REGIONAL ELEMENTS IN THE FLORA OF IRAQ

Only two other phytogeographic regions need be briefly mentioned here: the Eurosibero-Boreoamerican and the Sudano-Deccanian. Most of the twenty-three species which Zohary listed of the Eurosibero-Boreoamerican element in Iraq are confined to special habitats, while many penetrate into other Irano-Turanian as well as into Mediterranean countries.

Bi- and Pluri-regional Groups

The number of bi- and pluri-regional species in the flora of Iraq, that is plants ranging in distribution over two or more phytogeographic regions-is high. The majority of these species come within the categories of hydrophytes, halophytes, hemerophytes (Any cultivated plant, especially one introduced from elsewhere, or anthropophytes: segetal and ruderal plants introduced through the agency of man) or other plants of secondary habitats.

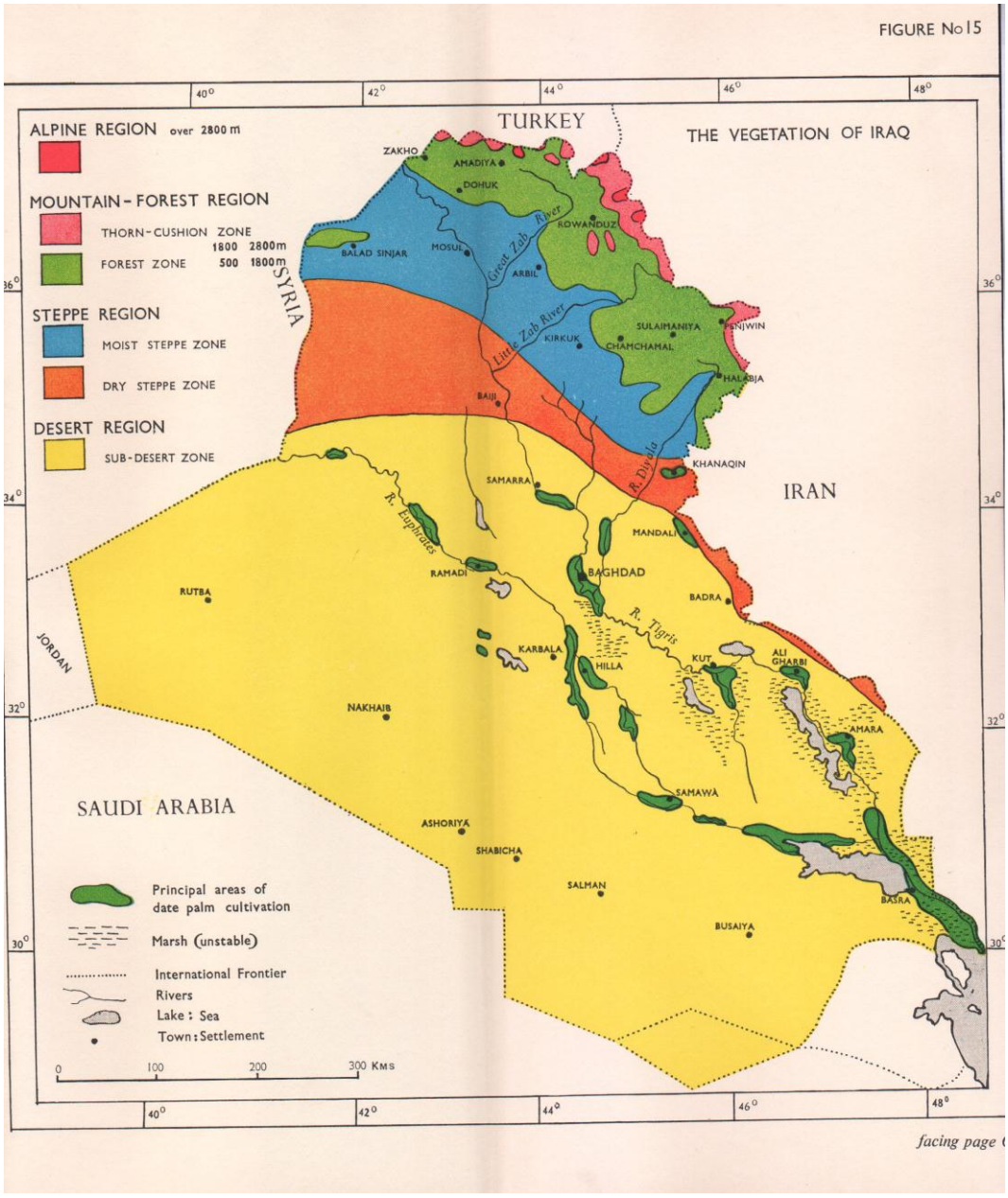
The Endemic Species of Iraq

In his detailed analysis of the endemic species of Iraq, Zohary (1950, 183-8) found some 95% Irano-Turanian endemics but only 5% Saharo-Sindian. His total number of endemics in Iraq amounted to some 190 species, representing about 10% of the known species of the Iraqi flora at the time of his analysis (c. 1946 when his manuscript was printed: it was not published till four years later, in 1950) and some 15% of the mono-regional species then observed. Of the 181 Irano-Turanian endemics nearly three quarters (132) belong to the Irano-Anatolian element and only 49 to the Mesopotamian.

ZONES OF VEGETATION IN IRAQ

When dividing our territory into physiographic regions and districts *(vide* pp. 3-4, and frontispiece map, Fig. 1) we were primarily concerned with the delimitation of convenient geographic units for citation: thus, under any species, a glance at the regional and district symbols gives a general idea of its distribution in Iraq. So far as possible we chose well-

defined physical features as our boundaries. In varying degree certain of these physiographic boundaries will be found to coincide with, or lie near, the natural lines of transition between major categories of vegetation, but the two maps must not be confused; the former is an artificial sub-division based on geographic convenience, the latter (with which we are here concerned) an attempt to define and sketch out on the map the boundaries of natural climatic zones of vegetation in Iraq (Fig. 15).



CLIMAX VEGETATION

