and household water has plagued water into this area. Five hundred productive grassland area can now be ranches watering approximately 300,000 acres of rangeland. This grazed safely and efficiently with a forty-five miles of PVC pipe have been installed, or are planned, on 108 stable, good quality water supply. is an abundance of water in Nebraska's many streams, rivers and lakes. Good quality water is available from shallow wells throughout the Sandhills region. 

The Problem

The water situation in Sioux and Dawes Counties in Northwest Nebraska is somewhat different. This area is called the "Gumbo Country"

Plastic Pipelines for Livestock Water in Northwest Nebraska

WARREN PEDEN
Range Conservationist, Soil Conservation Service, Rushville, Nebraska.

Highlight

A shortage of good quality livestock and household water has plagued northwest Nebraska ranchers. The development of Polyvinyl-chloride pipe has provided a method of piping good water into this area. Five hundred forty miles of PVC pipe have been installed, or are planned, on 108 ranches watering approximately 300,000 acres of rangeland. This productive grassland area can now be grazed safely and efficiently with a stable, good quality water supply.

When discussing the resources of Nebraska, water is one resource that seems to be plentiful. There is an abundance of water in Nebraska's many streams, rivers and lakes. Good quality water is available from shallow wells throughout the Sandhills region.

The Problem

The water situation in Sioux and Dawes Counties in Northwest Nebraska is somewhat different. This area is called the "Gumbo Country"

1 Received March 25, 1971.

resources must be managed to meet the needs of both the plants and the animals. Flexibility in management plans will aid the manager in obtaining optimum use of the range and related resources despite fluctuating forage production.

Literature Cited


Resources

This area is in the Pierre Shale Plains and Badlands Resource area in the 14 to 16 inch precipitation zone. The mean length of the frost free period is approximately 120 days.

The major soils are Samsil, Pierre and Kyle clay. These are upland soils (U. S. Dep. Agr., 1969), developed in the weathered, gray shale of the Pierre formation. All have clay surfaces and subsoils, but differ in the thickness of the soil material over the unweathered parent shale. Samsil is shallow, Pierre is moderately deep, and Kyle is a deep soil.

The vegetation is dominantly western wheatgrass (Agropyron smithii), green needlegrass (Stipa viridula), blue grama (Bouteloua gracilis), side oats grama (Bouteloua curtipendula), and buffalograss (Buchloe dactyloides).

These ranges yield from 500 to 1500 pounds of air dry forage per acre (Jensc, 1968). This is a valuable grass resource that the ranchers have not been able to use efficiently because of the water situation.

The ranches in this area are primarily cow, calf, and yearling operations with some sheep production. The hay supply is limited and the livestock are ranged year round. The antelope population is quite high and there are some deer.

This "Gumbo" area is fortunate
in having a source of well water nearby in the sandstone formation along the Pine Ridge escarpment. This Pine Ridge escarpment angles across the northwest corner of Nebraska. Most of the wells are 8 inches in diameter, are 50 to 250 feet deep, and produce 10 to 40 gallons per minute.

Materials and Methods

Prior to the development of Polyvinyl-chloride pipe (PVC), livestock water pipelines were impractical. The cost of metal pipe was too high to make pipelines feasible and the soils in this area are highly corrosive to metal pipe. PVC comes in 40 foot lengths, is resistant to corrosion and damage by rodents, and has a low friction loss.

Ranchers and farmers interested in installing a pipeline contact the Soil Conservation Service for technical assistance. Surveys are made to get the elevations along the proposed pipeline and other information is gathered that is necessary to design the pipeline. Cost sharing is provided by the Agricultural Conservation Program (ACP) or the Great Plains Conservation Program. When there are several ranchers interested in a pipeline, they can form a nonprofit organization and make application for a pooling agreement for participation in one of the cost sharing programs. When the pipeline design is completed the organization puts the pipeline up for bids, or negotiates with the contractor for construction of the line.

Each ranch is allotted a certain percentage of the cost sharing payment and is assessed with a percentage of the maintenance costs. The percentage is generally based on the acres, and/or cattle numbers, served by the pipeline on each ranch.

The pipelines are designed to provide 20 gallons per day per animal unit and 500 gallons per day per ranch headquarters. Irrigating of lawns and gardens is not allowed.

Fig. 1. Trenching for livestock water pipeline on Antelope Pipeline, Sioux County, Nebraska.

Fig. 2. Contractor gluing sections of 2 inch plastic pipe for livestock water pipeline.
MANAGEMENT NOTES

Table 1. Summary of installed and planned pipelines in Sioux and Dawes Counties Nebraska.

<table>
<thead>
<tr>
<th>Name of line</th>
<th>No. of ranches</th>
<th>Length (miles)</th>
<th>Acres watered</th>
<th>No. of farmsteads</th>
<th>No. of tanks</th>
<th>Year completed</th>
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Pressures approach 160 psi, pressure reducing valves or cisterns are installed. Vacuum release valves are installed where there is a danger of the pipe collapsing from negative pressure.

The livestock watering tanks on the pipeline are provided with floats to control the water level and check valves to prevent the possibility of tank water from draining back into the line. The tanks are galvanized steel with concrete, or steel, bottoms and vary in size from 10 to 20 feet in diameter. The larger tanks have been more successful because of the additional storage capacity. Some tank installations have a length of concrete pipe placed over the intake valve and float. This pipe has a cover to prevent freezing, and to protect the float mechanism from breakage. Each tank is provided with a shut-off, so service to the rest of the line is not interrupted when maintenance is required.

