chainsaws and all-terrain-vehicles. It is most efficient to have a crew of no fewer than four employees, six to ten crewmembers is optimum.

a. Pole Cutting

Cutting and transporting building materials to the worksite is the most labor-intensive component of the process. At this point you need to determine which method would be most efficient and cost effective for you. You may purchase posts and poles commercially and have them delivered to the site, pay a contractor to cut materials from your local source and deliver it to the jobsite, or cut it and deliver it yourself. We have found the latter to be most cost effective in terms of price per piece, but probably not the most efficient. The more time a crew spends cutting material, the less time they have to construct fence line. An experienced crew of 8 to 10 people can usually cut enough material in a day to build 300 to 500 feet of fence. Government field units that employ large fire crews can sometimes take advantage of that resource by bringing them on prior

to their scheduled field season. Cutting posts and poles gives a fire crew an opportunity to work on their chainsaw skills while providing you with fencing materials. The following division of labor has been the most efficient for us:

- 2-3 teams of 3-person saw crews consisting of someone to measure and mark the pieces, a faller/bucker, and a swamper/pole mover.
- 1-2 teams of 2 people loading truck(s).
- 1-2 truck driver(s).
- 1-2 teams of 2 people unloading poles at the worksite.

b. Fence Building

An experienced crew of 6 people can construct an average of 300-500 feet of fence in a day (depending on length of shift and distance to worksite). We have used crews ranging in size from 4 to 10 people. A crew of 6 to 8 people is optimum when building fences over 1000 feet in length. This allows for the following division of labor:

- 1 person loading rails/A-frames on ATV trailer.
- 1 person loading rails/ A-frames and operating ATV.
- 2 people erecting A-frames. We usually have the entire crew spend a day constructing the A-frames.
- 1-2 teams of 2 people nailing on rails.

For large fences it is more efficient to have two stockpiles of materials, one at either end of the proposed fence. Having a team, equipped with an ATV, moving materials from each pile decreases the lag time between material deliveries.

4. Contracting

We have not used contractors for construction of buck and pole fences because we felt it would be cost-prohibitive. This is probably not true in every situation. For several years we did contract the cutting and delivery of post and poles. In recent years, the bid-prices were cost prohibitive and we were forced to do the cutting ourselves. This was probably due to the small number of contractors in our remote area. Our jobs have not been large enough to attract contractors in from any great distance.

A neighboring district has contracted with a youth corps group to build a single, large fence. They were very pleased with the results. The group camped out on site, was well disciplined and highly motivated, and had excellent supervision. The cost for their labor was $6,000 per week. The materials were provided by the District.

5. Funding

The federal government has provided very little appropriated monies for native plant restoration. In the past, most of our aspen fencing projects were funded with KV wildlife funds. Now that the great KV pool of money has all but dried up, we have had to explore more creative funding opportunities. Today all of our projects are challenge-cost share funded. The government matching funds have come largely from various wildlife program dollars for structural improvements to habitat. We have also tapped into special funding opportunities such as money set aside specifically for aspen projects in 1999, and the Demonstration Projects funded from 2000-20002 in the Blue Mountains. Our partner groups include sportsman's organizations such as Rocky Mountain Elk Foundation, the Blue Mountain Elk Initiative, the Mule Deer Foundation, Ruffed Grouse Society, and state or local organizations, to name a few. We are also trying to engage the support of local environmental and recreational groups. Aspen restoration benefits fish, wildlife and riparian restoration. The potential partners are numerous and varied.

A great deal of work can be accomplished with the help of volunteers. Aspen fencing projects are great opportunities to educate students, however, you would need to target high school or college-aged students due to the physical intensity of the work. Sportsman groups often enjoy spending a weekend building a fence--especially if they can place a nice dedication plaque nearby to give their group the credit!

6. NEPA

Government projects require the appropriate documentation and analysis mandated by the National Environmental Policy Act. The cost of this endeavor needs to be included in your cost analysis as well. You also need to allow the appropriate amount of lead time to accomplish this prior to starting the project. It will not reflect well on your organization if partners pledge money and the project does not get completed on the ground due to the lack of completed paperwork!

