SDSU-RSI-83-07

Land Classification/Soil Survey Project of the

SYRIAN ARAB REPUBLIC

VOLUME 6

An Evaluation of Syrian Rangeland Problems

October 1982

Prepared for

United States Agency for International Development
and the
Syrian Arab Republic

Prepared by

Louis Berger International, Inc.
East Orange, New Jersey, U.S.A.

Remote Sensing Institute
South Dakota State University
Brookings, South Dakota , U.S.A.

and the
Ministry of Agriculture and Agrarian Reform
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1. Introduction, Summary and Recommendations
2. Reconnaissance Soil Survey, 1:500,00 scale
3. Soil Survey of the First Settlement Zone, 1:100,00 scale
4. Detailed Soil Survey of the Tartous Area, 1:25,000 scale
5. Reconnaissance Land Use Survey of Syria, 1:500,000 scale and Land Use Survey of the First Settlement Zone, 1:100,000 scale
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FOREWORD

The rangeland study included areas of Syria receiving less than 350 mm of precipitation.

The rangeland study was affected by several factors beyond the control of the range specialist. First, there was no access to aerial photographs so that methods of rangeland study involving aerial photographs were not employed. Second, although clearance for field study was requested in October 1980, final permission was not secured until mid-June, 1981. This delay in getting to the field was due in part to delays in vehicle clearance.

Although Landsat satellite imagery was available, mid-June in Syria is late in terms of relating vegetation to imagery since this is after the growing season and the annual vegetation essentially has disappeared due to grazing and trampling by livestock. Thus, with little or no vegetation remaining, it was difficult to relate the Landsat imagery to vegetation. This set of circumstances tended to affect how Syrian scientists viewed remote sensing as a useful tool in rangeland studies. Timeliness of field studies is an essential part in the application of remote sensing principles for rangeland studies.

There are many reasons for overgrazing of rangelands. Lack of precipitation, however, is not a cause of overgrazing but a limiting factor in the production of vegetation just as shallow soils, low soil fertility or a short growing season are limiting factors. It seems obvious that the solution to overgrazing lies partly in the social and political arena. The scientist provides an inventory, rates areas in terms of ability to produce vegetation, and points out consequences if overgrazing is uncontrolled.

Many excellent reports by Syrians and others are available dealing with Syria's rangelands. These were studied. Their focus, however, was on specific treatments for specific areas or on specific problems such as forage improvement at an experiment station. Since this subject matter had already been addressed, I chose to look at the basic needs for long-term rangeland renovation. This includes the major research needs, inventory requirements, and social and economic inputs to a grazing system. These considerations must be dealt with if Syrian grazing lands are ever to reach their potential.

I support the concept of cooperative committees in both rangeland improvement and sheep breeding. The effectiveness and success of these cooperatives will not reach full potential, however, unless individual members are encouraged to provide input and exchange ideas.

Research seems expensive because cash outlays are required at the outset and useful results often are delayed for years. Yet the problem of range renovation cannot be addressed until basic research determines what vegetation will grow in the various environments of Syria or what grazing rotations will improve the rangeland. Many of these problems require field research for their solution.

A map was to have been a part of this report. However, local administrative delays resulted finally in its cancellation.

volume 6

An Evaluation of Syrian Rangeland Problems

1 INTRODUCTION AND OBJECTIVES *

The term rangeland as used in this report refers to those areas which are neither forested nor cultivated and receive less than 350 mm of precipitation per year. For the most part, they have only limited potential for uses other than grazing. Those areas receiving less than 150 mm annual precipitation sometimes are grazed on an intermittent basis, productivity being limited particularly during unfavorable years. Some exceptions are found locally where additional moisture is available from runoff.

No specific description of project outputs were outlined in the area of range management under the terms of the contract. Therefore, the project personnel involved developed a plan of action which was accepted by the Directorate of Soils and USAID representatives.

Due to an unfortunate, but unavoidable delay in approval of the range management specialist and the clearing of project vehicles through customs, field evaluation was delayed until late June, well into the dry season. By that time it was impossible to delineate range types except on such a broad basis as to be nearly useless due to the state of the vegetation.

(*)Prepared by Gene K. Eulert, Sabah Al Baba and Imad Hassoun. Dr. Eulert is a Range Ecologist for the Remote Sensing Institute, South Dakota State University, Brookings, SD, USA. Mr. Baba and Mr. Hassoun are staff members with the Soils Department, Ministry of Agriculture, Damascus, Syria.

Range condition designation is determined by comparing current vegetation with potential vegetation, thus is based on types and typing. A potential vegetation map was being produced by the Syrian Arab Republic Government (SARG) and the Arab Centre for the Study of Arid Zones and Drylands (ACSAD) which was to have been completed by August 1982. It would have been used in conjunction with field notes to produce a general, large scale range condition map. However, the potential vegetation map was not completed until late December, only 3 weeks prior to the specialists departure, leaving far too little time to complete a range condition map. Regrettably, considerable time and effort were expended toward production of a condition map which could have better been utilized in the evaluation of topics discussed in the report.

The purpose of this report is to convey to SARG the current state of the steppes and at least some of the factors, policies and activities responsible. A number of recommendations for changes have been made which the author feels are necessary if improvement of the steppes is to be realized. These include suggestions for research, education and policy.

2 CURRENT STATUS AND CONTRIBUTING FACTORS

The present state of the rangelands indicates many decades of overuse. A few isolated pockets have partially escaped, perhaps due mainly to their remoteness from permanent water. There is a general consensus among ecologists that vegetation was considerably more diverse and dense, perhaps even forested (probably savanna) over much of the area. Other authors indicate that climatic changes have been minimal over the last 4,000 - 6,000 years, excluding it as a factor in vegetation changes. Indirect evidence includes the support of a relatively large population engaged in activities requiring fuel and materials for dwellings, pottery and tile making, etc., activities which would be impossible today using wood and/or charcoal as fuel. Sankary (1981) and Draz (1980) note that historical documents dating back at least 1,000 years indicate species which have virtually disappeared from Syria were major plant community components. During field trips, particularly in low, rough mountain areas, a few remnants of what may have been savanna were noted and in a few inaccessible patches, relatively dense and diverse floras were noted. Conspicuous by their absence were wildlife species with only a few reptiles and birds sighted during 1,000's of km of off road travel, indicating a low level of biological productivity.

Presently, there are signs that deterioration is continuing over large areas. Plant communities are badly depleted, usually dominated by unpalatable and/or poisonous species, a low disclimax state, much below potential as dictated by soils and precipitation. Although many annual species were almost certainly historically important as community components, they are now the dominant group and over extensive areas the only group present (Figure 6-1). In some areas no vegetation remains at all (Figure 6-2). Current dominant perennial species such as Artemisia herb-alba and Haloxylon spp appear to be in low vigor, (Figure 6-3) and not reproducing in some areas and dying out in others (Figure 6-4). These are being replaced by Peganum harmala, Anabasis syriaca, Noaea mucronata, Artemisia scoparius, Cousinia wesheni, Carex spp, annual grasses and other undesirable species. Evidence of both wind and water erosion is present with large areas being reduced to desert pavement, the finer soil fractions having

been washed and blown away leaving only the stony surface as shown in Figures 6-5 and 6-6. Other areas contained pedestalled rocks and plants or soil drifts on the lee side of bushes (Figure 6-7) and occasionally blowouts were seen in sandy soils. Active gully and sheet erosion were noted in all areas visited. Such conditions make it almost impossible for the re-establishment of vegetation either naturally or artificially.

