

Rangeland Management in Saudi Arabia

Atalla A. Abo-Hassan

The Kingdom of Saudi Arabia occupies approximately nine-tenths of the Arabian peninsula, one of the driest areas in the world. It lies between the Red Sea and the Gulf of Aquba to the west, and the Arabian Gulf to the east. It has common boundaries with Jordan, Iraq, and Kuwait on the north and Yemen to the south. Saudi Arabia has a land area of 2,250,000 square kilometers, of which less than 0.2 percent is presently under cultivation. The cultivated land is estimated at 525,000 hectares. Three to four times as much land is arable but not yet put to use. The salient feature of Saudi agriculture lies in the scarcity of water, with rainfall averaging about 100 (4 inches) mm per year in most regions except the southwest, which averages 250 mm or more.

The geology of Saudi Arabia has a base complex of mostly Cambrian rocks, pre-Cambrian rocks, granite, schists, diorites, gneiss, and gabbro. Prior to the rift that was responsible for the Red Sea, the Arabian Peninsula was a continuation of the east African continental block. After separation from Africa during the Tertiary Period, the Arabian Peninsula assumed the land form of a giant plateau lifted eastward from the Red Sea toward the Arabian Gulf. Exposed in the western highlands and mountains, the base complex ranges in elevation from 600 meters to 3,760 meters.

East and north of the Arabian shield, the remaining two-thirds of the country comprises sedimentary formations. These are mostly sandstone, limestone, shale, marl and alluvium comprising the ground water reservoirs or purifiers of the peninsula.

Saudi Arabia is situated in a vast desert belt encompassing much of North Africa and extending eastward into Asia. This desert belt is exposed seasonally to the northwest trade winds. The northern two-thirds receives sporadic winter and spring rains associated with the barometric lows moving from the eastern Mediterranean toward the Arabian Gulf. The intense heat of the summer months is the best known feature of the Arabian climate. Temperatures frequently exceed ° C (120° F) over much of the peninsula. The south west being in the high mountains is the only part with prevailingly pleasant summer temperature, (20° C (68° F) to 30° C). They have the highest rainfall with about 500-600 mm a year.

Sub-freezing temperatures in the morning have been recorded occasionally during the winter months in the southwest. Snow is very rare. However, in April 1971, a freak sleet storm (recorded as snow) left an accumulation of 1.5 meters immediately to the west of Abha in the high southwestern mountains. Frost usually occurs during winter in the north and central regions.

Since the rainfall over most of Saudi Arabia is not enough to support much vegetation, not many trees grow and most of the country is considered as desert. With the exception of the southwest highlands, the vegetation is similar to that of the north African-Indian desert region. Most of the plants are herbs or shrubs. These plants have adapted to the rigorous desert climate. There are few species. The eastern part of Saudi Arabia, for instance, has probably not more than 370 native species. The small number of desert species reflects the difficulties faced by plants in adapting to such a harsh environment. Most of the plant species in Saudi Arabia have migrated from adjacent countries.

In the eastern region of Saudi Arabia, the following plants are found in coastal grasslands areas: *Panicum turgidum*, *Juncus maritimus*, *Aelopus lagopoides*, *Cynodon dactylon*, and *Arabasis setitera*. In the salty areas, one can find *Haloxylon salicornicum*, *Suaeda beccata*, *Zygophyllum caccineum* and *Atriplex* spp. In the oases of the eastern district, perennials which are spreading include *Aristida plumosa*, *Artemisia herba alba*, *Ziziphus spina chriti*, *Rhanterium eppaposum*, *Calligonum comosum*, *Helianthemum lippii*, and *Lycium persicum*. Annuals are represented by *Plantago albicans*, *Neurada procumbens*, *Medicago ashersoniana* and *Stipa tortilis*.

In the northern part of the kingdom, one can find the following: *Poa sinaica*, *Achellia fragrantissima*, *Anabasis articulata*, *Atriplex leococlada*, *Salsola lancifolia*, and *Haloxylon articulatum*. In the central region of Najd plateau, the following shrubs cover wide areas: *Gymnacarpus decandrum*, *Helianthemum lippii* and *Helianthemum kahiricum*. Along with *Stipa tortilis*, the annual grass which grows underneath the shrubs in the oasis where water is available, one can find *Aristida* spp., *Artemisia* spp., *Lycium persicum*, *Panicum targidum lasiurushirsutus*, *Cenchrus ciliaris*, *Astragalus* spp., *Plantago* spp., *Trigonella* spp., *Acacia* spp., *Tamarix* spp., and *Ziziphus* spp.