Project Example

The following is an example of a project planned for the 1996 field season. Seven fences, totaling nearly 1 mile in perimeter were planned for construction within the Wolflick Timber Sale area.

Estimated cost: $27,560.00 Inflated for 2001: $45,800

Planning and Nepa: Inflated for 2001: $3,000

One GS-7 Project Leader - Project planning, proposals, NEPA -- 7 days
One GS-9 Botanist--Biological Evaluation ----------2 days
One GS-9 Fisheries Biologist--Biol. Eval.----------2 days
One GS-9 Wildlife Biologist --Biol. Eval.----------2 days
One GS-9 Archaeologist--Survey and Report----------2 days
One GS-11 Project Review----------1 day

Project Implementation: Inflated for 2001: $22,000

One GS-7 Project Leader----------10 days
One GS-5 Crew Boss----------120 days
Five GS-4 Forestry Techs----------120 days

Contracts, Equipment and Materials:

		Inflated for 2001
Lodgepole post and pole contract	$10,000.00	$15,000
Nails	$ 800.00	$ 1,500
ATV trailer maintenance	$ 600.00	$ 500 (2000 costs)
Hammers, tool belts, misc.	$ 110.00	$ 200
Chainsaw supplies and maintenance	$ 500.00	$ 500
ATV supplies and maintenance	$ 500.00	$ 800

Vehicle Needs:		2001 costs
2-ton Stake-side	10 days	$ 500
3/4 ton, 6-passenger, 4WD pick-up	120 days	$1800

Editors Note: The above costs were planned costs. No actual costs were provided at the end of the season. At that time, the contractor was charging $2.00 per piece, regardless of size, for the posts, poles, and rails. Our last contract, in 1999, was negotiated down to an average of $3.00 per piece. That would raise an equivalent contract price for the 1996 Wolflick project to $15,000 in 1999. It's difficult to provide a cost per foot for these fences, as the cost of materials will vary with your local market and availability of local lodgepole pine stands. The amount of time it may take your particular crew could also vary. Also, individuals in the private sector will not have to factor in the cost of NEPA and biological assessments. In 1994, the fencing crew on our District built one large fence, over 5000 feet in length, at a cost of $4.11 per foot. Most seasons we build numerous small fences on different locations across the District. Naturally the cost of moving materials to the different locations increases the cost.

The Steps to Building a Buck and Pole Exclosure

Step 1: Site Preparation

After a stand has been selected for protection, the site needs to be evaluated for pre-fencing treatments. Aspen is a shade-intolerant species; if there is significant conifer encroachment in the stand, conifers should be felled prior to building the fence. You may wish to remove those trees to recover any economical value, leave them in place, or pile them and burn them. Opening up the stand and burning the piles often results in an increase in suckering. Some aspen managers prefer to underburn a stand, killing most of the aspen overstory, to promote suckering. We have found this to be unnecessary as fencing alone allows a sufficient number of suckers to

grow and repopulate the exclosure. In addition, our stands are so small that we prefer to hold onto the few remaining adult trees that we have left. Root-ripping to a depth of 6 inches around adult trees also may increase the density of suckers without killing the overstory. This is not recommended on dry sites as the connection to the parent tree may be the only way a new sucker can receive an adequate supply of moisture. In any event, these treatments should be completed prior to erecting the fence.

Step 2: Preparing the Fence Right-of-Way

After prepping the stand, take a walk around it and flag out the best route for your fenceline. The path needs to be 12 feet wide; 6 feet of clearance is needed for the structure and an additional 6 feet is necessary for the ATV path. Choose your path carefully to minimize the amount of clearing you need to do. Avoid areas of jackstrawed timber, dense thickets of brush and small trees, and wet areas. Cut all stumps as low as possible on the ATV path. You also need to remove any hazard trees outside of the right-of-way. These would be live trees with a heavy lean towards the fence or dead trees that could endanger people working on the fence or fall across the fence itself.