2.1 OVERGRAZING

A number of factors have contributed to the retrogression of rangelands in Syria. It appears that the major cause has been overgrazing by domestic livestock. Undoubtedly, there has been very long term abuse. Judging from the literature and current vegetation, much of the current serious deterioration noted appears to have occurred during the last 4 or 5 decades due to rapid population increase magnified by rather drastic political policy changes. Contributing factors are other, but related, activities carried out by the inhabitants of the region, some of which are discussed below.

2.2 PLANTS AS A FUEL SOURCE

One important activity is the still fairly common practice of using woody species for fuel as shown by Figure 6-8, although other energy sources are readily available and their use encouraged. During field trips, one encampment alone contained a stockpile of an estimated 50 m^3 of mainly Artemisia and Haloxylon material which represents a significant area being completely or partially denuded. Old campsites, some perhaps 10 years old (judging from rubbish left behind) are quite apparent because of denuded areas. Obviously the erosion hazard and subsequent loss of silt is increased many times over on such areas.

2.3 PLOUGHING

Another activity observed was the illegal ploughing of "virgin steppe" as shown in Figure 6-9. Since, at best, these areas are marginal during normal years, they are abandoned (often permanently) during droughts or even after one or two normal years. The result may be the replacement of the "pre-plough" vegetation by undesirable species, or worse, the removal of soil particles initiating the early stages of desert pavement development before significant numbers of plants become established. Even if plants become established, considerable erosion has normally taken place resulting in a lowering of productivity. Since there is no concurrent reduction in animal numbers, the same number graze on a smaller area, resulting in a higher stocking rate. Although the rate increase is small, its effect is significant on rangeland already overstocked.

2.4 ROADS

Ready access to modern technology has had other impacts as well. With the continuing increase in the use of wheeled vehicles, many km of new roads have

been developed (Figure 6-10). Since these roads are not constructed and maintained, but are developed by repeated passage, a road is used until it becomes uncomfortable, rough and rutted. It is then abandoned and a new track developed usually parallel to the old, starting the cycle once more (Figure 6-11). Many of these "roads" are easily observable on 1:500,000 scale imagery (Figure 6-12). During field trips, some were observed to be at least 1 km in width at some points. This has removed 100's of km^2 from production, a process which is continuing and which may, in fact, accelerate.

2.5 WATER DEVELOPMENT AND TRANSPORTATION

The availability of wheeled vehicles has resulted in the easy transportation of water into areas which formerly were grazed infrequently or during short periods when water from runoff, temporary wells or snow was available (Figure 6-13). Normally, a more uniform distribution of grazing pressure is desirable and often a major range improvement goal. However, the apparent vacuum created encouraged additional animal numbers resulting in continual grazing in those areas. Formerly some areas would have undergone a rest while the temporary grazing areas were being utilized. These additional animals cause considerable degradation during periods of moisture stress when drought forces flocks from certain areas, in effect, concentrating them around permanent reliable water sources. In some areas, the drilling of new wells has had a similar effect. One unfortunate effect of heavy usage in these "new" areas is the elimination of very palatable plants and the loss of genetic variability of possible seed sources for native species which likely offer the highest potential for range renovation.

2.6 ANIMAL HEALTH AND DISEASE CONTROL

Better animal health and disease control have also played a role in insuring increased numbers of animals grazing over longer time periods. For example, a starting flock size of 100 animals with losses of 1 percent (as compared to say 10 percent loss) exerts considerably more pressure on the range over a grazing season. To maintain a similar grazing pressure would require the starting flock size to be smaller. In reality, what has happened is that animal numbers have actually increased over the years and the impact of better animal health has been considerable.

2.7 MOBILITY

There appears to be a tendency to occupy campsites for longer periods of time than in the past. Initially this appears to be a paradox since potential mobility is at its highest point in history. However, with rapid movement possible, it is no longer necessary to start seasonal movements until a day or two before moving many kms. In the past it was necessary to move more often and on a more continual basis to reach the desired areas. In addition, the amount of personal belongings has increased resulting in more work to move, fostering a tendency to stay in one place as long as possible. Since damage to vegetation is directly related to the use of trails and campsites and the bedding and milking of animals in their vicinity, more severe damage occurs than in the past when (because of required moves due to lack of rapid transportation) the campsites and

trails were more temporary. Also there may be an increased tendency to camp year after year in the most highly desired sites, usually near water since flocks need not come to water but rather water is hauled to them.

2.8 CHANGES IN ANIMAL NUMBERS

The desire to move as seldom as possible has apparently resulted in fewer camel herds being maintained (Figure 6-14). In areas with no camels in evidence, but well-suited to their grazing, a number of Bedouins were asked why they didn't herd them. The almost universal answer was that it required too much moving. Since camels utilized many plants that are unpalatable or unused by sheep, part of the range resources goes unutilized. Those unused species gain a competitive advantage over the plants palatable to sheep resulting in a lowering of vigor and, therefore, carrying capacity as time passes. Since sheep numbers have not been lowered, but have increased, the deterioration has accelerated. This upward trend is reflected in government statistics. Between 1964 and 1977, sheep populations increased from 1.75 million to 7.07 million, goats from 0.8 million to 1.01 million, cattle from 464 thousand to 639 thousand with camels decreasing from 11 thousand to 6.5 thousand. The result has therefore been an increase in grazing pressure and a decrease in utilization of a portion of plant communities.

A number of reasons account for these increases in numbers. First there is a larger demand for protein in a rapidly growing population seeking a higher standard of living. There is also a desire to improve individual wealth which has been intensified by increased mobility, exposure to urban environments and consumer goods, and the relative ease of transportation of additional possessions. These all necessitate additional cash flow which means more income to be generated. Supplements to income in some areas include shepherding of additional animals for absentee owners who are usually dwellers in an adjacent population center.

2.9 MILK PRODUCTION

Milk and milk products add to the income, are preferred dietary components, and a source of important nutrients as well. The former, of course, encourages overgrazing and the latter is an extremely "expensive" source of protein. It has been estimated that in a diet composed mainly of milk and related foods, 30 sheep per adult per year are required to maintain good health. An additional negative effect of milking rangeland animals (which produce comparatively little milk) is that young animals are robbed of essential nutrients, are therefore smaller and require more feedlot time, or in many cases, are stunted and unsuitable for feeding. In ecological terms, by utilizing milk as a major component of the diet, man is one step further down the food chain. Since there is a very large amount of energy used (particularly under range conditions) in producing milk, much less of the basic resources (that is the range plants) is converted to a consumable form for man. Figure 6-15 shows sheep being tied in rows, head to head in preparation for milking.

2.10 DROUGHT AND ANIMAL NUMBER CYCLES

Rangelands also suffer from the cyclic nature of sheep numbers and weather. During a period of favorable weather, numbers build to or above the point of overstocking. With a return to a drier than normal period, the range is rapidly depleted and damaged. Animals must be removed and sold, lost on the range or fed entirely on feed supplements which are likely in short supply because of drought. Until recently, the normal sequence was a sell-off of animals with a subsequent surplus of meat at low prices and the movement of flocks across national boundaries where prices were higher. With the return of normal or better conditions, numbers are low and animals were held to rebuild flocks, forcing prices upward and encouraged movement back across national boundaries.