It is no easy task to draw such a map. Until an intensive vegetational survey of the whole territory has been completed it is perhaps ambitious to attempt it; and, even if detailed survey results were available from all over the country, the problem of interpretation would be formidable. In a land of ancient civilization like ours, one so extensively cultivated and grazed for centuries or even for millenia, the natural vegetation of the territory has been greatly changed as the result of man's activities: even largely destroyed over vast tracts of country. It is thus often difficult to determine from the vegetation as it exists today the climax (or form it would have assumed and to which it would ultimately revert if protected from interference by human activity).

ACTUAL EXTENT OF THE FORESTS

Compare, for example, the actual state and extent of the northern forests as mapped by Chapman in 1948 (Fig. 16) with the territory delimited as" mountain- forest " in our own vegetation map (Fig. 15). We have little doubt that if the whole of our forest territory could be fenced off to exclude man and his animals-and thus left for a suitably long period of years-it would in time revert to its natural state of forest climax. Where erosion has followed the destruction of the forest restoration might take a very long time indeed; but there is historic evidence that areas partly or wholly denuded today were clothed with trees a century ago.

LOWER MESOPOTAMIAN ALLUVIAL PLAIN

Thesame may be said of immense tracts of steppe and sub-desert in our country where cultivation, overgrazing and the activities of fuel gatherers have largely destroyed the perennial herbs and shrubs, leaving in many places but few relics of the perennials: the least palatable, the toughest and the most heavily-armed species. It is only in the more remote or protected places that we can get an idea of the form the vegetation would have assumed if it had not been interfered with. Again, throughout the whole of the Lower Mesopotamian alluvial plain, between the twin rivers and sometimes beyond their present limits, hardly a vestige of natural vegetation remains today: almost the whole of this important agricultural

region has at one time or another been irrigated and cultivated. Large tracts, now desert wasteland, were abandoned when increasing salinity rendered the land unproductive or when, due to floods, changing levels or breached canals, the supply of irrigation water failed. In some parts of the plain there are large or small strips and patches of vegetation which may appear to be natural but are in reality of secondary origin-still largely influenced by the agricultural history of the district, the proximity of adjacent habitations and pastoral activities (e.g. the halophytic communities of chenopods forming low thickets between Kut and Dujaila and in many other localities).