Since many aspen stands grow in riparian areas, you will need to plan where the fence will cross the stream. Temporary bridges can be built from available fencing material and should be strong enough to support the weight of the ATV pulling a fully loaded trailer. If the stream is wider than 10 feet, it is probably better to build separate exclosures on either side of the stream.

Step 3: Stockpile Location

If your fence will be over 1,000 feet on a side, it is most efficient to place piles of materials in several locations around the fence. Unless your worksite is secure (behind a good, locked gate), it is not recommended to move all of the building materials to the site at one time. Lodgepole posts and poles bring a good price on the open market, serve as excellent meat racks during hunting season, and make dandy firewood. We usually keep the main stockpile inside the District compound and transport enough material for several days of work to the worksite. It takes a considerable amount of material to build a mile of fence--be sure you have adequate space to store it before the shipment arrives!

Step 4: A-Frame Construction

Length of fence perimeter can easily be determined using a string box. Dividing the total perimeter by 10 will give you the total number of A-frames you will need to build. We usually spend one day building frames and laying them out along the proposed fence perimeter. A-frame construction is time consuming but should not be short-cut as the frames are crucial to the strength of the fence.

First you need to construct a pattern. It is important to use a pattern to assure the proper angle and height for the frames. A simple pattern can be constructed out of a sheet of 3/4-inch plywood and 2" x 4" lumber (Figure 1).

Notching Posts: Lay 2 posts on the pattern, crossing at the top, with 1 foot of each post extending above the apex of the A-frame. With a chainsaw, make 2 shallow cuts on the bottom post, placing each cut along, and parallel to, either side of the top post. Make similar cuts on the underside of the top post. These cuts delineate the notch zones. Move the posts a safe distance from the pattern and roll them so the notch zones are on top. With a chainsaw, make parallel cuts approximately 3 inches deep and 1 inch apart, within the notch zone. Next take a hammer and knock out the slats to form the notch (Figure 2). Be sure to keep the posts in their matched pairs or they may not fit together.

Assembling the A-frames: Figure 3 shows a side view of a buck and pole fence, giving the dimensions of the A-frames and placement of the rails. To construct the A-frames, lay one post at a 60-degree angle, on top of the other post, and lock the notches together. Drive a single 7- or 8-inch spike through the center of the intersecting posts. Take a 6-foot pole and attach it to the bottom of the A-frame, about 8 inches from the bottom of each post, using 60D nails. The crosspiece should extend approximately 6 to 8 inches beyond the posts, on the outside of the frame. You will place your lowest rail on top of this crosspiece extension.

Step 5: A-Frame and Pole Placement

It is more efficient to spend one day laying out A-frames and rails along the proposed fence perimeter than to try to keep a fast working crew supplied with frames and poles as they build. We use a 6-wheel drive ATV, pulling a flatbed trailer with sideboards, to move completed A-frames and rails around the fence perimeter. Three to four A-frames, or 20 rails, make a heavy load. Great care must be exercised when moving fence materials over uneven terrain. Lay out one A-frame and 2 rails every 10 feet. If using a back rail for additional support, lay one out every other frame.

Step 6: A-Frame Erection

A-frame crews should consist of 2-3 people. One person lifts and holds each A-frame in position while another nails on the top rail. The top rail lies in the fork of the crossed posts of the A-frame. Use 60D nails or 70D spikes, depending on the diameter of the rail. You need a minimum of 2 inches of nail penetration through the rail and into the post. If your rails are 5 inches in diameter, then you should use 70D spikes. The rails should overhang the A-frames by 10-12 inches, especially on corners and curves. After the top rail is attached, nail on the bottom rail. This rail sits on top of the 6-foot crosspieces attached to the bottom of the A-frames. If using the back rail, attach it now. The back rail keeps the back legs of the A-frames from shifting. This is most important when building fences on wet soils or steep slopes. The back rail may be placed anywhere on the bottom 3 feet of the inside legs of the A-frames. We usually place the back rail on top of the crosspieces. It is only necessary to use 1 back rail for every other pair of A-frames.