Such a sequence of events has an adverse effect on the balance of payments with the importing of grain during periods of high demand and prices and the exporting of low quality meat at low prices. With the return to normal weather, low numbers and better grazing coupled with higher grain yields (and low demand) meant low grain prices for export and high meat prices because of low numbers and flock rebuilding. In short, commodities are exported at low prices, but imported at high prices.

The effect of these cycles on the rangeland appears to be as follows: with the high stock rates at the start of the drought cycle, the desirable plants undergo very heavy pressure when physiologically they are least able to tolerate it. During these periods, many die and those able to survive reproduce at reduced levels, usually not at all. With return to normal weather, flocks are increased as rapidly as possible (before the range has recovered) to the point of overstocking. When another drought occurs, the cycle is repeated. In effect, the range conditions cascade downward somewhat with each drought cycle. Because of the heavy stock rates and low plant vigor, little improvement takes place between major droughts.

2.11 BREAKDOWN OF TRADITIONAL CONTROLS

Historically Hema type ranged from no grazing to year long grazing with the number, kind and season of use being controlled by persons closely associated with the land. This was replaced by open and green grazing as summarized by Draz (1980). "Most of the Near East governments, throughout the last 50 years have maintained the belief that all arid and semi-arid regions should be considered and kept as government land. Previous grazing rights that have generally been abrogated and which are still claimed by certain tribes for specific ranges have been cancelled with no compensation, thus enhancing misuse and allowing uncontrolled nomadic grazing to become dominant over the steppe regions".

A more detailed treatise on the subject can be found by Hardin (1968) in the "Tragedy of the Commons". Basically there has been a removal of evolved dynamic socioeconomic systems without replacement. Neither social nor economic (or perhaps equally important, psychological) substitutes have been supplied.

The development of a "first come first serve" philosophy not only leads to uncontrolled grazing, but to the expansion of cultivation into land and climates very poorly suited or totally unsuited for it.

3 RECOMMENDATIONS

3.1 SURVEYS

To initiate any attempt to manage, manipulate, access or monitor the steppe resources, there must be a comprehensive body of basic data as to the current resource status. Without reliable information as to what constitutes the current resource, there is no benchmark from which to estimate carrying capacities, initiate management and/or manipulative practices or a basis for monitoring trends by which the success (or failure) of practices can be measured.

3.1.1 MAPPING AND AERIAL PHOTOGRAPHY

From observations made during field trips, it appears that aerial photography between the scale of 1:12,000 to 1:20,000 would be the optimum for management at the intensity that is needed if the potential of the steppe is to be realized. At this scale, small, but often important, vegetation types can be accurately located and mapped. The photos should be taken at the time of maximum vegetation growth (weather permitting) particularly if they are infrared, which seems preferable. Aerial photography was not available for use by the author during his stay. However, at the time this report was being completed, he was informed that it had now been released for use by the public. Scale, however, is unknown.

Survey information, to be useful, must record the major dominants in a type and when known, indicator species which may indicate soil, chemical or physical characteristics, past use, or trends. In addition, the presence or absence of rare, but highly palatable and/or desirable plants is useful perhaps, for example, as a future seed source. It is highly desirable to emphasize perennial species as they are less subject to annual variations in weather.

3.1.2 PRODUCTIVITY AND COVER

With sufficient practice and training, productivity can be rapidly estimated particularly if checked by actual clipping results once a day. The same is true of cover estimate when divided and recorded in no more than 5 class intervals. However, in ranges dominated by annuals, both values are strongly influenced by year to year fluctuations which must be taken into account during analysis and interpretation of data. At any rate, the measurements or attributes recorded must be those needed for the level of long term planning necessary to fulfill policy expectations. Once typing is completed, areas with similar plant communities and other attributes such as soil type, precipitation and elevation can be grouped and information for management, production, etc. from representative intense study areas can be extrapolated to them.

Since the season of maximum standing crop is short, it is important that estimates of productivity and cover be carried out at that time. The season for typing on the basis of perennials can be extended somewhat; in other words, typing can be carried out over a longer field season than productivity and cover estimates.

Another aspect of surveying that must be addressed is the determining of what areas will be given priority. An argument is to immediately concentrate on those areas which are currently undergoing desertification to prevent total, permanent loss of productivity.

It must be emphasized that this initial phase, that is delineating types, must be done as accurately and precisely as possible. To be sure, the time element is important as it reflects costs, however, considerations of quality must be given priority. A fast, but inaccurate, survey is worthless and results in inappropriate planning and confuses the interpretation of study results.

3.2 MONITORING

Monitoring is obviously necessary to assess the success of range programs, to determine changes in composition, and for the comparison of treatments. The method selected must give rapid, accurate and repeatable results when used by different personnel and produce data which can be statistically analyzed.

3.2.1 LINE INTERCEPT METHOD

A method which meets these criteria is the so-called line intercept method. Permanent stakes are placed a predetermined distance apart, with one being designated as the zero end or starting end. A steel tape measure is stretched taut by a fairly strong spring at the other end. When vegetation intercepts the vertical plane of the tape, it is recorded by species, or in a general study, the category of vegetation. In addition, a ruled tape makes it very convenient to locate small plots or loops for density or productivity quadrates. This method of sampling allows the standardization of data collection, data forms, filed methods and data analysis. It also allows a direct comparison of grazing treatment results among different areas and types.

A suggested procedure for carrying out a study program is as follows: given the type of vegetation that predominates over the steppe region, the line intercept measurements should be recorded for those species in which the limits of the plant is easily defined as examplified by the crowns of Artemisia herbalba and Haloxylon spp or plants with easily definable clumps such as Carex stenophylla. The intercept method is not well suited for recording single-stem species such as the annual gramnoids, a major component of steppe vegetation. For those species, the loop method is preferable using the same line. The method involves using a loop or ring which in reality is a small circular plot. The edge of the loop is attached at right angles to a 1 mm to 2 mm diameter shank of suitable length (usually about 40-50 mm) so that when the loop is sitting on the ground, the shank extends vertically past the suspended tape. The shank is then placed exactly vertical to the tape at some interval (probably about every 30 mm) and the position (along the tape) and the name of the species found inside the loop is recorded. Categories other than standing vegetation are normally recorded and include rock, desert pavement, bare soil and litter.

The tape can also serve as the locating device for quadrates for recording plant density and for production data either estimates or actual weights. For example, a dm^2 quadrat could be placed every meter along the chosen side of the

tape (the side of the quadrat lying exactly on the vertical plane formed by the suspended tape) and density counts taken by species or vegetation category. Likewise, fewer, but larger, plots could be located at longer intervals for larger, more widely spaced species, woody or otherwise.

From a practical standpoint, a tape length of 25 to 30 meters ruled in cm would probably be sufficient. Strong steel stakes should be driven at least 75 cm into the soil or set in concrete to prevent removal and movement when the tape is stretched into place. One end must be designated as the zero end and so marked by painting or perhaps using different kinds of metal stakes so the tape can only be hooked up one way. Transects may also be placed in clusters with lines radiating outward on compass lines; that is, with one central stake acting as the zero end for all lines to be sampled.

Using the line transect in the manner described, allows the exact areas to be resampled and accurate comparisons to be made.

Care must be taken in location of the permanent sample areas to insure that they are representative of the overall areas; that is, representative of soils, species composition, condition and topography. Data recording forms need to be standardized and as simple to use as possible, both in the field and during data analysis and reduction. Field procedures must be standardized and documented so all areas are sampled in exactly the same manner regardless of the personnel involved and for each sampling period and area. Since differences in data are often misleading when casually examined, statistical analysis must be applied if small, but important, differences or changes are to be found. This is particularly important because of yearly variations in weather and other uncontrollable factors. However, this can only be done if data collection is standardized and carried out for a number of years.