VEGETATIONAL REGIONS AND ZONES

Though it may sometimes be difficult to decide where to draw the boundary between one zone of vegetation and another we can nevertheless distinguish six or seven fairly well-defined categories of vegetations in Iraq. (There is seldom any hard and fast line between the zones since their ill-defined borders are usually separated by a wide transition belt where both types of vegetation intermingle and interpenetrate each other in response to local variations in habitat.) Moreover, as we shall see, the exact criterion of what is " desert" and what is "sub-desert", what dry-steppe and what moist-steppe, etc., eludes precise definition. Passing from the lowlands to the highlands of Iraq, starting on the extreme southern frontier and travelling almost due north to the higher mountain summits in the north and north-east of our country, the successive zones of vegetation appear in the following order (Table 1):

With the exception of the alpine region, restricted to the higher summits in the Kurdish alps, each of the above categories of vegetation dominates considerable tracts of territory. Very roughly it may be said that about 4/5 of the surface of Iraq is desert (approximately 350,000 sq. kms. if we exclude the Neutral Zone, nearer 400,000 sq. km. if we include it in our territory) while about 1 /7 is steppe and 1/16 forest and high mountain scrub. The approximate altitudinal limits of each zone of vegetation is shown in the table. In this rough computation of areas the extensive tracts of cultivated land which now occupy considerable parts of some regions have been ignored: notably the Lower Mesopotamian alluvial

plain in the Desert Region, the extensive dry-farmed plains of Mosul, Arbil and Kirkuk (with the lesser plains in Upper Diyala province) in the steppe and the cultivated valleys in the mountains. Of these by far the largest tract of territory is the Lower Mesopotamian plain which we divided off from the Desert Plateau as a separate region in our physiographic sub-division of Iraq. The physiographic Lower Mesopotamian Region is a geographic area comprising the flood plain and delta of the Tigris and Euphrates, together with the flood plains of rivulets flowing into the Mesopotamian basin from the Persian foothills east of the Tigris. Although physiographically distinct from the Desert Plateau Region and conveniently designated as such for purposes of citation, it is not ecologically distinct. It is an alluvial plain of varying salinity intersected by numerous irrigation canals and water channels, both ancient and modern, which contains extensive tracts of shift- ing marshland and abandoned farmland in addition to the considerable areas under cultivation today. Historically and edaphically the alluvial plain has a certain uniformity by which it might be distinguished from the desert plateau-but climatically (rainfall, temperature, etc.) there is no reason to separate the Lower Mesopotamian alluvial plain from the Desert Region in which it lies.

Table 1

VEGETATIONAL REGIONS AND ZONES IN IRAQ

Region (approx. area in sq. kms)	Zone	Approximate Altitudinal limits in Iraq (m)
A. Desert Region (350,000-400,000)	1. (Desert Zone?) 2. Sub-desert Zone	(?)250-400 0-1000
B.Steppe Region (65,000)	3. Dry-steppe Zone 4. Moist-steppe Zone	100-350 200-800
C.Mountain-Forest Region (30,000)	5. Forest Zone 6. Thorn-cushion Zone	500-1800 1700-3000
D. Alpine Region (100 ?)	7. Alpine Zone	2750-3730

STEPPE AND DESERT

Before describing the salient characteristics of the zones of natural vegetation we wish to clarify our own concept of the words " steppe " and " desert "-terms variously used by different authors, both in the popular sense and in the stricter scientific sense.

An early review of the principal desert regions of the world was given by Schimper (1903) who, in describing the Great Sahara, observed: " Not-withstanding the extreme dryness of the climate, the occasional abundance of common salt, and the fact that the soil except in loamy localities permits the rapid percolation of the scanty rainwater, there are nevertheless few places where a glance around fails to reveal a single plant."

Handel-Mazzetti (1910-14) whose studies covered part of the territory which is now Iraq, divided Kurdistan (the mountains) from Mesopotamia (the plains); he sub-divided the latter into the steppes of northern Mesopotamia and the deserts of southern Mesopotamia by a line running from the Jabal Hamrin through Tikrit towards the direction of Dair az-Zur in Syria, approximately along the 35th parallel of latitude and at an elevation of about 1SO m. After discussing the implications of the terms " steppe" and " desert" he differentiated *(a) steppe*, as uniformly distributed open tree-less vegetation, dry in summer yet still visible throughout the summer, during which time it can be pastured, and *(b) desert* vegetation, as that which often appears luxuriously and uniformly distributed in spring, but which disappears completely during the summer, or survives very sparsely in special and well-defined localities, or produces reduced perennials and then provides no more pasture.