Step 7: Rail Attachment

We have tested several rail systems and have found 6-7 rails, placed no further than 12 inches apart, to work the best. Spacing on the bottom 3 rails is most important. We have observed deer sliding under our fences when spacing between the ground and the bottom rail is greater than 12 inches. Placing the lowest rail no higher than 8-10 inches above the ground works best. Remember that a good snow pack may make the openings between the top rails more accessible. These fences aren't cheap to build--don't slop on the top!

After all the A-frames are up, place the remaining 4-5 rails around the fence at each section. If you have enough people, you can do this behind the teams putting up the A-frames. Two teams of two people can make short work of the remaining construction. Have one team nail on the lower 2 remaining rails and another team follow with the remaining 2-3 rails.

It is usually not necessary to put a gate on small enclosures. Gates are handy, however, if you will be doing additional treatments or surveys inside the exclosure. The easiest gates to build are sliding rail gates (Figure 4). Choose the section where you would like to locate the gate prior to erecting the A-frames. Do not attach the top and bottom rails when erecting the A-frames for that section. It helps if this is the last section to construct. On either side of the gate, nail a 6-foot pole vertically to the outside of each adjacent buck. Place this pole perpendicular to and against the section rails. Attach the top of the pole to the top of one of the 7-foot posts, and the bottom of the rail to the outside of the 6-foot cross-pole. Attach the pole at each point where it intersects the six cross-rails. Simply place the ends of the gate rails on top of the rails attached to the supporting A-frames on either side of the gate. The two vertical poles will keep the gate rails from falling off the fence. To access the interior of the fence, just slide the rails off the end of one of the supporting A-frames.

Buck and Pole Fence

Construction Notes: Upright posts shall be 7' long x 5"-8" in diameter. Rails shall be 3"-5" in diameter, 12' long, and 12" apart. Back rail shall be 3"-5" in diameter, and placed between every other pair of bucks. Secure rails with spikes long enough to ensure 3" nail penetration into the post.

Figure 1

A-Frame Pattern consists of one sheet of ¾" plywood with 2"x4" layout boards. Posts are placed on the boards, overlapping each other, and then the notches are cut.

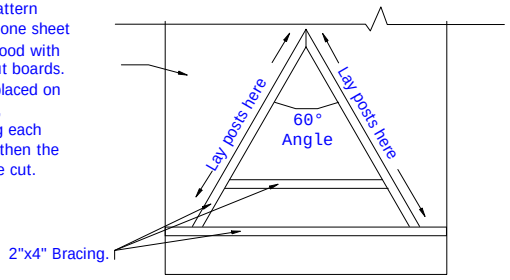
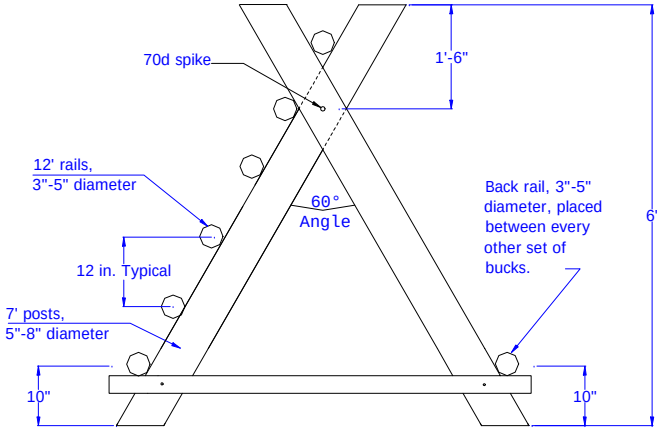


Figure 2

Notch both posts to a depth of 1/3 the diameter of the post, at the point at which they cross. Posts shall fit together snugly

Figure 3



Bottom cross piece shall be 6 ft. long, 2"-3" diameter, 8" off of ground. Spike to posts with 60D spikes.

Figure 4

Construction Notes: For sliding gate, fasten 6' x 2"-3" holding poles to rails on adjacent bucks. Slide 12' long poles in between rails and holding poles. The gate poles can easily be slid out and removed for access.