An effort to establish line transects for monitoring purposes was initiated in Syria during the spring of 1979. These were established at five locations within range and sheep centers and cooperative boundaries - three in the Hama province and two in the Aleppo province. Training has been carried out at at least one of these locations and vegetation data collection has been undertaken. Unfortunately, it was not possible to visit these areas due to a shortened stay period, transportation problems, difficulty of arranging schedules with individuals involved and a general lack of knowledge within the government of their existence.

3.3 RANGELAND IMPROVEMENT

Rangeland improvement is and should be a major priority of the Syrian government. As noted, considerable degradation has taken place on rangelands, much of it in the last few decades. By the time the scope and importance of the problem was realized and acknowledged, an advanced degraded state was present which leads to the seeking of quick, panacea solutions. Unfortunately, such solutions rarely, if ever, exist particularly when complex systems such as the rangeland ecosystem are upset.

In areas where little or no vegetation exists and soils have blown or washed away, there may be little hope in re-establishing vegetation, particularly when

large areas are involved and precipitation is low. Areas where vegetation is still present will probably recover with a minimum of help if grazing pressure is much reduced or removed. If a removal of pressure occurred during a higher than normal precipitation year, a good seed set would probably result. In fact, if very light grazing were allowed after seed set germination and establishment might be improved due to tramping of seeds into the ground by the animals hooves.

3.3.1 THE ESTABLISHMENT OF PERMANENT STUDY SITES

As far as the author was able to determine, there is relatively little known about the response of steppe vegetation to deferment or other grazing systems. It is therefore recommended that exclosures be constructed for long term demonstration and research purposes in the major vegetation types in different rainfall belts.

3.3.1.1 FENCE REQUIREMENTS AND MAINTENANCE

The exclosure or plot fences should be very sturdy in construction to exclude all forms of livestock. A fence with a short span between large, strong posts, with barbed wire at close vertical intervals to a height of at least 2.5 meters is probably adequate. These should be well maintained and checked periodically, clearly labelled as to function and penalties posted for disturbance if such exist. It would perhaps be wise to locate these in areas which are easily accessible for the research team, but not at the expense of representing the major vegetation. In addition, it would be wise to involve some local community leader or other influential person in checking and monitoring, as this would probably discourage disturbance or interference by area inhabitants. Since this particularly incorporates locals into the project, it creates local interest and can be used as an avenue for dispersing information verbally and visually.

Establishment of these plots would be an initial one-time expense. If built correctly, there should be only a minimum of maintenance for many years; however, they should be checked and repaired as necessary. Any slackness in maintenance, which would allow unintentional use, could destroy years of research effort.

3.3.1.2 SIZE, STUDIES AND LOCATIONS

Size is, of course, important because it reflects costs and must meet research needs. It is the author's experience that these should be at least one hectare in area for deferment studies which largely eliminates most edge effects. This size allows microclimate to develop as changes occur in density and cover. One hectare is inadequate in area if research on reseeding and/or grazing are also to be conducted. Such research could compare suitability of exotic and nature species for range renovation and the comparison of various types of deferment and levels of utilization. These studies could be monitored, as previously discussed, or preferably should contain three to be statistically sound.

If the exclosures were increased to 10 hectares, they would be of considerable use to ongoing and future remote sensing studies. They could provide ground truth for parameters of density and cover, and perhaps "signatures" for species or species groups as technology improves. It should be kept in mind that the larger these exclosures are, the more useful they are for remote sensing. There are any number of detailed research projects that could be carried out which would contribute to the needed body of knowledge -- for example, relationships between cover and density and/or treatment and micro-climate development, soil-plant relationships, erosion and many others. As the Syrian graduate level education program develops, these offer controlled areas where research can be carried out and where results can be compared and analyzed with sufficient related background information, not only resulting in better interpretations, but in better training as well.

The major point to remember is that a sampling method which documents exact locations of samples for detecting changes and which reflect trends must be used for an assessment of management practices whether within research plots or on the open steppe. The line transect method, as described, meets these criteria, requires a minimum of training, can be standardized as to data forms, field methods and analysis, is rapid, and lends itself to statistical analysis. Likely over the next decade, remote sensing will improve to the point of providing some monitoring of large areas. However, it will not in the foreseeable future replace detailed data available for actual sampling. The presence of a solid, detailed, ground system already in place will be of great use and importance in testing and refining remote sensing technology for future projects. The author realizes that certain of the above recommendations seem somewhat removed from immediate practical application; however, such research builds up the necessary background and baseline data for developing and reforming management and innovation under Syrian conditions. Suggested locations for exclosures include about 40 km east of Mayadin toward the Iraqi border, another in the area straight north of Deir az Zor and slightly northeast of Raqqa, another in the area 1/2 the distance on a line drawn between Sabea Biar and Abu Kamal, another 20-25 km south, southeast of Sabea Biar and one somewhere north or northwest of Qaryatein. A last one could be located in the elevated area northwest of Palmyra. The locations are only approximate and their exact location in the field must be established based on the requirements already discussed. Locations suggested are based on data available at the time of this report, primarily to represent major soil types and climatic zones. Any additional information that may be generalized or made available at the time of implementation should be incorporated to determine the final locations. Figure 6-16 indicates possible sites for study locations.

3.3.2 GRAZING CONTROL

Due to the other areas of concentration of effort and the short time span involved, the recommendations and comments that follow do not dwell on specific cases or areas, but are generally applicable at the macro-scale level.

In an effort to halt rangeland deterioration and in fact reverse the trend, the "Hema Cooperatives" system has been developed and applied to certain areas. The general idea is that these cooperative units will replace the traditional grazing right removed by government decree as exemplified by the Syrian Land

Reform Act.

Within the last two decades, an attempt has been made to reinstate controlled grazing (or at least the mechanism to do so) through "Hema-cooperatives" where grazing is permitted only by cooperative members. This has been the central thrust for the development of sheep production center and sheep fattening cooperatives. Currently it appears that 25-30 percent of the steppe is under cooperative control.

It seems obvious that a return to a traditional system is impossible. The Hema system, as used in the modern text, is an attempt to salvage the useful portions of the traditional systems in light of rapid socio-economic changes which have and are taking place. Hopefully such an approach will foster a sense of strong land stewardship, which is essential for a range improvement program.

In any cooperative system, a major danger is the strong individual incentives can be and often are lost if an individual feels over-protected or sheltered and therefore feels the system will support him without effort on his part. Equally undesirable is a system which does not allow sufficient input, in which a participant will feel overwhelmed by the system and loses all initiative. Education of the members needs to be an integrated part of the development of the cooperatives where the why's and how's are examined.

Boundaries and sizes of "Hema-Cooperatives" should be determined on the basis of natural, social and economic units and <u>not</u> on political or administrative considerations. Attempting to apply the same Hema system (as an example) to north central and to south central Syria would result in less than optimal results, if not failure. If differences are considered and the system is allowed to remain quite flexible, then probabilities of success are much higher.

