An Alternative to Fences

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The technology of electronics and bioinstrumentation is now able to replace traditional fencing. Limited and degrading rangelands, concern about current grazing practices, and the need for protection of delicate riparian areas led to the development of an invention, entitled "Animal Control Device." This device is particularly suited to domestic cattle and sheep. The device consists of two components: Signal Transmitters/Receivers (Fig. 1) and Animal Implant Electrical Stimulators (Fig. 2).

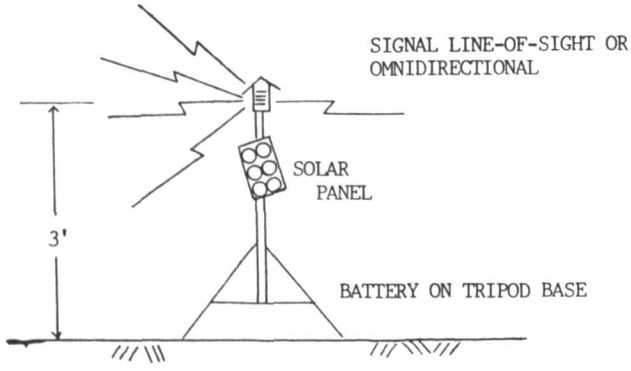

Fig. 1. *Signal Transmitter/Receiver (STR)*

The Signal Transmitters/Receivers (STR's) are low power-requirement radio-frequency devices mounted on portable poles. These poles are arranged to describe an area of desired grazing or to designate an exclusion zone (Fig. 3). Transmissions radiated by STR's may occur on a line-of-sight path, have various degrees of divergence (arc), or be omnidirectional. The radiation (antenna) pattern can be adjusted in the field as a function of the distance between poles and/or topography. For distances between poles of 1/4 mile or more a narrow arc is desired, while for shorter distances a wider arc is preferred. The range of transmission can be over 5 miles. In riparian areas a STR may act alone, emitting a signal in all directions over a very short range. The antenna pattern describes characteristics of field intensity, power density, and radiation intensity.

For details about radiowave patterns the reader is referred to Radiotron Designer's Handbook (1968). Power for STR's is supplied by a small nickel-cadmium battery. The battery drives an internal crystal oscillator, which in turn, generates a continuous, FCC-approved signal. The battery is charged by a small photovoltaic solar panel. STR's are portable, stand-alone units suited for exposure and operation in rugged environments.

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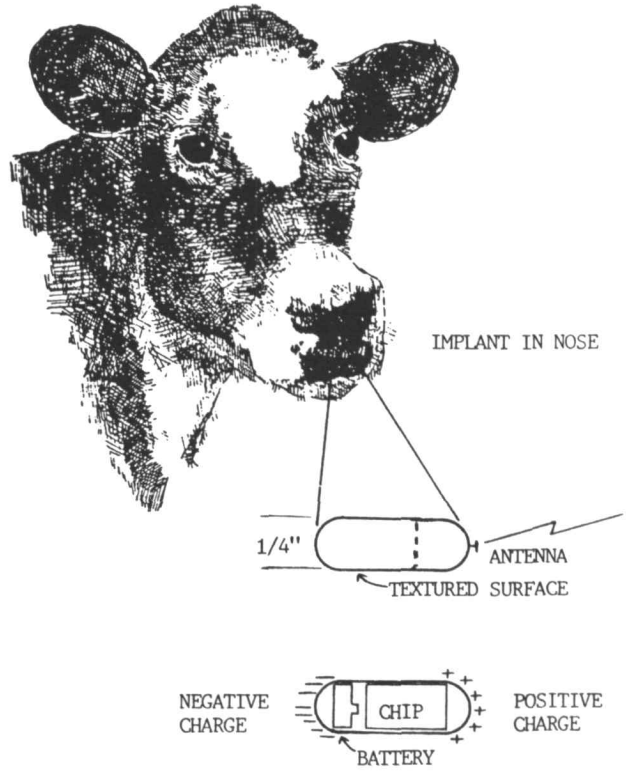

Fig. 2. *Animal Implant Electrical Stimulator (AIES)*

The Animal Implant Electrical Stimulators (AIES's) are miniature battery-powered transceivers and shock applicators implanted in the animal's nose or upper lip. The AIES's are small capsulated electronic receivers with the ability to shock the animal at *variable* intensities. As cattle approach the delineated boundary, the pickup of radio signal causes a minor shock (in order of microamps). The strength of the shock is proportional to the power of the received radio wave. Voltage in the AIES is supplied by miniature batteries.