Buxton (1923) opined that the term " desert " is not capable of strict definition; he himself used it (p. 2) "to include places in which the climate is hostile to animals and plants, in which normal agriculture is impossible, and in which nearly all the existent forms of animal and plant life are modified to endure life in their peculiar environment ". (By " normal agriculture " we assume that Buxton means the growing of crops without irrigation.) He used the word "semi-desert", without exact definition, " to describe country of which the climate is less hostile, and the flora and fauna less specialized, than that of a desert", adding "semi- deserts support cultivation at certain seasons, and provide grazing, though it is

often bad grazing, at all seasons ". He goes on to stress that " deserts grade quite imperceptibly into semi-deserts, and these into savannahs, steppes and downs, and that a country may be desert at one season and covered with lush vegetation at another. Furthermore, deserts are not necessarily permanent or very ancient".

In 1946 Zohary (1950, p. 9) summarized his own conclusions from geobotanical investigations in some of the Near East countries and wrote:

" ' Steppe ' and ' Desert ' are physiognomical-vegetational concepts and not plantgeographical units. This is to say, deserts or steppes may occur in various plant0geographical regions. In the Near East countries deserts and steppes occur in the Irano-Turanian region and in the Saharo-Sindian region as well.

" Steppes and deserts consist of open plant communities, both limited as to climatic conditions which do not allow the development of an arboreal vegetation. They are physiognomically distinguished from one another mainly by the degree of vegetation coverage. Deserts are depauperated steppes only. Every distinction between them, based on physiognomy of vegetation, is thus arbitrary.

" In our opinion steppes may best be distinguished from deserts by ecological factors. In climatic deserts it is the temperature or the rainfall, in edaphic deserts the substratum. Thus, in the region considered here it is the rainfall which plays the decisive role iri the development of the vegetation. In the countries of the Near East we may consider those areas as deserts where the annual rainfall (or its seasonal distribution) does not suffice to support vegetation throughout the surface. In such deserts plant life is largely dependent upon topography, being limited as to habitats obtaining additional moisture from the surrounding terrains (such as depressions or wadis) or to other favourable habitats.

" Thus in arid regions a climatic desert is an area in which the amount of atmospheric moisture does not reach the point at which development of vegetation throughout the whole area.

" In contrast, the vegetation of the steppe can be supported by the atmospheric moisture of the area so that plant life is not limited to habitats obtaining moisture besides rainfall.

" The critical limit of atmospheric moisture below which plant life ceases to exist is of course relative and must therefore be empirically determined in each case. For Southern Transjordan this limit was found to be approximately 100 mm. Stretches lying behind the 100 mm. isohyet represent here dreary deserts in which vegetation is limited to wadis and depressions only. For Northern Egypt as well as for the Western Negeb of Palestine (due to the proximity of the Mediter- ranean Sea) the critical limit of rainfall is far below 100 mm.

" In Iraq this critical limit lies considerably higher, due to the somewhat continental climate, whereby part of the rainfall occurs during the cold winter months. Part of the rain moisture is thus ' lost ' for vegetation. Therefore we find here deserts even in areas obtaining over 150 mm. of annual rainfall."

We accept Zohary's view that the distinction between desert and steppe is in many respects arbitrary and may best be based on the degree of plant coverage rather than on any differentiation of the vegetation they support. Broadly speaking the vegetation of the *steppe* comprises a number of closed communities covering the greater part of the land-surface, at least at certain seasons of the year; while the plant communities of the *desert* are open, often scattered, and usually more or less restricted to favourable habitats. Ecologically, the critical factor in Iraq is moisture. Passing from places of very low available moisture (low rainfall, high salt content in the soil inhibiting water uptake, etc.) to places where rainfall is sufficient to support a closed plant cover we may observe changes in vegetation marking the transition from absolute desert (very little represented in Iraq) to semi- or sub-desert, dry-steppe and moist-steppe-but, in practice it is very difficult to decide precisely where to draw the line between one zone and another. There is no such abrupt demarcation as that between steppe and woodland. Harris (1960) observed the distribution of a few selected species in desert and steppe; he concluded that *Lycium barbarum* (sic., i.e. *L. depressum)* and *Cressa cretica* are absent from the steppe grasslands while *Poa bulbosa* and *Artemisia scoparia-and* we may add, *Gundelia tournef ortii-are* rare in the desert plains.

