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Ecology and utilization of desert shrub rangelands in Iraq

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SUMMARY

'Desertification' has been recognized as a worldwide problem for the arid lands, particularly since the subject was dealt with at the United Nations conference in 1977 in Nairobi. The situation in South West Asia provides a clear example. In the present century, mainly in the last decades, several changes in land use have taken place in this area. Such changes often cause degradation and deterioration of natural resources, especially of fauna, vegetation and soils. The value of the land decreases and ultimately the land may even be of no further use to man.

When grazing is the accepted land use, vegetation is the key resource. The present study deals with the desert shrub rangelands of Iraq, which contain the major characteristics of such an area, having been under grazing for many centuries. Emphasis is given to the ecology and utilization of the vegetation and to man as an ecological factor. The aim of this study is to contribute to a well planned land use of these areas under proper management.

The field data were collected from April 1970 to June 1973 when the author worked for UNESCO in the UNDP/SF/UNESCO supported Institute for Applied Research on Natural Resources near Baghdad. The study area comprises the Southern Desert, Western Desert and Lower Jezira (Fig. 1-3), in total some 240 000 km². The vegetation mainly consists of low shrubs, growing in open stands. In between the shrubs an ephemeral vegetation develops after the winter and spring rains. Shrub vegetation types cover about 10-15% of the earth's land area. They are an important natural resource, especially for livestock grazing. The area investigated covers some 55% of the total land area of Iraq, a country well known for its ancient civilizations which existed in and near the Mesopotamian Plain. At present oil is the main source of income. With a few exceptions, the soils, vegetation and fauna of the desert areas of Iraq have hardly been investigated due to the limitations of the area for an intensive land use. The floristic and phyto-geographical aspects have been relatively closely studied by plant collectors.

Mean annual rainfall in the study area varies from about 50 to 350 mm. There can be great differences from year to year. Most of the rain falls in a few heavy showers. In winter frost is recorded while in summer the temperatures can rise to 50°C. Annual evaporation ranges from two to three and a half metres and relative air humidity can in summer be less than ten per cent. Seven physiographic units have been distinguished, based on relief, occurrence of wadis, sandy or stony nature, soil type and elevation (about 0-915 metres a.s.l.). These units and the soil types are described. Until early this century water for man and livestock came from the following sources: a few deep wells, some shallow wells in wadibeds, a few springs, and rainwater which had temporarily accumulated at the surface. Starting in the Thirties a large number of wells has been drilled so far, in total a few hundred. The wells are often very deep and equipped with pumps and storage tanks. This improvement in water supply and the introduction of terrain cars have

made the entire desert area accessible to man and his livestock. After the introduction of modern firearms and with the new fast means of transport, the larger wild animals were exterminated. Oryx, ostrich, lion and cheetah have disappeared. Gazelles still occur, but only in very small numbers.

Artifacts prove that man has been living in these areas for a long time but at first probably only temporarily and in small numbers. In the second or first millennium B.C. when nomadism came into existence and after the domestication of the dromedary or one-humped camel, in places there may have been a pressure on the land. For many centuries nomadic grazing was the only land use in the desert rangelands. The Bedouin tribes had their own strict rules for the right to use certain areas, in which drinking water supply played a major role. Lack of watering points and raiding were two factors which controlled the total number of livestock. A profound change in this pattern took place after World War I. The boundaries of the present Iraq were fixed, police control became effective and fast transport and improved water supply 'opened up' the desert rangelands. The number of camels and sheep increased; sheep from 5 525 000 in 1938 to 11 040 000 in 1965 for Iraq as a whole.

The impact of this process on the vegetation has been investigated in this study. Based on a 4000 kilometres' reconnaissance survey for which a description of terrain, soils, vegetation and land use was made, a detailed vegetation sampling was completed at 54 subjectively selected locations. In 50 quadrats, of 4 m² per location, density, height, crown cover and (total) aerial biomass of the perennials was measured. For each location soil samples were taken from two sites, from 0–30 cm and 30–60 cm depth. The precision of the sampling and the data processing for the classification are discussed. To quantify the relative contribution of the species to the stand, RIMP-values (Relative Importance Percentages), mean value of relative density, relative frequency and relative crown cover, were calculated. In total 15 community types and 14 socio-ecological species groups were distinguished. A climatic gradient, differences in soil texture and land use (former ploughing) partly explain the types ecologically. Per cent cover ranges from 1% to 20% with a few higher values. The total number of (perennial) species is low.

Aspects of the autecology of three key shrub species, viz. *Haloxylon salicornicum*, *Rhanterium epapposum* and *Artemisia herba-alba* were studied, in particular seed production, seed dispersal, germination and seedling development. The first two species have their northernmost distribution in Iraq. Germination and seedling development demonstrate the adaptive characteristics of the species to the harsh environment. The germination of *Rhanterium epapposum*, a member of the Compositae family growing on sandy soils, is described for the first time. In the flowerheads, after falling, several seeds germinate simultaneously while remaining together in the flowerhead. The rootlets penetrate through the receptacle into the

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moist sand. More than one seedling will usually develop simultaneously to form a new shrub. A comparison of the adaptive characteristics shows how each species is best adapted to a particular set of environmental conditions.