**Discussion**

The pipelines that are completed or are in the planning stages (Table 1) have from 1 mile up to 125 miles of pipe. The longer lines start out with 3 inch inside diameter pipe and gradually decrease down to 1 inch on the spur lines. To date, these pipelines water about 63 ranch headquarters and approximately 300,000 acres of rangeland with about 760 tanks (Fig. 3). An occasional country schoolhouse is also supplied with water from these pipelines.

The cost of these pipelines is high and without financial assistance from Federal programs, they would not be feasible. The per acre costs for supplying water through pipelines is, approximately, $4.00 to $5.00 per acre. Although the costs are high, the benefits are far reaching. The water supply can be placed where it is needed the most. Planned grazing systems are now possible and areas formerly overgrazed have been rested and non-grazed areas are now providing valuable forage. Livestock distribution is greatly improved and livestock performance has improved with the good quality water being available.

Some ranchers believe that yearling cattle will gain an additional 50 to 150 pounds more with good water. Assuming a calf crop of 85%, there would be about 12,000 calves produced per year. Using an average of 100 pounds additional gain per yearling, this would mean an additional 1,200,000 pounds of beef produced. If beef is worth $2.50 per pound, this would mean $300,000 additional income, per year, to the area.

PVC pipelines make water available to fight range fires and the clear water will not plug up the nozzles on fire fighting equipment.

It is needless to say that the ranchers' wives are extremely happy with the good quality water brought into their homes by the pipelines. There are no more pipes and faucets clogged with salts and minerals, and there is nothing like being able to get a good, cool drink of water.

Fig. 3. The end product—a supply of good quality water for a registered cow herd.

This book is a collection of papers expressing various viewpoints concerning decision making in environmental problems. The impending theme throughout the book is that the causes of the degradation of our surroundings are: (1) rapid population growth; (2) increase in Gross National Product; and (3) changing patterns of our lives. Revelle and Landsberg point out in their fine introductory chapter that as our nation grew in affluence each individual used a larger quantity of materials and thus there was more to throw away. We could afford, because of our affluence, to discard many objects we once saved and reused. But as the primary wants of the great majority have become satiated, we are now more concerned with the quality rather than the quantity of "life." They go on to say, "Thus in the past our growing affluence has led to environmental destruction but in the future it can give us greater opportunities both to perceive and to protect the quality of life and the diversity, beauty, and wonder of our land."

The tools used to achieve these goals serve as the major groupings of the chapters, namely: science, economics, politics, technology and education. Many fields are represented among the twenty contributors. The social scientists far outnumber the biological scientists. Thus, the emphasis of the book is on the interactions and behavior of people and their subsequent effects on the environment rather than on the standard biological and physical aspects of the ecosystem. Fifteen of the twenty essays were first published in the fall 1967 issue of the Journal of the American Academy of Arts and Sciences. The other four essays and the introductory chapter are published here for the first time.

The science section stresses ecology as an integrative and synthesizing science both in dealing with different levels of biological organization and in point of view. The chapters under economics and political action contain not only general essays pointing out the difficulty of evaluating environmental problems in terms of the present market systems, but also contain interesting case histories involving particular government agencies and specific problems. It is emphasized that economists have dealt with only half of the problem, i.e., the economic benefits of pollution to the polluter and the economic costs of pollution control. The other half—the costs of pollution and benefits of pollution control—is hard to state in ordinary economic terms because these values cannot be dealt with in the market place as it exists today. Since pollution ignores political boundaries, one must think in terms of airsheds and watersheds instead of areas of cities, counties, or nations. To overcome these difficulties of political action, it is suggested that it may be necessary to invent new political institutions or modify old ones. Technological innovations may remove or ameliorate some problems. We should not indict neutral technology for the consequences we find ourselves in today, but rather should indict our inability to organize intelligently for its (technology) beneficial use.

The role of education in helping to remedy the environmental crisis is presented as threefold: (1) production of many kinds of specialists to deal with specific problems; (2) formulation of moral and intellectual values on which environmental improvement must rest; and (3) creation of a heightened sensitivity among young people to the world around them. Many of the basic concepts and problems concerning environmental quality are repeated often. This repetition makes reading difficult, but also makes individual chapters more complete. Although no specific references are made to rangelands, this does not or should not keep us from recognizing the implications of this work to our own fields.—Michael C. Stroud and Harold H. Biswell, Berkeley, California.


Although the authors are probably best remembered for their 1960 television program about behavior among wild chimpanzees, they have also been conducting a considerable study of some of Tanzania’s carnivores. This book reports observations on behavior of wild dogs (Lycaon pictus), golden jackals (Canis aureus) and spotted hyenas (Crocuta crocuta). One facet of their studies was to determine whether killing or scavenging provide the principle means by which these carnivores obtain food. They concluded that these particular species depend primarily upon hunting to procure their food, but being opportunists, they are scavengers whenever the rewards exceed the risks. By logical inference from these studies and the studies of chimpanzees, the authors suggest that early man was most probably dependent upon hunting, rather than scavenging, as his primary source of meat.

Most of the book is devoted to observations on behavior of the three carnivores and the related fauna. The photographs are technically excellent, and some are of near "salon" quality.