

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

**REPORT OF THE EXPERT CONSULTATION
ON
RANGE MONITORING INCLUDING UNDER FOREST
SYSTEMS IN THE NEAR EAST**

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SUMMARY

Rangelands of the Near East Region are generally deteriorating. Biodiversity, climate change, and desertification are three sides of the same coin. Healthy rangelands are critical to livelihoods of dependent communities as well as to adaptation and mitigation of climate change and biodiversity loss. Rangelands monitoring and sustainable management need to be up front on the agenda in the drylands and mountainous regions. The interest in range monitoring has diminished due to several reasons. Experts from around the Region came together and noted critical changes that would need to be made both in the science as well as in the management to overcome constraints and challenges in a timely manner.

There is a strong view that only a holistic approach should be used to address sustainable rangelands management and pastoral development. The challenge is to address policy issues and to enhance national and regional collaboration to promote exchange of information and experiences as well as to facilitate coordinated national and regional programmes.

The recommendations of the Consultation are presented under two sub-headings one on priority and the other on additional recommendations. It is hoped that these recommendations will help fostering rational actions for sustainable management, effective and consistent monitoring, and practical rehabilitation of rangelands in the Region.

1.INTRODUCTION

1.1. General

The Near East Region has extensive and diverse rangeland types and ecosystems ranging from deserts, steppes, savannas, mountain and alpine range, swamps and wetlands and forest grazing. The past few decades have witnessed different pressures and changes, some of them drastic, on the rangelands in the Region. The changes were reflected on range production quantity and quality attributes. The contribution of rangelands to livestock feeding has declined, in many areas, from 80-100% to 10-20% of herds' requirements. The impacts of these pressures have been accentuated by the effects of natural phenomena as drought and irrational human activities that caused and/or accelerated the rate of land degradation. The accumulated result is shrinkage of the area of rangelands, and the occurrence of undesirable changes in their environmental condition and botanical composition to communities that are less productive with respect to forage supply and less efficient in protecting the soil.

Natural forests cover is less than 10% in most countries of the Region. In spite of this limited area they, in association with rangelands, play vital socio-economic and environmental roles including the variety of products and support to production systems, carbon sequestration, biodiversity conservation and soil and watershed protection. In arid and semi-arid lands range and forests are considered the same resource, forest grazing being the major type of use. Several forest stands are at an advanced state of degradation as a result of human activities and natural hazards e.g. drought. Population growth, encroachment of urban areas, expansion of cultivation, and resource mis-management have accentuated pressure on forests and rangelands and reduced their geographical extent and productivity. During the sessions of the Near East Forestry Commission (NEFC) member countries expressed deep concern about the alarming situation of increasing depletion of resources bases, namely forests, woodlands, rangelands and water systems, and their negative ecological, economic and social impacts in many countries of the Region. It was strongly suggested that the Commission should more systematically include the issue of rangelands management in its activities both during and outside the sessions. The Commission also noted that despite most of its member countries have elaborated their national action plans for combating desertification and participated in the preparation of sub-regional action plans, very little support have so far been recorded to help implement these plans which in most cases aim at addressing the issues of water resources, rehabilitation of degraded forests and rangelands as well as sustainable management of remaining resources.

NEFC Task Force comprising members of the current Bureau proposed a study to further discuss key issues such as: the management of forests and rangelands, better forest protection including control of fires, integrated management of forests and water resources, and valuating Non-Wood Forest Products (NWFP).

Proper use and management of rangeland resources require regular and consistent monitoring. Monitoring in association with inventory provide baseline data and information badly needed to support management and efficient utilization. Besides monitoring data can provide insight into the extent and degree to which degradation proceeded. In this regard the need to know and quantify the range vegetation attributes, soil characteristics and conditions is obvious. Monitoring should be supported by a well-equipped herbarium to assist in identification of plant species.