The utilization of the desert shrub rangelands by man and his livestock is treated in a separate part in this study.

Grazing by sheep, at present numbering a few millions, and to a less extent by camels, goats and donkeys, has taken place since olden times. Due to an increased grazing pressure the vegetation has in recent years been affected by overgrazing and grazing too early. The existing data on palatability and selectivity have been gathered and are presented together with newly collected information. Chemical analyses of plant samples show that the parts of the shrubs selected by the animals are high in crude protein and also in minerals, even to the extent that the content is higher than in cultivated fodder crops. Moisture content varies strongly according to the seasons. In spring it can be so high for the range vegetation as a whole, including the annuals, that no drinking water is required for the livestock. Seasonal forage production of selected species has been measured and for *Haloxylon salicornicum* a comparison of the production in 1971 and 1972 has been made. An analysis of the 4000 km reconnaissance survey transects in combination with the forage production measurements allows a rough estimate of the total forage production in the 240 000 km² study area. For 1971 this amounts to 2.91×10^9 kg dry. A comparison with the forage demand as estimated from the 1971 livestock census figures ($2.52 - 3.31 \times 10^9$ kg dry) shows that for 1971 the figures are of the same magnitude. The animal-census figures of 1965 indicate that in that year the livestock numbers were much higher and it is, therefore, likely that at that time and probably also in the earlier years forage production was much higher. Field observations providing further evidence for a decreased production are discussed. Moreover, the production per millimetre rainfall is only about one kilogram per hectare, while figures of three to four kilograms are given in the literature for similar areas in North Africa.

Cutting of shrubs for fuel is another vegetation utilization process that is doing damage to the desert shrub rangelands. Around villages, wells, etc. a continuous cutting takes place and often the young shoots of the regrowth are being grazed. This results in bare areas around such settlements. Experiments to study the impact of cutting on *Haloxylon salicornicum* and *Rhanterium epapposum* were carried out. *Haloxylon* shows a relatively high resistance to cutting but the frequency of this treatment as well as the uprooting of the plants by the fuel gatherers also has the inevitable effect on this species, resulting in the death of the plants. *Rhanterium epapposum* shows very little resistance to cutting.

Areas receiving runoff water are locally ploughed for cereal cultivation. In such areas the most productive natural vegetation is found. This is destroyed by the

ploughing; regeneration is poor. Crop failures are common because of the unreliable rainfall, but the introduction of heavy machinery has made the ploughing and harvesting relatively easy. In particular in the northern Jezira, the part of the study area with the highest annual rainfall, almost the entire natural vegetation has been destroyed by this process and been replaced by a relatively useless vegetation in which *Peganum harmala* and *Artemisia scoparia* are the most common dominants. In the Western and Southern Deserts degradation of the vegetation in wadibeds and depressions is taking place by the same process.

Observations inside exclosures in comparison to the outside situation show the increase in cover and aerial biomass of the vegetation under protection from (over)utilization. Succession was found to be a very slow process for the desert shrub vegetation. Aerial biomass and crown cover inside exclosures was more than three times higher than outside. *Haloxylon salicornicum* showed a decreased production under full protection. Light to moderate grazing seems to stimulate the growth of this species.

Overgrazing, fuel cutting and ploughing, in various combinations, are causing an extensive degradation of the vegetation of the desert shrub rangelands and an increasing soil erosion. Regeneration of the vegetation in many areas will already pose problems or may even be impossible. The once productive desert rangelands of Iraq are increasingly converted to barren, lifeless desert. Desertification is here not a 'desert creep' but rather a process occurring from the inside whereby the influence of degraded land grows until the entire area is affected.

The last part of the study describes an approach that could lead to improved management. An economic justification for management of the desert shrub rangelands, especially in relation to livestock production, is presented. For the period 1953-1961, for which the required data were available, the desert rangelands contributed about 10-15% in the total contribution of the agricultural sector to the national income. The increasing demand for livestock products, caused by a growing population with an increasing per capita income, is reflected in the continuously increasing meatprices.

An approach in three phases to achieve a proper management and use of the study area is presented. In the first phase reconnaissance surveys of terrain, soil and vegetation should produce small scale maps and a qualitative land suitability classification for different land utilization types. The FAO land evaluation procedure provides a useful methodology. The relevant land utilization types and the land qualities that should be assessed for the rangeland evaluation are discussed. The government should then select priority areas and desired land utilization types. In the next phase the selected areas should be mapped at a scale ten times larger than that of the first phase and a quantitative land evaluation should follow,

including the socio-economic factors and a cost-benefit prediction. This should lead to an implementation of land management practices in the third phase. This would require a strong governmental organization dealing with these areas. Some aspects of the required mapping and the measurement of production in the shrub vegetation are discussed separately. With modern survey techniques the surveys could be carried out in a short period of time. Aerial biomass and production of the vegetation can be calculated from the height and diameters of individual shrubs, attributes which are easy to measure.

The developments in the area are briefly summarized. The same technology causing the extensive degradation of the desert shrub rangelands could be used for a proper management. The methods to be used are by and large known and with the oil revenues Iraq is in a better position to deal with the problem of desertification than most other countries with arid areas.