The southwestern highlands of Saudi Arabia are classed as part of the East African Highlands floristic region. True forests of Juniper (*Juniperus procera*), wild olive (*Olea chrysophylla*) and *Acacia assac* cover the higher slopes in the south. Recently forestry work was undertaken by the Ministry of Agriculture to protect and develop these important resources. Slopes of the western coast are covered with *Acacia species*, *Panicum turgidum*, *Lasiurus hiraustus* and *Aiber* spp. In salty places, species from *Chenopodiaceae* and *Zygophyllaceae* are widespread underneath the *Avicennia marina* shrubs. Many poisonous plants are spread over the range area. These include *Calatropis procera*, *Chrozophora oblongiflora*, *Datura stramonium*, *Delonix elata*, *Euphorbia cornta*, *Euphorbia kahirensis*, *Razya stricta*, *Peganum har-*

The author is Head, Plant Production Department, College of Agriculture, University of Riyadh, Riyadh, Saudi Arabia.

mala, *Pergularia tomentosa*, *Tribulus terrestris* and *Withania somnifera*.

The agriculture and grasslands in Saudi Arabia are concentrated in few areas with adequate water supplies in the oases. In addition, the relatively high rainfall region is the southwest. Therefore, most of the grasslands and animals are concentrated in the southwest. Range areas in Saudi Arabia contain about 140 million hectares and represent about 56% of the utilized land of Saudi Arabia. Animal raising is considered secondary only to oil in the economy of Saudi Arabia. Estimated livestock in Saudi Arabia in 1975 were 104,922 camels, 281,753 cattle, 2,147,850 sheep, and 1,242,216 goats.

In Saudi Arabia, sheep and goats are the primary milk and meat producers of the desert wherever water and pasture requirements can be met. Both wool and goats hair are used in weaving the tents of the Bedouins, because camel hair is not strong enough for this purpose. Also, the Arabian camel, which is a recognized symbol of Arabian desert life, still plays an important role in the Bedouin economy, even though it has been supplanted by the trucks as a carrier of commercial goods. Also some cattle, most of them of Indian strains, are kept in settled areas. The Arabian horses are famous for their beauty and endurance, but there are not many horses in Arabia today. However, some breeds are reserved by the Ministry of Agriculture and by a number of private horse fanciers.

In the past, although the Arab people who used these animals knew nothing about modern education, they used an ideal system of range management, especially in managing sheep. These people divided their grasslands into several small areas. They allowed their animals to graze one area then moved to another until the grass grew well again in the first. Then they used the first area again. In this respect, they protected their pastures from overgrazing. This system was called "rotating grazing or Ahmieh." By experience, they learned to keep a balance between their animals and the plants grown in the grasslands. This kept their grasslands in good condition until the drought which passed through the country 20 years ago and destroyed many of the natural pastures. On the other hand, the Bedouins' camels graze on the desert shrubs instead of regular pasture land. Camels do not require any water for many weeks while grazing in living grass and bushes. The desert contains a few watering places but affords good grazing for camels, sheep, and goats during the winter.

As a result of the drought and grazing pressure, the natural grasslands have been destroyed by over-grazing, and the soil has been eroded. Everyone is trying to sell sheep because there is no food for them, resulting in a flood of animals on the market with low prices. The Ministry of Agriculture is attempting to find a solution for this problem; otherwise in a short time, the country will need to import meat from other countries.

Because there are no national specialists in range management, the Ministry of Agriculture made a contract with experts in range management from Britain to study the situation and to propose solutions to the problem. They studied the types of grasses and shrubs growing in the grasslands and tried to find the best management for the pastures. They found that the grasslands area was estimated to be 140,000,000 hectares, of which, 5 percent in excellent condition, with 75 to 100 percent of preferable species for all kinds of animals; 10 percent in good condition with 50 to 75 per-

cent of preferable species; 25 percent in medium condition, containing 25 to 50 percent of preferred species, and 60 percent in the poorest condition with zero to 24 percent of preferred species.

The study also pointed out three main reasons for the deterioration of grasslands:

1. Consecutive years of drought.
2. Arbitrary use of pastures.
3. Cutting the shrubs and using them for fuel.

Because of this the government issued a law prohibiting the cutting of any kind of shrubs for fuel.

A research station has been established in the southwestern part of Saudi Arabia.

In addition, the British scientists tried to introduce several foreign grasses to the area, such as *Panicum antidotale*, *Paspalum dilatatum*, and Bermuda grass (*Cynodon dactylon*).

There is also an effort to increase the prairies by distributing the watering places for animals over a large area. The scientists also studied the palatability rates of different plants for use by livestock. Some experiments were also done by artificially cutting the grasses to heights of 5 cm, 15 cm, and 35 cm, on different species.

Since research in range management must go in hand with natural ecology and the annual rainfall, the experiments do take a long time to obtain satisfactory results applicable to a large area. Although the experiments in Saudi Arabia haven't been completed yet, they have shown that some introduced grasses can be used. Experiments have also noticed a decrease in the desirable grasses and an increase in undesirable plant cover by more than 60 percent.