There is a tendency to apply a "set approach" that has proven successful in one situation or set of circumstances, to any and all situations. Areas where rangeland and agricultural lands are intermixed may be better managed on an individual or family group basis even if it requires some modification of current statutes. Individualized operations can respond many times as quickly as bureaucracy controlled ones, regardless of how efficient the latter attempts to be. For example, a bureaucratic decision to remove sheep from range to crop aftermath or selling animals might take weeks. In the meantime, sheep may have lost considerable vigor and weight, perhaps even starved and, at the same time, severely damaged the range itself. An individual operator facing no such delay can make a decision and carry it out immediately. This, of course, assumes he knows what options are available, what the likely outcome of choices are, and realizes he does have at least some control over, and responsibility for his own fate. In many cases, this means he must be educated to these realizations which is a governmental responsibility and will be discussed in more detail in another section. Apparently there are some individual operations of this type already, and they are operating successfully.

As opposed to the above situation in southern Syria and other low precipitation zones where camels are or should be the major grazer, the system structure must be different to correspond to the conditions. Camels graze over large areas and require mobile herders. Since some areas of the steppe appear to best utilized by mixed grazing (camels and sheep), cooperatives or Hema

boundaries could be crossed by both classes of livestock to the benefit of both and to the rangeland itself. This means that the system must be very flexible and that a generous amount of local input to decisions be allowed. Again a cumbersome, inflexible bureaucracy with little local input will not only be slow to react, but will probably make inept decision and policies.

3.3.3 FOOD AND ENERGY

There is a heavy dependence on milk-derived foods in the diet of many Bedouin families. As previously pointed out, milking rangeland animals is an undesirable and ecologically unsound method of producing milk, usually resulting in larger flock size and in low quality or unsuitable lambs for fattening or sale. By the inclusion of more grain and other products into the diet, a nutritional balance is easier to maintain resulting in better health. Also since fewer animals need to be maintained on a year round basis, the operator has more options available to adjust to ever changing conditions. This added flexibility makes it easier to develop comprehensive programs to meet the physiological requirements of steppe vegetation.

A problem with adding more grain products to the diet is that additional cooking (hence fuel) is required (as compared to milk-based foods). As discussed earlier, considerable areas have suffered because of woody plant removal for fuel, a major degenerative process. It is quite possible, unless alternate methods of economical cooking are introduced concurrently with higher grain diet, that the dietary change would contribute to rangeland deterioration.

Several options are open; the following list includes several, although not necessary, exhaustive options:

1. Do nothing
2. Strictly enforce no removal of steppe species for fuel
3. Subsidize mazout fuel for Bedouin use
4. Provide low cost solar cookers which are rugged and simple to use
5. Inform and educate the persons involved as to the problems and options available with respect to their activities and needs

Obviously, option 1 would simply maintain the status quo which is unacceptable if the steppes are to be saved and improved. Option 2 would probably fail with the present "first come, first serve" attitude and in fact is, for all practical purposes, unenforceable anyway. Option 3 seems feasible initially; however, it requires additional bureaucracy, and offers a high potential for corruption. In addition, subsidy programs everywhere tend to create more problems than solutions by introducing artificial inputs to dynamic systems, which if left alone, move toward a self-adjusting dynamic stability.

A resource in plentiful supply during much of the year is solar energy. To be sure, past attempts to introduce solar cooking everywhere have not met with wide success. However, it does not mean it is unfeasible. To be of use under steppe conditions, the design would have to be very rugged and simple to maintain, move and use. Past designs have been overly ambitious and/or the operational conditions and requirements were not firmly or correctly specified or perhaps even fully known. If a suitable design can be found, option 4 becomes

quite attractive, even if only as a supplementary source.

Option 5 would likely not solve the problem by itself, but would greatly improve the chances of success if used in conjunction with one or more of the others.

3.3.4 PLANTING AND RESEEDING

The Syrian government has expressed great interest in rangeland renovation by reseeding or planting of seedlings. In such an effort, there is a strong tendency to seek an exotic species which would be ideal; that is easy to propagate, easy to establish, resistant to grazing and drought, highly productive, nutritious, and palatable to all classes of livestock. Current ecological theory indicates that no such plant exists; in fact, the most desirable vegetation is a diverse number of species. Furthermore, species which have evolved in a given area are those which are, almost without exception, best adapted to conditions found there. For obvious reasons, exotic plants from areas with similar environments have the best chance of success if native species are not available for renovation.

3.3.4.1 SELECTING SPECIES

A program of testing species suitability is currently underway near Aleppo where exotic and native species are under trial. Results have been mixed with several native and exotic species looking promising. However little is known as to their applicability to other areas in Syria where conditions are much different; in fact, species doing well in one location might do quite poorly elsewhere and vice-versa. As noted earlier, transplanting and seeding trials could be conducted in the proposed exclosures. Those which become successfully established could then be subjected to controlled grazing trials to determine grazing resistance, suitability and seeding capabilities. Such trials are necessary if the steppes are to be returned to a higher productive state.

3.3.4.2 ADDITIONAL BOTANICAL WORK REQUIRED

Apparently little botanical work has been done in Syria for some time. It is recommended that a team of botanists/ecologists attempt to locate any remnant of relict vegetation. For example, areas which are or have been inaccessible to grazing animals such as: long term fenced areas; seldom used areas because of lack of water; very small patches in large barren areas such as north and northeast of Souweyda; or inaccessible ledges in steppe mountain ranges. The areas may contain a genetic pool that has all but disappeared from Syria. It is very important that this genetic material not be lost for all time. Very possibly, there are ecotypes (varieties) present which are well-suited to local and regional conditions that would form the basis for replenishing plant cover. Even if only a few plants are found, they can be established in a nursery and eventually be used in trials and if successful, for reseeding.

3.3.4.3 UTILIZATION OF BEDOUINS

It has been suggested that in Syria and elsewhere in the Middle East that the Bedouins themselves might become the instruments of restoration of shrubs in steppe areas. Presumably they would be given seed or seedlings to plant and would then take the responsibility of protecting such plantings. While this is a near ideal solution, the author is skeptical about its widespread implementation and success under present circumstances. For such a program to work, the individuals must be closely tied to a certain area of land and in fact, have an intimate association with it. Perhaps when a cooperative or another system which rigidly controls grazing rights becomes fully established and firmly in place and the education process complete, such an idea will bare fruit. Some areas where livestock and agriculture are combined (or in a cooperative as noted above) could probably benefit from such a program at present if the operators are properly educated.

3.3.4.4 WATER SPREADING

It appears that there is a considerable potential in Syria for utilizing runoff water using a system of water spreaders. These areas could take considerable pressure off other range areas if sufficient numbers were developed. Such areas would be ideal for the establishment of seedlings due to the extra moisture available. Historically, in the Middle East, water spreading has supported considerable agriculture and populations and there is every reason to believe it has a high potential for increasing yields of rangeland vegetation in Syria where conditions are correct. Numerous potential sites were noticed in the low mountains of central Syria during field trips. It is recommended that several sites be chosen and developed to demonstrate its feasibility. Normally it is recommended that spreading areas should be on slopes of between 2 to 5 percent and large enough in area so that sediments are dropped out on the upper 20 percent of the slope. The soil depth should be sufficient to hold at least 10 cm of water with an expected flooding (of sufficient volume) once a year. A more detailed discussion can be found in Miller et al. (1969), Hubbell and Gardner (1950), Hadley and McQueen (1961) and Monson and Quesenberry (1940).