Zohary did not attempt to distinguish between desert (the more extreme type or absolute desert) and the less extreme category or " sub-desert ". Neither did he distinguish categories of steppe. This subject was examined by Gillett (1948) whose conclusions though available in the Libraries at Kew and at Abu Ghraib have not been published; his main findings were however summarized by Springfield (1954). In line with Buxton's" semi-desert" Gillett used the term" sub-desert" for the category of desert which " provides grazing, though often bad grazing, at all seasons". By contrast desert (absolute desert) is territory so devoid of vege- tation that it cannot provide appreciable grazing. Agriculturally speaking, it is generally impossible to cultivate either category of desert without irrigation: on the other hand, in occasional depressions or particularly favourable habitats it may sometimes be possible to raise a crop without irrigation in the sub-desert, while in the desert proper the rainfall is too low for this. Similarly, as we shall see later, Gillett established two well-defined categories of steppe.

A. Desert Region

On this basis we must classify by far the greater part of the desert region of Iraq- if not all of it-as sub-desert (semi-desert). Taking the region as a whole it includes few appreciable natural areas where plant cover is (a) almost altogether lacking or (b) so scanty that, provided drinking water is available it cannot support animal life. Broadly speaking the check to grazing throughout the year is not lack of vegetation, except locally in areas of edaphic or secondary desert, but lack of water points at which the animals may drink during the long dry summer season. Where well water is available flocks and herds can generally subsist in the desert region of Iraq throughout the year. Removed from wells, water is usually available in rainpools and depressions during the winter months and, except in abnormally dry seasons, there is hardly a part of the region where an appreciable population of nomads cannot be found living in winter and spring, normally for a number of months on end. Locally, in the sub-desert, there may be barren tracts almost devoid of vegetation, and sometimes of quite considerable extent. Examination usually reveals that these desert

places are either of secondary origin (the result of overgrazing and excessive fuel gathering for prolonged periods of years) or due to local features of soil (edaphic desert due to excessive salinity, extremely impervious soil, very rocky tracts of plain, etc.) or topography (e.g. stretches of flat low-lying land subject to prolonged shallow inundation). Only in the extreme southern corner of Iraq does the sub-desert begin to give way to desert in its stricter sense. There is however no appreciable territory in Iraq comparable in extent to the Rub al-Khali or" empty quarter" of Arabia or other great desert tracts of the world where plant life is almost completely lacking over vast distances or only to be found in very favourable situations. As we have said above, apart from restricted localities where blown sand, periodic and prolonged winter flooding, salinity, etc., may have created conditions of absolute desert over limited areas, districts which appear barren in the Desert Region are seldom really lifeless, neither are they natural. Usually these barren tracts, found around wells, settlements and camping shallow grey calcareous soils, low in organic matter, overlying gypsum or lime accumulation. The brown soils are deeper and of good structure, with a content of 1-2% organic matter, slightly alkaline, and usually overlying lime: even where the underlying rock is not calcareous lime is generally present in the soil, having been brought in the form of calcareous dust. The rainfall in the region is in-sufficient to remove plant nutrients from the soil by leaching to any great extent, but organic matter in the soil may be rapidly oxidized under the prevailing con- ditions of high temperature and thorough aeration. Salinity is not often found in these steppe soils, the rainfall being high enough to remove excess soluble salts except where ground-water comes close to the surface.

In many parts of the steppe these brown soils are very deep; but over large tracts of territory they have been removed by erosion as a result of over-grazing
and careless methods of cultivation. In such denuded places we may find an exceedingly thin layer of soil, or even bare rock or gravel. This is no natural state of affairs: merely the result of human interference over a long period of years.

Characteristic Types of Steppe Plants. Gillett (1948, 3) has pointed out that the characteristic plants of the steppe may be grouped under the following five main types:

(a) Ephemerals: Small spring annuals such as *Erophila verna, Androsace maxima* and *Plantago* spp. etc. which appear early in the winter, flower, seed and disappear before the heat of summer. They are particularly characteristic of places with very shallow soil. Together with lichens and mosses they play some part in starting the accumulation of soil on bare rock or gravel surfaces, thus helping to prepare the ground for more useful types of plant to succeed them.

