reduced coyote predation by over 80% and the off set single strand fence reduced predation by 65%.

The greatest problems in western Canada to fence construction and performance are post damage at corners, electricity drain due to "shorting out" caused by vegetation growth and other wire cross-over interference and inadequate grounding. High tensile steel wire (recommended tensile pull 85 kg) can cause severe corner post damage if line wire tension is not adequately adjusted (see tension adjusters) prior to onset of cold temperatures (i.e. colder than –15° C).

We recommend fence-lines be treated with a quick knockdown herbicide (i.e. glyphosate) prior to fence construction to reduce vegetation growth that will interfere with electricity flow.

Also, steel ground rods (2.0 - 2.5 cm diameter) need to be submerged three to four meters into the ground at each corner or every 0.5 km for adequate electricity return, during dry conditions in areas of light, sandy type soil.

AAFRD experienced only occasional wire breakage due to other wild life such as moose (*Alces alces*), white tailed deer (*Odocoileus virginianus*) or American black bear (*Ursus americanus*). Where large wild animals roam, fences should be flagged or identified to minimize accidental encounters.

The success of electric fences AAFRD developed has immensely benefited the livestock industry; in many cases producers altered fence designs/ configuration to meet personal farm requirements and conditions. Nonetheless, the use of electricity has greatly improved the protection capabilities of Alberta livestock producers, particularly those whose property overlaps the natural occurrence of coyotes. Unfortunately, electric fencing is not for everyone and/or for every type of livestock operation; in those cases, other control strategies or agents must be incorporated into livestock management plans to prevent and control coyote predation.

AAFRD website:
http://www.agric.gov.ab.ca

Information on electric fencing on:
http://www.agric.gov.ab.ca/agdex/600/684-7.html

Electric Fencing and Carnivore Damage Prevention

by
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Electric fencing is usually a well-accepted method for constraining livestock movements. It is fairly simple to use but it presents nearly no physical barrier, relying almost entirely on the fact that the animal receives a painful shock whenever it touches the fence. The goal of this article is to point out some remarks and ideas of what you have to note and what can help to achieve better protection of livestock against predators by using electric fences.

Carnivore damage prevention (CDP) fence

Livestock are easy to train to electric fences because they are calm animals, they usually have enough food and water on their pastures and they have learned to respect electric fences since the beginning of their life. Therefore, the motivation to escape is very low and they will stay on the same enclosure for several days. However, the fence must always be properly electrified. With predators the situation is quite different. They can penetrate the fence by accidental wandering, especially if the pen is located on traditional movement routes (e.g. bears). In the search for food predators have a higher motivation to try to penetrate the enclosure to get at the livestock. There are still very few electric fences designed for predator exclusion on a year round basis, decreasing the chance for large carnivores to be taught to respect electric fences. Moreover, livestock fences are usually switched off when livestock are not inside. Consequently, predators do not learn from the beginning to be fearful of electric fences, especially in areas where predators are recolonising. There are some basic rules when building the electric fence as well as conventional electric fencing for controlling livestock and electric fencing for CDP: design, visibility, high power, maintenance and training.

Design

The fence should be specifically designed to be predator-proof, especially adapted to increase the chance that the predator will receive its first electric shock through the head which is more severe than through other parts of the body. Like this, the electricity passes through the longer part of the body, increasing the effect. A fence will be tested continu-

ously, sometimes by the same animal or by new individuals that are roaming in the area. Fences for CDP must be set up with at least six wires, alternating the charges (-,+,-,+,-,+, etc.). The bottom wire should be grounded (earth return wire) and lying at only 10 cm above the ground. This wire should stop animals that attempt to crawl under fences (e.g. foxes). Like this, when it touches the second wire (live wire) while standing on the lower ground wire, good electric contact is made. This method will be particularly useful when the ground is very dry and may hinder conductivity to earth. But if the lowest wire is up to 20 cm above the ground, it should be positively charged to deter crawlers or diggers.

Predators that jump over the electric fence (e.g. wolves) seem to learn this with mesh wire fences (sheep fences) or similar non-electric fences. The height of the fence is the only limit for jumpers. By adding a supplement fence in front the first one to enlarge the whole system, a jumper will hesitate to leap over. It is also possible to bend (over-hang) the fence towards the direction from which the animal approaches. These kinds of fences definitely give better predator exclusion than simple vertical ones. They seem to deter the predator from jumping over or from pushing through. But vertical fences are much more easy to construct and maintain. Offset wires can be used to achieve the same benefits of the angled fence without the associated construction, and in some cases, maintenance problems. The use of appropriately designed, galvanised spring-steel wire offset brackets are easily attached to existing fences and are flexible to withstand animal pressure. One or more offset wires, on the side from which the predator will approach, improves the exclusion ability of electric fences. If only one is used, it should be positioned at 2/3 rd of the height of the predator.

For large carnivores, because of the insulation of their thick fur, wire tension must be increased and maintained at 180 kg, especially on bottom wires. Permanent tension springs can be fixed on each line, and wire tension must be checked frequently. The wire should be at least 2.5 mm thick. Thinner wire reduces the visibility, conductivity, and life of the fence.