Technically, these devices can be constructed with off-the-shelf hardware. Electronic components in the AIES include a miniature antenna, transceiver, battery, and integrated circuit. The components are protected in a conductive metallic capsule which provides the direct interface with the animal's tissue and nerves. The muzzle area consists of many receptors. These are specialized nerve endings that transduce various stimula into frequency-modulated trains of action potential for the sensory neuron. For further details about the central nervous system and physiology of cattle the reader is referred to Lefcourt (1982) and Stermer (1980). Implantation of the capsule can be accomplished using a local anesthetic and a simple injection. The AIES is designed to have a

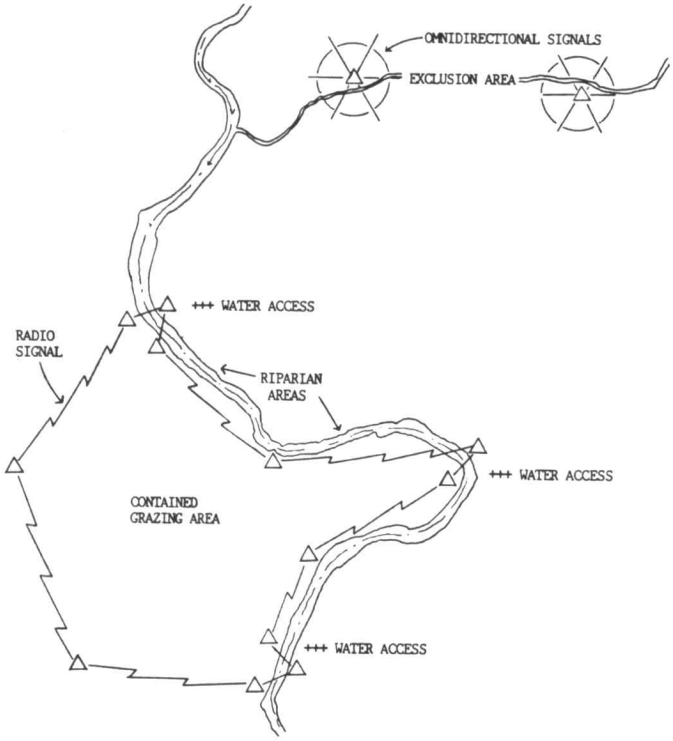

Fig. 3. *Plan view of grazing and exclusion areas.*

battery life longer than that of the animal. Upon slaughter the AIES is removed, the battery replaced, and reimplanted in another animal. During each implant, resident memory in the AIES is reprogrammed with the date of birth of the animal, breed, brand, inoculations, etc. This information can be "read" while the animal is alive by using a scanner.

Economically, a rancher must justify the benefits and costs before adapting this technology to his operation. The benefits and costs are summarized in table form below:

Benefits

NO FENCES, CATTLEGUARDS or GATES
Improved forage use with better livestock control
Brand, breed, inoculations, etc., included on AIES
Easier herding

Costs

STR's (one time)
AIES's (one time)
Batteries (3 years)
implant (one time)
setup time (varies)

In a strict cost comparison between conventional fencing and an alternative to fences, let's assume a pasture of one section (640 acres) is desired for the grazing of 100 head of cattle. Following is a comparison of costs.

TRADITIONAL FENCING:		
4 miles of fence at $.50/ft installed	=	$10,560
Annualized cost over 25 years at 6% interest	=	$826
AN ALTERNATIVE TO FENCING:		
10 STR's at $200/each (# depends on terrain)	=	$2,000
100 AIES's at $25/each	=	$2,500
50 implants per year (estimate) at $5/animal	=	$250
Annualized cost	=	$602

While these numbers are very preliminary, they indicate a $224/year savings on a cost basis alone. The primary benefit unavailable with traditional fencing is that you create a portable pasture. The rancher can reestablish the pasture depending on grass availability, changes in water availability, or changes in the weather. Short-term, high intensity grazing of riparian areas can be simplified with this device.

Philosophically, adoption of this invention raises certain questions. How will society react to such a change in the western landscape? Should the task of fixing fence and roping cows be replaced by transmitter placement and in directing cattle with electric shock? Ranchers might agree that no more fence to fix might be okay. And electric shock is already in use with electric fences and with cattle prods.

The number of livestock in the western U.S. and limited rangelands are two diverse and valuable resources. The stewards of these resources—ranchers, natural resource professionals, and the general public—must work together for the best general welfare of society. It is my hope that the above described technology might play a role towards meeting that goal.

Literature Cited

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