(b) Spring perennials: With superficial storage organs at, or a little below, the surface of the soil; they flower in spring and disappear from above ground in summer. Among the more important of these *arePoa bulbosa* s.l., *Carex stenophylla, Ranunculus asiaticus* (Fig. 21c) and *Anemone coronaria:* also *Iris sisyrinchium* and many plants of the family *Liliaceq:e,* such as species of *Gagea, Ornithogalum, Allium* and *Muscari.* It is mainly such plants which produce the wonderful display of flowers often seen in the steppe in spring. The roots and rhizomes of these plants form a network in the upper layers of soil and are most valuable in helping to check soil erosion.

(c) Early summer annuals and biennials: These plants are much taller than the spring ephemerals and perennials of the two preceding categories. They are found chiefly in places where there is sufficient soil for them to develop an extensive root system such as will enable them to prolong their growth later into the season and ripen their fruits as the steppe dries up in late May or early June. The more important of them are grasses such as *Aegilops speltoides, Hordeum spontaneum, H. bulbosum, Taeniatherum caput-medusae, Heteranthelium piliferum,* etc., but members of families other than the *Gramineae* also occur: *Crepis (Compo- sitae), Pimpinella, Daucus* and *Torilis* (among the *Umbelliferae)* and *Trigonella* and *Trifolium* (among the *Papilionaceae).*

It is characteristic of the steppe that in favourable seasons, and where grazing is not too heavy, these plants grow quickly enough for grass fires to take hold: this has certainly exercised enormous influence on the vegetation ever since Man first discovered how to produce fire. Plants of this category provide the greater part of the grazing in the

steppes, and it is some of these plants-or rather their modified descendants-which Man has learned to cultivate: such as wheat and barley, the most important crop plants of the region.

(d) Summer perennials: These plants die back to ground-level in winter; they have very deep rooting systems and make considerable growth in spring but do not flower till summer. They are able to remain active later in the season than the three former categories because their deep roots enable them to draw on soil- water which the latter cannot reach. *Phlomis kurdica, P. bruguieri, Cousinia* spp. and *Hypericum triquetrifolium* are common examples of this category.

None of these plants, which are now at all common, are palatable to animals- either on account of thorns, dense felty foliage or the chemical substances they contain: *H. triquetrifolium,* for example, is poisonous. Under present conditions of overgrazing in the steppes of Iraq no plant producing foliage in summer could survive if it were palatable to animals. (The spring plants appear in such numbers that the animals cannot eat them all: therefore unpalatability is not essential to their survival). Since the plants of this fourth category can regenerate from their underground organs, they survive grass fires, and they often escape destruction by shallow ploughing.

(e) Persistent perennials: Which remain above ground-level throughout the year-e.g. tufted grasses such as *Chrysopogon gryllus, Aristida plumosa, Cymbopogon olivieri, Hyparrhenia hirta,* etc., and small bushes such as *Prunus arabica (Amygdalus spartioides), Prosopis farcta, Artemisia herba-alba, Achillea conferta* and *Haloxylon articulatum:* the two former species in the moist-steppe, the three latter species in the dry-steppe.

When edible, plants of this category are particularly valuable, since they provide fodder at all times of the year. They are also important because they protect the soil from erosion at seasons when other plants are dead or dormant in their subterranean parts. In the past-before man interfered with the vegetation by his fires and ploughing, and by maintaining over-large herds of herbivorous animals-these persistent perennials were undoubtedly very much more numerous than they are today. Apart from the considerable tracts of the Moist-steppe Zone under the plough today,

there are other extensive areas where little of the original vegetation remains, namely lands formerly cultivated until the soil was washed away and then abandoned. The persistent perennials do not easily return to such places, often because there is no ready supply of seed available: also because, if they are palatable, the young plants get eaten away before they have the chance to re-establish themselves.

Degradation of the Vegetation of the Steppe: It is well known that useful perennial species have become very scarce or disappeared from other arid regions of the world besides Iraq: for instance, in the drier prairies of North America, in the South African veldt and in Australia. But the process has taken place in these countries during the last three hundred years or less and it has generally been observed by educated farmers and by people interested in science. Furthermore, barbed-wire fencing has been extensively used to control grazing in these countries and also to compare places where over-grazing was intense with protected places. In the very much older civilization of Iraq the destruction of the natural vegetation has been proceeding unchecked for centuries; until quite recently, no accessible areas had been protected from over-grazing nor had any facts about the changes in vegetation been recorded. Thus most people in our country fail to realize how greatly the steppe, in its present state, differs from what it was once in its original condition. Even when this is realized it is extremely difficult to reconstruct the natural state of the vegetation.