Several reservoirs were observed during field trips and as would be expected, from the deteriorated condition of the plant cover in their vicinity, were partially to completely silted in (Figure 6-17). In addition, water loss from evaporation is very high during summer months. Permanent to sub-permanent habitation has sprung up around these reservoirs (Figure 6-18). The result is an almost complete destruction of vegetation on the watershed increasing erosion and hastening siltation. Keeping the above in mind, water spreading appears much more desirable and effective in utilizing and storing run-off water.

3.3.4.5 ROAD DEVELOPMENT

As noted earlier, the lack of graded roads encourages the development of numerous wandering tracks, the result being the destruction of many square km of steppe vegetation. Graded and maintained road development would enhance the movement of products to and from markets perhaps at lower rates. In a few areas where this type of road was available, they were being heavily utilized and old

"pre-road" tracks were being abandoned. Since a better road is more comfortable, easier on vehicles and saves time and fuel, people will travel out of their way to utilize them rather than going point to point straight across the steppe. There will of course be tracks which act as feeder roads, but the damage cycle caused by the development and abandonment of major routes as currently practiced will be avoided.

Roads as envisioned would not require tarmac, but should be graded, elevated and graveled for all weather use. Planning could be carried out with local people within the structure of cooperatives which may exist. One trained man full time with a proper motorized scraper could maintain many km of road at a minimum of expense.

3.4 ADULT EDUCATION

Many social, economical, cultural and policy changes will be required for improvement or even maintenance of the steppes. This will require a change of attitude for a large segment of the population. Considerable stress and strain will be introduced for all involved which will require continual pressure by government through policy, trained personnel and finances. Teaching of factual material is necessary, but the major task is convincing the people that their own best long term interests will be served and then motivating them to change regardless of the difficulties encountered.

Implementation of such a plan would require some additional expense and additional trained people. There are several points to be considered if such a program is to be even partially successful.

3.4.1 PLANNING

First and foremost the educational program must be carefully planned and implemented. It must be organized on a sound, scientific basis, relative to subject matter being considered. Sometimes there is a tendency for officials or experts to talk down to people and to show little respect and patience for their views or ideas. This situation must be avoided at all costs as it alienates the audience and increases their resistance to change.

It is of utmost importance that very high quality people be used in such an extension education program. It is recommended that an outside expert with considerable experience in extension work be used in planning and training of Syrian staff and in the initial stages of actual contacts and presentations. The expert should spend up to one year in Syria in order to understand Syrian conditions and to initiate the plan in place, so to speak. This would be much more desirable and effective than sending people outside of Syria for training.

3.4.2 USE OF VISUAL AIDS AND PRESENTATION

It would be of great value and probably necessary to use well prepared visual aids or demonstrations as they hold peoples' interest and are at least partially understood by everyone, literature or not. An effort should also be

made to produce simple, easy to read handout material with the presentations for reinforcement of the materials covered and other subjects as well. As stated before, presentations and subject matters must be as objective as possible and adhere to the facts as there will normally be a wide variety of opinions among those present. Subjective materials and ideals would only add to differences in opinion and may increase polarization. A generally successful format is an objective presentation followed by a discussion, and question and answer period. This allows a two-way interchange; that is, information has been gained. This feedback can be used to improve future presentations.

There are some major hazards that must be avoided at all costs in using this format. First the experts themselves must be knowledgeable and must be able to keep their egos in control. In other words, they must be willing to admit that they do not know the answer when that is true. He or she must be able to make the audience feel at ease and that no question is too simple to answer or that by asking questions, a participant is exhibiting personal ignorance.

3.4.3 EQUIPMENT

The use of visual aids necessitates equipment such as projectors, and screens, tape recorders, portable generators, and other equipment for demonstrations; for example, equipment needed for a solar cooking demonstration. Obviously, some spare parts such as bulbs, fuses, extension cords, and other equipment needs must be carried along and the personnel must be completely familiar with the use and repair of all equipment. Comparable mobile classrooms for nomadic people in several countries of the Middle East have been used for a number of years. There is every reason to believe that they would be successful for adult education as well.

3.4.4 EDUCATION TARGETS

Education should be aimed at both the male and the female segments of the population even though there will be some cultural resistance to it. Since children spend much of their time with their mother and other females, they are influenced and develop attitudes from them. Also much of the actual work burden falls to the women; therefore, they should be exposed directly to the concept involved. It is the woman that must actually change the diet, learn new methods of food preparation and if solar cooking is to be successful, must learn to assemble, use and maintain a solar device. The men should be educated in the areas of their responsibilities as well.

3.5 POPULATION CONTROL

When a country such as Syria is faced with a rapidly increasing population, major emphasis is understandably placed on increasing animal production with less consideration for the fate of the habitat on which it is produced. In the very short term, over-utilization of the resources can yield more forage for a limited time; however, the resulting degradation of soils and vegetation soon take their toll and there is an inevitable decline. Therefore the priority item is to first halt the degradation of the basic resources and only after this is achieved,

increase yield of livestock through rangeland improvement.

A higher sustained production of Syrian rangeland is possible, but it will be realized by adhering to management centered around ecological principles. An attempt to ignore necessary priorities as dictated by ecological principles in management programs will not meet with long term success, the only feasible goal. Solutions to problems must be generated from a factual, scientific structure, not emotional, political, socio-economical or cultural ideals regardless how attractive they appear at a given time if outside that framework.

It must be fully realized that regardless of how intensive and well any habitat is managed, there is an intrinsic limit to the number of people which can be supported, whether referring to range or irrigated lands. The obvious conclusion is that land has a carrying capacity for people also. Unless there is a successful control of human population, there will never be an adequate diet or amounts of other necessities as well.

If Syria's growth rate does not drop, the population will double by the year 2000. Governmental aspirations are to approximately double the per capita consumption of meat and dairy products which means a requirement of 4 times the present production. It is this author's opinion that it will be impossible to meet these expectations even with a maximal effort. Certainly the rangeland, even with a massive improvement effort, cannot produce at that level. It would therefore seem of paramount importance to instigate a strong and effective population control program immediately. To be sure, there will be much resistance to certain changes and perhaps some undesirable side effects or inconveniences which, when compared to the effect of failure, are insignificant.

4 SUMMARY

Syrian rangelands were examined and found to be in a general degraded state. Initial stages of desertification were often present and in some areas were complete.

It appears that the activities of man, particularly during the last few decades, are mainly responsible. Several factors account for this, probably the major one being the removal of traditional grazing rights which has led to virtually uncontrolled grazing. Also, lack of control has resulted in ploughing of areas unsuited to it, causing degradation and erosion.

Activities of steppe residents such as gathering vegetation for fuel, development and abandonment of roads, and the heavy dependence on milk and milk products for food and additional income have all contributed to degradation. The development of wells and the ability to transport water into areas formerly used on an intermittent basis, encouraged increases in flock size, which (coupled with better animal health) have placed considerably more stress on plant communities, particularly during dry periods.

Although some attempts at monitoring and renovation have been started, they are grossly inadequate in view of the severity and extent of degradation. Due to the sparse vegetation cover and the strong reflectance of the soil surface, remote sensing, using currently available technology, is of very limited use. It

is recommended that survey and mapping be undertaken immediately at a scale of 1:12,000 to 1:20,000 utilizing aerial photography. As discussed, permanent study and monitoring sites of sufficient size to conduct renovation and revegetation studies and to act as reference points for future remote sensing studies are a necessity.