Member countries through national initiatives or in collaboration with international and regional organizations and research centers, have initiated programmes and projects to: (i) survey,

evaluate and document the condition of their rangeland resources (ii) research and investigate monitoring, improvement and rehabilitation techniques and (iii) achieve range or range and livestock development.

FAO projects covered rangeland resources survey and mapping, range monitoring and information, range improvement/rehabilitation, and range and livestock development. FAO training efforts as part of Regular or Field Programmes to upgrade skills and knowledge of national staff formed an important component of its activities.

The need for reliable and recent data about the rangeland resources following various pressures and changes that intensified in recent years: increased human population, increased livestock population, encroachment of cropping, spontaneous settlements, uncoordinated development and rapid socio-political changes as has happened in central Asia. Lack of sufficiently trained and experienced national staff, in range monitoring and recent advances in remote sensing GIS and modern technology in relation to monitoring is common to many countries. There are also indications that analysis of monitoring data, on continuous basis to draw appropriate conclusions to aid management and development of the range and dependent livestock is a constraint/weakness, due to limited abilities of range technicians of handling these data statistically, a situation that should be addressed. Utilizing remote sensing, GPS and GIS should support rangelands resources inventory, mapping and monitoring.

The Consultation is intended to form an opportunity to identify priorities in the area of range survey, monitoring and use of remote sensing and GIS techniques, requiring concerted actions by member countries as well as by FAO and others active in the Region. From the aforementioned and based on the need to enhance member countries efforts to regularly evaluate and monitor their range resources to detect changes and furnish valuable data and information for planning and decision making purposes; this Consultation on Range Monitoring Including under Forest Systems in the Near East has been proposed.

1.2. The Consultation

An Expert Consultation on Range Monitoring Including under Forest Systems, jointly organized by FAO/RNE Range Management and Forestry Programmes, was held in Cairo Egypt from 26 to 28 November 2007 (Annex I). The Consultation provided a forum of range management and forestry specialists from member countries, from regional organizations and research centres (Annex II) to discuss range monitoring practices, share experiences, identify constraints and problems, and to outline improvement and increasing efficiency of data collection and utilization for forests and rangeland management and development as well as for integrated natural resources management. The Consultation aimed to foster cooperation among member countries and between them and regional organizations and research centres on sharing experience about methodologies and the use of modern techniques of RS, GIS and GPS in range monitoring.

The main focus of the Consultation was on the Near East Region. Participating experts beside those of regional organizations and research centres presented a review of past and current activities and methodologies in member countries. Discussions, however, covered experience of a broader extent. Taking into account the papers presented to the meeting, discussion of the different experiences of the participants, recommendations were made for enhancing range monitoring and integrated natural resources management efforts at national and regional levels. Recommendations were also made to strengthen and integrate activities of FAO/RNE Sub-Programmes as well as to promote more interaction and complimentary activities with regional organizations and research centres.

Mr. Pape Djiby Koné, RNE Senior Forestry Officer welcomed participants on behalf of Mr. Mohamed I. Albraithen Assistant Director General, Regional Representative for the Near East (Annex III) and referred to the importance of the theme of their gathering and the value of discussing methodologies and sharing information and experiences. He reminded participants of the fact that pastures and rangelands, including those under forest cover occupy the largest area under one type of land use in the Region. He referred to FAO consistent support to member countries efforts made to rehabilitate and manage range resources through Regular Programme and field activities. Further he reminded participants of the NEFC efforts to raise awareness, provide advice and recommending to FAO and member countries with respect to actions to be taken for the sustainable management of forests and rangelands resources. Mr. Koné noted that a continuous range monitoring programme is essential for policy decisions and planning for sustainable development. Based on the objectives of the Consultation, presentations and discussions it is hoped that the participants would formulate recommendations and establish priorities for the required actions at national and regional levels.