Puzzling as this may be, we can often glean information from one or other of the following sources:

(1) localities where some special factor may have preserved relicts of the vegetation from the destructive influence of Man.

(2) the early recollections of old men who have known the district from boyhood and observed a change-the best sources here are the shepherds, since they know more about the vegetation than others.

(3) references to the vegetation in more or less ancient literature. We shall see below how these three lines of approach may help us to elucidate recent or historic changes in the vegetation.

Degraded Forest as apparent Steppe: Which now appear to be part of the Steppe Region do not belong there at all, being indeed degraded forest from

which almost all trace of the original arboreal vegetation has vanished. Gillett, for example, has drawn attention to a large oak tree on the bare hills south-west of Chemchemal. This tree (Q. *aegilops)* is protected by a wall and has been preserved there because the spot where it grows is sacred to the memory of a holy man. If one tree can grow here so well, it is reasonable to assume that other trees of *Q. aegilops* could also grow in this now bleak locality. Thus, on reflection, we are driven to the conclusion that the steppic plants now found here are not the natural vegetation of the locality which, if protected and left to itself, would eventually be covered by oak forest, thus reverting to the natural condition in which it was before the forest trees were destroyed. This theory is confirmed if we examine the herbaceous plants of the locality: several species normally found only in the oak forest grow here-e.g. *Geranium tuberosum.* Gillett (1948, 4) has also extracted and commented on some pertinent observations by Rich (1836) who visited the district in 1820. From these it is clear that the condition of the oak forests of Sulaimaniya province, at any rate the parts of it west of the town of Sulaimaniya, was not so very different in 1820 to what it is today. Thus the deforestation of the Chemchemal-Sulaimaniya district must have been accom- plished well over 150 years ago.

Many other small shrines and graveyards in the hills and foothills of Kurdistan bear similar testimony: one of these may be seen on the road between Sulaimaniya and Penjwin a solitary and magnificent oak in a treeless plain (alt. 750-1000 m.) which has long ago been completely denuded by the woodcutters and charcoal burners of Sulaimaniya. Thus it is clear that certain areas where the vegetation today is physiognomically steppic belong in reality-that is ecologically to the Mountain-forest Region.

Degraded Dry-steppe Vegetation: As it exists today there is so little of the original vegetation left in the Dry-steppe Zone in Iraq that it is difficult to pick out its leading plant associations. On the deeper soils *Artemisietum herbae-albae* is one of the most widespread; *Achillietum confertae* occupies considerable tracts where the soil is thin and poor. There seems little doubt that *Haloxyletum articulati* was once a leading association in this zone, and probably not so very long ago. Gillett in the

course of extensive travels in the locality in 1947-8 only found the species in one or two inaccessible places, while Bodenheimer (who had carefully investigated the vegetation of the locust breeding grounds between al-Hadhr and Tal Afar in 1943) never found it at all. This confirms the testimony of the older tribesmen in the Jazira today when they recall that the vegetation used to be much thicker in their boyhood, the ground being covered as a thicket of SHIH *(A. herba-alba),* QAISUM *(Achillea)* and RIMTH *(Haloxylon)* while HAMDH (salt bushes in general) was abundant, and that most of the more valuable shrublets have disappeared during the course of their own lifetime. Remnants of the perennial shrublets may still be found in certain parts of the central Jazira but only in localities some 20 km. or more distant from permanent water or in the less accessible parts of stony hills such as Jabal Makhul where grazing has been less intense and where there has consequently been less thorough search for wood for the fires of the tribal camp. Large tracts have been reduced to an almost bare expanse dominated by *Poa bulbosa* and other short grasses, with a colourful showing of small annual herbs in spring. As in the sub-desert, at a still later stage of degradation, much of the *Poa* may be replaced by the grass *Stipa capensis* (S. *tortilis).*