Very few well-qualified range management personnel are present and those that are, although energetic and enthusiastic, receive too little support and may have additional duties. This in part, appears to reflect insufficient concern and understanding at higher levels of government as to the importance of both the rangeland resources and the scope of the problem. The shortage of trained personnel may decline somewhat as students currently being trained in Syria graduate.

It appears that the development of the "Hema-Cooperative" system may be helpful in the re-establishment of grazing control if they are based on a sound, but flexible ecological foundation. They will probably fail if based on political or administrative considerations only.

It must be recognized that it is necessary to educate all segments of the adult steppe population to the social, economical and cultural changes that are required if their own best interests are to be served. In terms of education, it appears that the Syrian range management experts have not expended sufficient effort in educating high level officials (including cabinet level) to: 1) the nature and seriousness of the steppe problem, 2) the effects that SARG policy (both direct and indirect policy) has on the steppes and 3) the identification, nature and level of research needed.

Finally, SARG must realize that there is a limit to the population that can be supported by the available resources including agriculture and appropriate action should be taken at once if an eventual catastrophe is to be avoided.

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Figure 6-1.

Area dominated by annuals in central Syria.

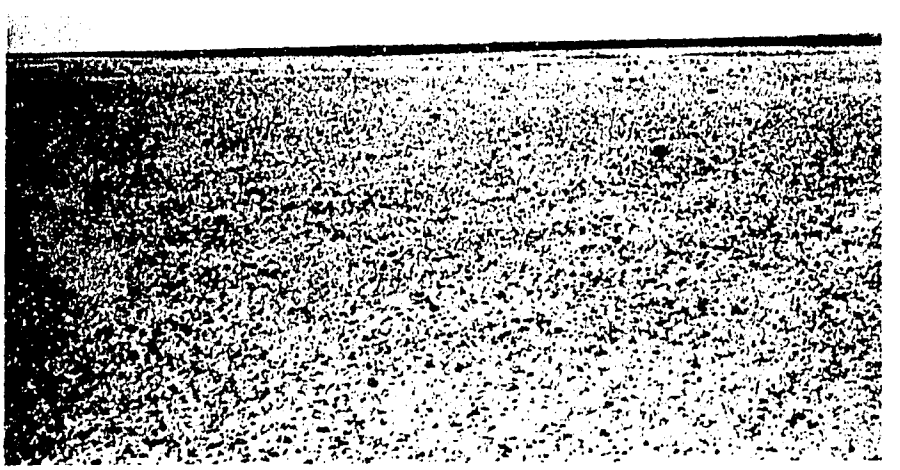

Figure 6-2.

Scene in east-central Syria showing complete lack of vegetation, desertification almost complete here over many km^2.

Figure 6-3.

An example of the major vegetation type in Syria composed mainly of Artemisia herb-alba and some Haloxylon spp with an understory of annuals, shown in above average conditions.

Figure 6-4.

Community dominated by Artemisia herb-alba and Haloxylon spp heavily utilized and in low vigor with little reproduction.

Figure 6-5.

Example of finer soil factions having been removed by wind and water.

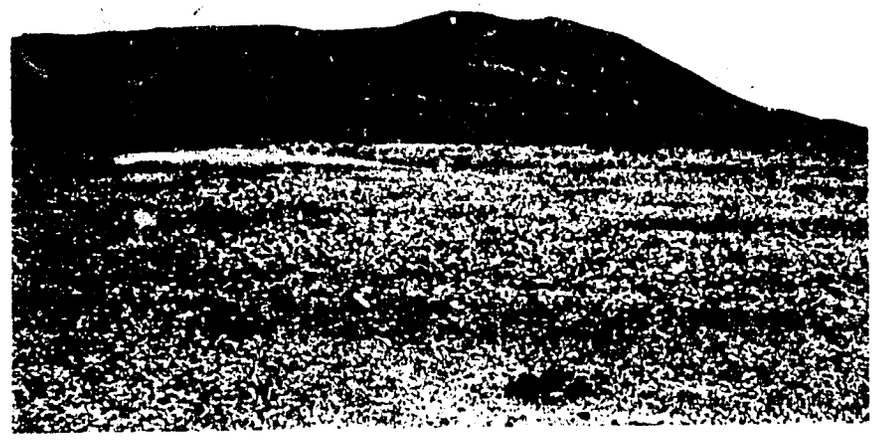

Figure 6-6. Typical area showing desert pavement in early stages of development.

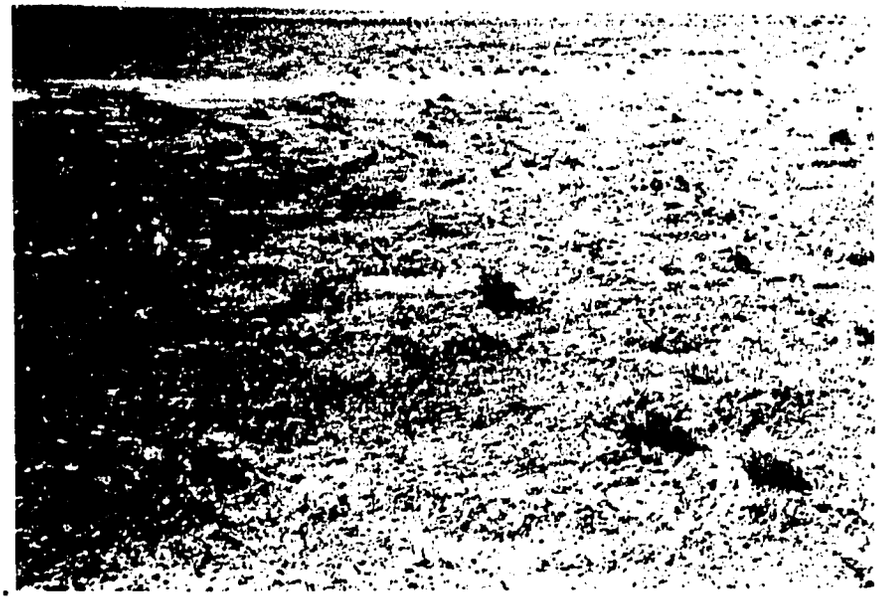

Figure 6-7. Scene in east-central Syria showing plants on very low vigor, pedestalled plants and some soil drifting.

Figure 6-8. Stockpile of vegetation for use as household fuel, a common practice in both nomadic and permanent settlements.

Figure 6-9. One of the numerous small, illegal, ploughed fields observed on the steppes. Such fields are used only during favorable moisture periods or are often abandoned permanently after a few years.

Figure 6-10.

An example of profuse, spontaneous road development.

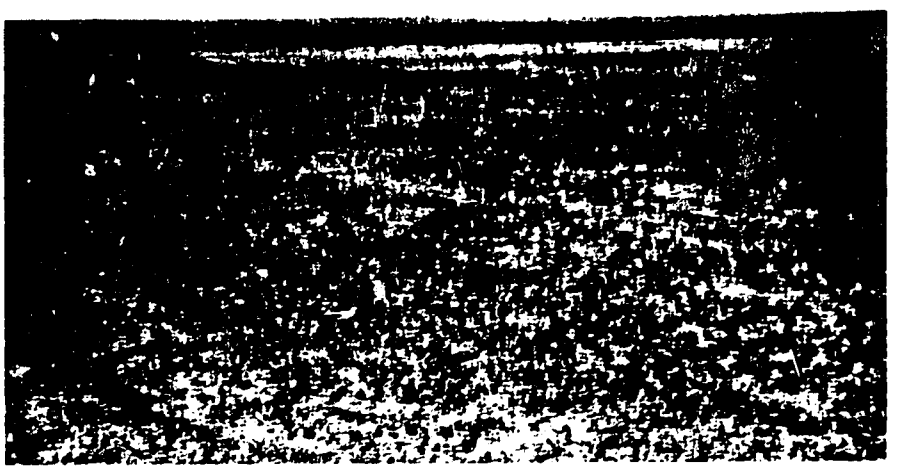

Figure 6-11.