In its final session Mr. Mohamed Mirreh, RNE Range Management Officer, who thanked the participants and informed them that taking fund limitations into account, consistent and sincere efforts will be made to build Regional activities based on and guided by the Consultation recommendations, addressed the Consultation. The participants were reminded that member countries should also play their roles. Mr. Mirreh referred to the possibilities that issues as capacity building and formulation of sound policies and strategies will get possible support from the Regional Programme. Further he indicated willingness to facilitate and coordinate efforts on standardization and harmonization of monitoring techniques in collaboration with national institutions including universities. The Regional Programme will also consider facilitating meeting of experts from the Region to discuss and evaluate the outcome of standardization efforts.

The Consultation benefited from combining a facilitated, participatory process with participants' presentations. To reach the agreed objectives and outputs, interactive and analytical discussions were guided by key questions and tasks that took place in pair and group work and during the plenary. Discussion sessions were held intermittently during the series of presentations in order to capture key points that were being contributed through the Consultation. All points were captured on cards and organized visually on the wall or pin boards for easy reference. During the final day, working groups were dedicated to drawing out concrete recommendations according to four major themes that had emerged through the Consultation.

2. OBJECTIVES AND EXPECTED OUTPUTS

2.1. Objectives

The objectives of the Consultation were to:

- Enhance the Regional Sub-programme on Range Management with respect to providing appropriate assistance to related member country programmes including range monitoring, trend evaluation, and utilization of current techniques;
- Strengthen collaboration/coordination among forestry and range sub-programmes, in order to better reflect the realities and priorities at country level and ensure greater efficiency at field level;

- Investigate the possible standardization of range monitoring methodology, data collection and handling for areas with similar environments and range vegetation;
- Initiate a collaborative programme, with regional organizations and research centres as well as projects for training technical staff from member countries national institutions in range monitoring and the use of current techniques; and
- Encourage and guide member countries efforts for the establishment of range ecosystems database by carrying out regular monitoring and evaluation of range resources making use, whenever possible, of remote sensing and GIS tools.

2.2. Expected Outputs

Direct outputs:

- Working document comprising recommendations for RNE Sub-programme activities as well as guidelines for member countries and projects with respect to range monitoring methodology, data collection, data organization and analysis. Updating range data and information linked to range practices will assist management and proper utilization; and guide measures to ensure sustainability of resources.
- Proceedings of the Expert Consultation with papers and resulting recommendations.
- Collaborative regional programme for upgrading skills of national staff on range monitoring and the application of modern techniques.

Indirect outputs:

- Establish informal regional network for range-forest practitioners (newsletter, email group, etc...).
- Promote greater synergies between the Range and Forestry programmes at RNE.

3. RECOMMENDATIONS

Based on the deliberations of the Consultation the following recommendations were adopted by the participating experts for strengthening range monitoring and integrated natural resources management programmes of member countries and for FAO and regional organizations and research centres for strengthening and guiding their efforts to plan and implement such programmes.

High Priority Recommendations	Who is Addressed	How It Can be Implemented	Duration
National Capacity			
<p>1. The need to set rational policies and regulations for range and forests management and monitoring as well as for enhancing synergies between different policies and legislation has been emphasized by participants. Therefore it is recommended that consistent efforts should be made to formulate, improve and harmonize policies and legislation on rangelands and forest resources; and simultaneously ensure that they streamline with policies & legislation of other natural resources and sectors. Specifically legislation adapted to socio-cultural realities and environmental contexts should be in place to enhance the sustainability of these resources.</p>	<p>Governments in cooperation with regional and international organizations (FAO, ACSAD, AOAD, ICARDA)</p>	<ul style="list-style-type: none"> . Initiation of national and regional dialogue for policy harmonization. . Organization of meetings and workshops, provide technical assistance to member countries. 	<p>3 years</p>
Linking Management to Monitoring			
<p>2. Formulate and implement an integrated natural resources management pilot project to strengthen range and forests monitoring at national level for the purpose of enhancing biodiversity conservation, carbon sequestration and sustainable management of natural vegetation resources. The project should ensure proper dissemination of monitoring outputs in forms that can be adopted and used by different users. Its first phase should be funded from FAO TCP resources to support member countries activities or initiate new ones according to the stages of development of national programmes.</p>	<p>Regional and international organizations (FAO, ACSAD, AOAD, ICARDA) local community, NGOs, private sector, national institutions.</p>	<ul style="list-style-type: none"> .Standardize terminology, .Establish criteria and indicators, .Provide funds, capacity building and experts, .Facilitate the exchange of practical experiences and results, .Encourage networking and issuance of a newsletter and other published material to disseminate information and data about activities and adopted methodologies on range and forests monitoring, surveys and application of modern techniques. 	<p>5 years</p>