Even in the depressions, where flood water collects after rain, or along the water courses and flood plains the shrubs and treelets we find in the Desert Region are comparatively rare. In the Southern Desert there is, not far from Shabicha, one small clump of *Acacia iraqensis* (which has been found at no other place in Iraq), while *Zizyphus nummularia* is widely distributed throughout all our deserts: yet in the dry-steppe it is comparatively rare in spite of the higher rainfall. This is because the greater Baduin population in this less remote zone has almost exter- minated the tree for fuel. Another small tree which has almost disappeared from the sand dune tracts of the Jazira (mostly in the Desert Region) is *Haloxylon ammodendron.* Not only are the trees cut but the roots are dug out to make charcoal. On a trip to the Wadi Thirthar some 50 km. N.E. of Ramadi in 1954 we found only occasional isolated shrubs of *H. ammodendron* among the sandhills where our guide informed us there had been quite extensive

thickets some thirty years before. The process of destruction here had been speeded up by lorries coming from Falluja with supplies for the charcoal burners whom they dropped and left for some days in the desert, returning then to pick up the men, collect the charcoal and take it to market in Baghdad. The charcoal from *H. ammodendron* is of high grade, burning with a hot smokeless flame and it is in great demand for cooking (fuel for grills), heating (fuel for braziers) and as "pipe coal".

Apart from improvements in communications and ease of transport there are probably two main factors which have greatly expedited the extermination of the woody perennials in many parts of the Jazira, and generally throughout the Dry- steppe Zone:

(a) the much greater number of animals sent out to graze in the desert since tribal warfare was supressed after Ottoman times.

(b) the increase in livestock resulting from the great increase in irrigated land along the river owing to the introduction of pump irrigation some 30-40 years ago and more recently by the construction of barrages.

Degraded Moist-steppe Vegetation. Hardly any part of the vegetation of the Moist-steppe Zone remains untouched in its natural state, since the zone runs across the rich sub-montane agricultural belt of Upper Iraq: the Upper Jazira and the plains of Mosul, Arbil and Kirkuk. Except perhaps in its extreme north- westerly corner (which has not been greatly explored by botanists) this belt is thickly populated with villages and almost every accessible piece of land there has been cultivated for millenia. Gillett's broad distinction between the dry-steppe (which has affinities with the sub-desert) and the moist-steppe (many of the species of which are also found in the forest) is however undeniable, though we cannot as yet reconstruct the natural aspect of the moist-steppe or be sure of what plant communities it is composed. More detailed research must precede any serious attempt to correlate differences in the existing (degraded) steppe vegetation with differences in soil (deep or shallow, sandy or silty, etc.), with minor differences in climate, with the degree of overgrazing and past agricultural treat- ment of the land (whether it has been ploughed and, if so, how long abandoned). Gillett has suggested that there is evidence that the natural condition of the Moist-steppe Zone is a kind of savannah or open forest of *Pistacia* with other small trees and

shrubs. For instance, on the northern foothills of Jabal Sinjar there are some 300-400 trees of *P. atlantica* var. *kurdica (Pistacia mutica)* which have apparently been preserved because the ground where they are situated is considered sacred to the memory of a saint buried there. These trees are in a country which, but for their presence, would be described as typical steppe.

Again, on Jabal Qara Choq, near Makhmur, in the dry south-west part of the province of Arbil, at quite low altitudes (about 400 m.) there are numerous bushes of *Pistacia atlantica, Ficus carica, Prunus microcarpa* and *Prunus arabica (Amygdalus spartioides).* Though the climate here may be a little different from that of the surrounding shrubless plain this alone would not account for the presence of these bushes. The probable reason for their survival is that ploughing has always been impossible on the steep rock slope while fuel-cutting and grazing have here been less than in many places owing to the distance from permanent water: moreover the larger limestone rocks have afforded protection against grass fires. Part of the upper steppe of Iraq really belongs to the Forest Zone, and an abrupt transition from forest to treeless steppe in the condition we find it in Iraq today appears improbable.

Moreover interesting confirmation of Gillett's hypothesis that the moist-steppe was originally an open savannah in which small trees of *Pistacia, Ficus,* etc. and bushes of *Prunus* were dotted about among the grass-in other words that the treeless condition of the dry-steppe did not abruptly give way to the wooded condition of the oak forest-may be adduced from records in Jordan where it is known that areas with a rainfall of 200-400 m. were covered with *Pistacia* scrub up till as recently as the 1914-18 war. The later survival of open *Pistacia* forest in Jordan as compared with Iraq is no doubt attributable to the absence of perennial rivers and high mountains there. In Iraq the number of sheep is far higher than the steppe alone could support; in the dry summer season the flocks graze on the stubble of irrigated fields or are taken up into the high mountain pastures. In springtime, when the cultivated land is under cereals and the mountain pastures still covered with snow, the animals depend for grazing on the steppe and sub- desert.