Roadway developed by repeated passage and subsequent abandonment. Width here is between 100 and 200 meters.

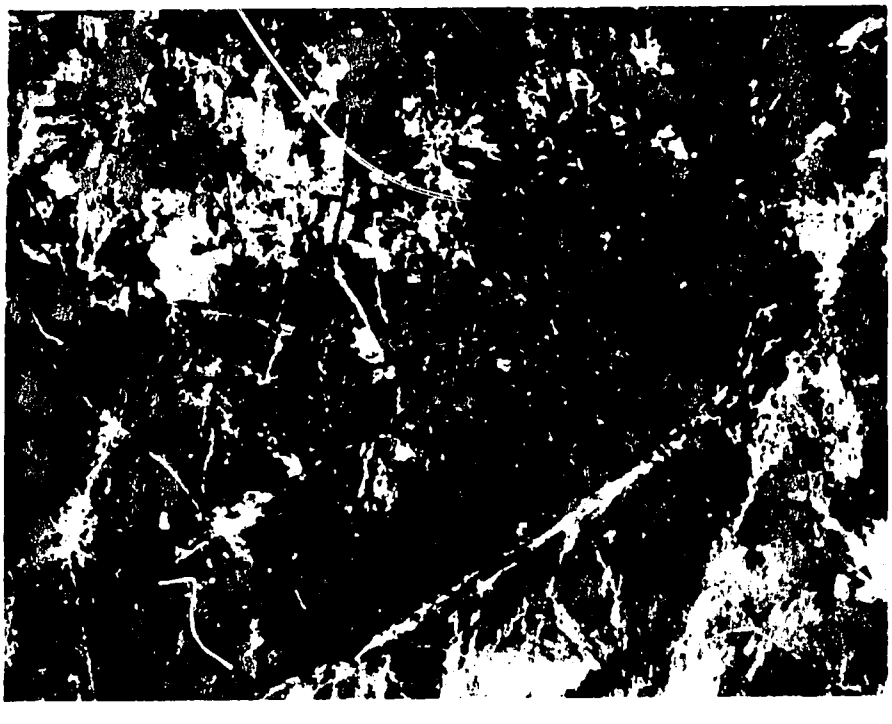

Figure 6-12.

1:1 scale photograph of 1:500,000 imagery showing multitudes of primitive but destructive roadway development.

Figure 6-13. Well in southeastern Syria allowing year-long use of areas formerly undergoing only seasonal use.

Figure 6-14. Camels near the Syria-Iraq border in southern Syria on rangeland with "rough" vegetation and few water sources.

Figure 6-15.

Women preparing to milk sheep southeast of Palmyra on poor condition rangeland.

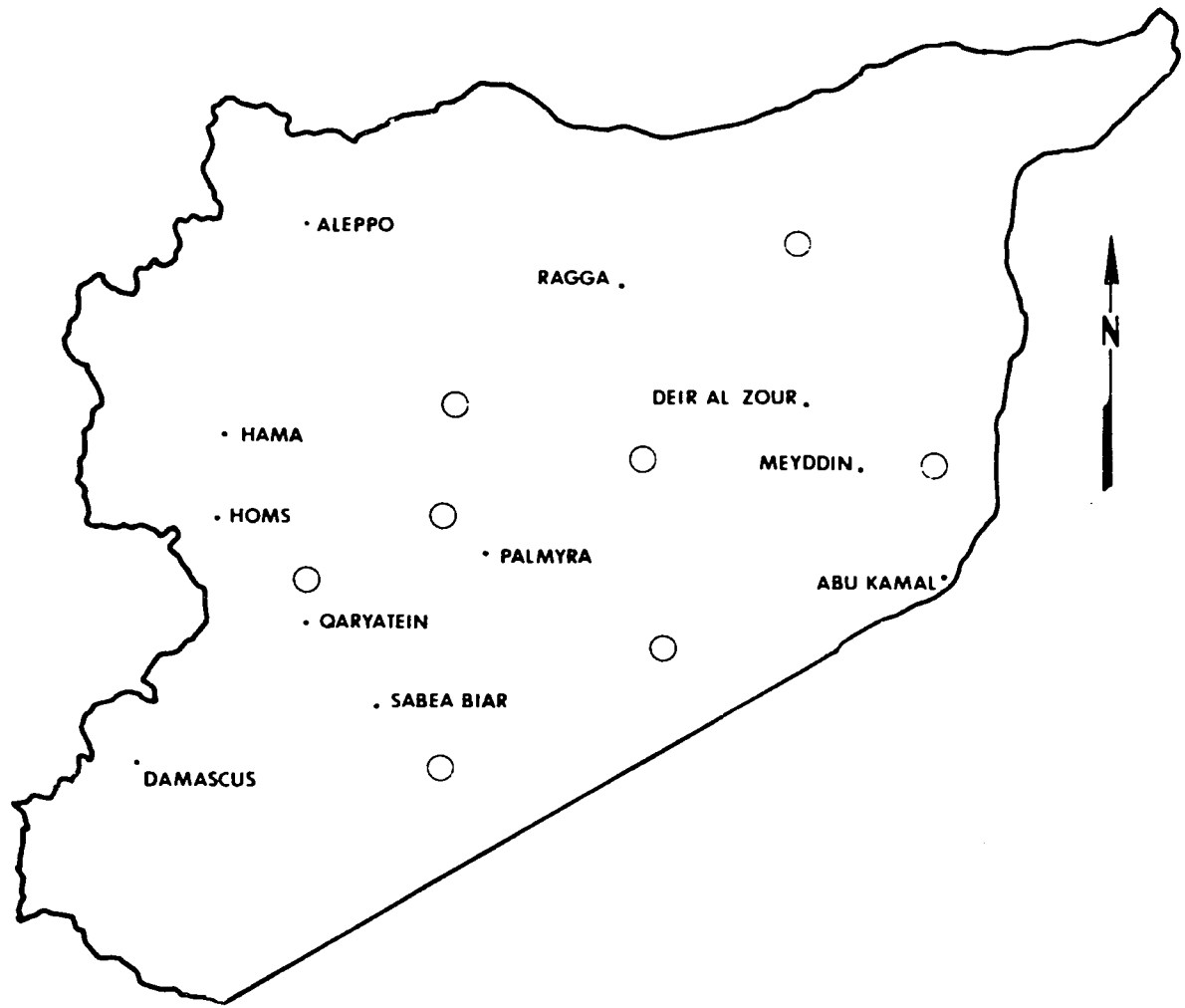

Figure 6-16.

Suggested locations for permanent study plots. Circles indicate general areas, not exact locations.

Figure 6-17. Reservoir northwest of Palmyra completely silted in. Tamarix spp, a phreatophyte, is shown in the foreground.

Figure 6-18. Reservoir west-northwest of Palmyra. Note permanent and temporary shelters and dwellings in the background. Surface denuded within a 1 km radius except for very unpalatable or poisonous plants such as Peganum harmala shown here.