Integrated Natural Resources Management

<p>3. The participants of the Consultation strongly recommended promotion of a Holistic Approach for Natural Resources Management in the Near East. It was emphasized that there is an immediate need to valorize indigenous knowledge and traditional systems e.g. Hima for integrated natural resources management. This should be coupled with the evaluation of the contribution of integrated systems (including agro-silvo-pastoral, ecotourism, local industries) in achieving sustainable livelihoods and alleviating poverty.</p>	<p>Member countries, national staff, decision makers, FAO, regional organizations</p>	<ul style="list-style-type: none"> .Concert the efforts of pastoralists and rural communities and encourage their active participation in the sustainable management of range and forests resources. .Compile, adapt and employ traditional monitoring practices and knowledge to complement regular monitoring activities. .Collective action by member countries and organizations. .Technical meetings (workshops etc) to address common problems and challenges. .Exchange information and experiences through formal and informal mechanisms. .Also raising awareness and organizing study tours. 	<p>5 years</p>
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Data Needs Harmonization

<p>4. Initiation and support of a programme for the standardization of monitoring systems and techniques at national and regional levels and concurrently ensure sustainability and consistent collection of data.</p>	<p>Universities, research institutions, local communities, FAO, regional organizations and projects</p>	<ul style="list-style-type: none"> .Implement a study at national level trying different techniques, .Compare them at regional level, .Select cost-effective reliable methods, .Availability of catalytic funds. 	<p>2 years</p>
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Additional Recommendations	Who is Addressed	How It Can be Implemented	Duration
National Capacity			
5. Strengthen training programmes to upgrade knowledge and skills of national staff and local communities on monitoring and integrated natural resources management.	National and regional training institutions in collaboration with FAO and regional organizations.	Formal and short-term training sessions, study tours remote sensing and GIS should be included.	6 years
6. Support national institutions through technology transfer and providing appropriate equipment and catalytic funds.	National institutions, regional organizations and donors.	.Interventions for research and technology transfer, .Provide suitable equipment (RS, GIS, weather stations), .Provide funds	3 years
Linking Management to Monitoring			
7. Establish/strengthen coordination mechanisms for management and monitoring of range and forests resources at national level.	National institutions, private sector, civil society, resource users.	Establish national coordination body, or boost/enhance the role of existing ones.	2 years
Integrated Natural Resources Management			
8. Concerned national institutions should investigate and evaluate market and non-market products and services provided by rangelands and forests.	Member countries	.Conduct field and market surveys, .Identify and document success stories.	
Data Needs Harmonization			
9. A natural resources monitoring system should be established to facilitate integration and provide combined data and information (ecological, socio-economical) on range, forests and other resources.	National institutions involved in natural resources management (including community, stake holders) FAO to facilitate such a programme.	.Review and classify existing data, .Select key indicators, .Compare techniques of measurement in each country for each climatic zone, .Organize meetings and workshops.	

4. TECHNICAL PAPERS

The participants presented fifteen papers during the different sessions of the Consultation. The following paragraphs summarize these papers as well as two additional ones (marked with*) not presented but contain interesting experience.