Snow and frozen ground can greatly reduce the effectiveness of the earth return system. If the electric fence is not in use during wintertime, all lines should be set down on the ground to be covered by the snow. Like this predators will not encounter an ineffective fence and learn how to cross it. The fence lines should be set up and electrified early enough before the return of the flock to the protected pasture, to teach predators to avoid such fences. In fact, fences should always be electrified. If they are not, the wires should lie on the ground or be removed.

Visibility

The fence will not stop a large animal that runs through the fence without even seeing it. Moreover, most contacts with electric fences occur at night. Therefore, the fence must be visible. The visibility of electric fences can be improved by adding ranks of wires and increasing the number of stakes, or by tying fluttering things on the wire, such as aluminium twists or spins. Light reflective material is best. The fence line must be well cleared from the side that predators approach to stop them and to get them investigating the fence in a slow and cautious manner. Good visibility of permanent wires in electric fences is achieved if white electric tape (polytape) is mounted on offset brackets on the fence from the predator approaching side. Such polytape can be set on the top of the fence to increase its height. Maintaining the visibility of the fence is part of the maintenance work.

High power

Trials with different domestic and wild animals have shown that a low powered shock does not deter animals from repeatedly testing the fence. Some animals can become accustomed to a low powered shock and learn to ignore it, with disastrous results. At least 4’500 volts should be maintained on all wildlife fences at anytime, with pulses around one per second. We must make sure the newly constructed fence is turned ON before securing for the night. The first contact must be a memorable event. The total length of the wires determines energizer choice.

The new generation technology makes power fences much more available, effective, reliable and easy to maintain. Features for managing smart and high power fence system include:

- Remote control to switch the energiser on/off from anywhere on the fence for the maintenance work on the fence
- Performance indicator lights or digital displays
- Monitors and alarms to warn of poor system performance
- Adapted control that automatically adjusts the output to suit fence conditions
- Replaceable modules for easy servicing
- Built-in lightning protection to help protect the energizer from extreme damage

Maintenance

Maintaining the fence visibility is part of the maintenance and animal training programme. Electric fences are not maintenance free. Each component should last for the expected life of the entire fence. The different prices between the most expensive item and the cheapest one does not affect significantly the total cost of the entire fence. If using inferior materials the CDP fence will not be effective for a very long time. Once the fence is erected, continual maintenance is very important. The fence must be periodically checked. The electric power must also be checked regularly with the help of a voltmeter or control light (live light) hanging on the fence, which tells you through a flash if it is still working. A yearly check of the earth system of the energiser is also required.

Training

The whole idea of predator training is to get them to investigate the fence in a slow and cautious manner, in order to get the first shock on the nose. If the shock is delivered to the back of the head, animals often react by lunging forward rather than backing up. There are several ways to help a predator to raise its nose on the fence. Baits (chicken wings) can be hung up on the live wire on the fence. There is no need that the predator grabs directly the bait, it is enough if it put its nose close enough to it. The strength of the first shock will often determine how the animal is going to react to the fence in the future.

Conclusion

If we want to develop sustainable farming practice (improving the soil fertility, maintaining or increasing biodiversity, paying attention to maintain clean water and air) then we need the domestic herbivores to help us to reach this goal. But this can only be achieved if we are able to protect domestic animals in an effective way against large carnivores. Permanent electric fencing costs so little and it is so easy to build up that we should spend enough time and buy material of good quality to do the work well. Otherwise there will be many reasons that the fence will not serve to its purpose. Our ability to think and develop new ideas to prevent carnivore damage is the only limitation that the electric fencing has.

Operation of Power Fences: Some Practical Advise

by
Agnès Dhilly

The following is a quick overview of some of the most important elements associated with the use of electric fences.

How does an electric fence work?

An electric fence stops animals because of the fear of an electric shock. Therefore, the most important thing in a electric fence is electrification.

For a better circulation of the electricity, the resistance R1, R2 and R3 - resistance of the conductor, of the surrounding factors, and of the soil - have to be as low as possible.

R1 – the conductor

Only the wires should be responsible for the transport of the electrical current. The other parts of the fence (e. g. poles) have to be insulated (fibreglass, plastic). However, the wires have a resistance R. Use of a good alloy, wires with a sufficient diameter, and several parallel wires in a fence all contribute to reduce the resistance.

R2 – resistance connected to the environment

Any contact with vegetation will increase the resistance. It is linked with the number of wires and is therefore smaller in fences with just one wire (cows, horses…) than in fences with 3-5 wires (sheep, goats…) with wires in contact with the vegetation. Keeping fences vegetation free will require constant maintenance.

R3 – resistance of the soil

The grounding is a crucial point for an effective electric fence (see Fig. 1). The resistance connected to the grounding system has to be as low as possible (0 Ohm). First of all the quality of the grounding is dependant on the type of soil.

Depth of the grounding system: Place at least 3 galvanized rods of 1-2 m length at a distance of 3 m from each other into the soil.
Stony soil: Look for a crack in the rocks!!, or try to spread the grounding system over a large surface (e.g. galvanized grid).

To insure that the circuit is complete and that the current is going back to the energizer (aggregate), the contact between the grounding system and the soil should be as high as possible. This is very important for both the efficiency of the system and for the amount of pain