Another plan for managing the grasslands is by training and settling the Bedouins. Because the central part of Saudi Arabia receives the least amount of rainfall, the Ministry of Agriculture has made a contract with an American company called FMC and a German company called Wakota to settle 1,000 families in an arable area of about 4,000 hectares. This area has a surplus of underground water. As a starting point, in a long program to settle the Bedouins and encourage them to stay in a specific place instead of moving constantly, they offered them houses and permanent and supplementary forage and training them to the best way of managing the range resources.

For Saudi Arabia, there are some important practices which if applied correctly will help in keeping the grasslands productive and increase animal productivity to supply the people's need for meat. These include:

1. Obtain the services of a specialist in range management.
2. Teach the people, especially those who use rangelands, how they can preserve their rangelands, and how they should use them.
3. Keep a balance between animals and forage. It is desirable to leave 10 to 13 cm of grass on the ground when the animals graze over the area.
4. Alternative uses of year-round grasslands and seasonal grasslands.
5. Use of annual plants during rainfall periods to give the perennial plants a good chance to grow better.
6. Not to use grasslands during drought years.
7. Reservation of a large area from use except during drought years.
8. Build dams to conserve the water which comes from the mountains.
9. Provide hay during drought years.

10. Eradication of poisonous plants and controlling other undesirable woody plants.
11. Prohibition of cutting trees and shrubs and encourage people to use natural gas for fuel.
12. Drill more wells to provide water for the animals on a year-round basis.

Summary

The problems in improving range management in Saudi Arabia can be summarized as follows:

1. The low rainfall of about 100 mm per year is not enough to grow many plants, except in the oases and the high mountains in the west and the southwest where the average rainfall is more than 400 mm. Most of the grassland is found in the higher rainfall area.
2. There is no organization to conserve the grasslands and to direct the people on how to use their grasslands, and keep a balance between the animals and the available forage.
3. There is no law controlling hunting. As a result, many game species are or are almost extinct.

These are the most important factors which have caused the severe range management problems in Saudi Arabia.

Organizations should be created with specialists in range management to show the people how important it is to keep their grasslands productive and how they should use their grasslands. Also, there should be more effort to drill more wells and distribute more water over larger areas.

Perhaps there should also be a program to use desalinated sea water to irrigate and cultivate large areas. Although the Ministry of Agriculture and Water has started building three desalination stations for this purpose, the program should be expanded.

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Some Characteristics of Iranian Rangelands

A. Koocheki

Iran covers approximately 1,650,000 square kilometers, making it almost 7 times larger than the state of Idaho. The country lies between 25° and 39° 45' north latitude, and 44° and 63° east longitude. Iran is bounded on the north by the Soviet Union and the Caspian Sea, on the east by Afghanistan and Pakistan, to the south by the Persian Gulf and Oman Gulf, and to the west by Iraq and Turkey.

There are four primary physiographic provinces distinguished in Iran: the Alborz and Zagros mountain ranges, the Caspian sea coast, the southern coastal plain and the Khuzistan, and the central plain.

The Alborz and Zagros mountains form the two major mountain systems of Iran. These two ranges meet in the northwest corner of the country near Turkey, Russia (Caucasus), and Iraq.

The Caspian Sea coast province includes the most productive lands found in Iran, but it covers only a relatively small area. Many crops, such as alfalfa, requiring neutral to basic soils are difficult to grow in this region because of soil acidity which generally increases from east to west. However, forage crops such as Bermuda grass, timothy, sorghums, and particularly Berseem clover grow well.

The area lying between the Alborz and Zagros mountains consists of a high V-shaped plateau which widens with decreasing elevation as it extends southward. Lesser moun-

tains and salt flats characterize the area.

The Khuzistan province includes part of the Mesopotamian plain and lowlands of both the Persian and Oman gulfs.

Climate

Five main climatic zones are recognized for Iran:

A-Caspian zone: This area lying between the Caspian Sea and the Alborz mountains is the only part of Iran which clearly receives more than 500 mm of precipitation annually. To date, no meaningful drought has been reported in this zone. The mean July temperature is 26° C and mean January temperature is 8° C.

Three principal vegetation belts are found in the Caspian zone, each a forest type to geologic, precipitation, soil type, and elevational differences and interactions. The lower forest belt occurs at elevations from below sea level to 700 meters. Annual grasses such as *Oplismenus undulatifolius* and *Setaria* spp. are abundant. Perennial grasses include *Festuca ovina*, *Phleum boeumeri*, *Dactylis glomerata*, and *Phalaris* spp. A few legumes of the *Trifolium* and *Onobrychis* genera occur where tree overstory is not too dense and soils are not too acid.

The middle forest belt ranges from 700 - 2000 meters above sea level. The effective precipitation of this belt is higher than either the lower or higher elevational belts. In contrast to the lower belt, here perennial understory species are dominant. Commonly found heraceous plants include *Dactylis glomerata*, *Phleum boeumeri*, *Melica* spp., *Trifolium*

This article is based mainly on information provided by Mr. F. Niknam as his thesis for a Masters Degree, 1970.

The author is professor of agriculture at Ferdowsi University, Mashhad, Iran, located in Khorasan Province.