State of Monitoring

4.1. Range Monitoring in the Islamic Republic of Iran

H. Arzani

Summary

Sustainable use of rangelands requires information on vegetation cover, changes in vegetation attributes through time, as well as the effect of climate and management practices on range condition and trend. Such information can be provided by a national monitoring system. In Iran a national project was formulated to establish such a system in order to generate the required information. The main objectives of the project were: (i) creating a national monitoring system, (ii) documenting long-term variation in vegetation attributes due to climate fluctuations and management effects (iv) providing updated database for rangelands to serve national planning and sustainable range utilization (v) understanding changes in range condition and trend and recognizing pertinent causes (vi) generating rangelands data for determination of long-term grazing capacity (vii) establishing permanent reference sites network (viii) determining efficiency of satellite data for estimation of vegetation attributes in vast areas (ix) training technical staff during the course of the study and creating knowledgeable research groups. The project started in 1997 to achieve its objectives, and has covered 17 provinces by now. The main vegetation communities in each province were identified. In each community one site was established for regular data collection. In each site cover and plant material produced (biomass) were estimated within 60 quadrates (1 or 2 m sq.) along four 400 or six 200 meters transects. Measurements were repeated for a period of 5 to 10 years. Biomass was measured using a double sampling procedure proposed by Arzani and King (1994). Correlations between satellite data and ground truth data were developed. Range condition was determined using the four-factorial method (Parker and Robert, 1952). One photo point was established in the beginning of transect 1 in order to obtain a photographic record of the site and to subsequently make repetitive photos at each measurement event. Summary of information obtained from annual monitoring programme was made available to range users and government agencies. Based on the primary results it is evident that the condition of range ecosystems in arid regions is fragile. Sparse vegetation cover, low production and poor range condition generally characterize such rangelands. Desirable species were absent in vegetation composition while moderate or less desirable species are abundant. Excessive grazing resulted in disruption of the ecological balance. Semi-arid rangelands have better cover and plant production when compared to those in arid areas. Integration of five years field and satellite data indicated the possibility of application of remotely sensed data for monitoring vegetation attributes. Organizing Rangeland Day is an effective way for informing land users, local experts and government agencies about the results obtained from the monitoring programme. As a result of the study establishing a national monitoring system (NMS) for analysis of data collected in different years and setting a network of reference sites in various regions are recommended. Information obtained from monitoring

programmes is essential for rangelands planning and development purposes. Several other research projects had been conducted in Iran. Their findings can be used in conjunction with the monitoring programme to determine long-term grazing capacity, proper practices for range management, etc.

4.2. Rangeland Survey in Saudi Arabia

Saud L.R. Al-Rowaily, Turki bin Saud Al-Saud, S.A. Al-Khateeb, F. S. Al Arifi, A. M. Assaeed, A. A. Al-Qarawi

Summary

This paper focuses on the extent, techniques employed and results of a comprehensive baseline inventory (survey) of Saudi Arabia rangelands. Vegetation in Northern, Middle, and Eastern Regions of Saudi Arabia was studied covering around 354,830 km² on eight hundred fifty nine sites. Sites were selected from satellite images and stratified to accommodate heterogeneity of small microhabitats. A total of 461 (spot-4) images were used. In each site, species were listed and vegetation cover, composition and density were estimated using three 60-meters transects laid randomly across gradient. Range condition class was given to each site.

The results showed *Haloxylon salicornicum* had the highest distribution over the study area, followed by *Rhanterium epapposum* then *Panicum turgidum*. It was found that vegetation cover ranged from bare ground (0%) to less than 35% and that around 70% of the area surveyed was in deteriorated range condition. An important issue indicated by the paper is the lack of management and environmental awareness.

4.3. Rangeland Monitoring in Jordan

Mohammad Noor Alhamad

Summary

Rangelands represented by steppe and desert grazing, estimated at about 90% of the area of Jordan, were the predominant source of feed for small ruminants and camels. More recently the productivity and contribution of these lands to livestock feed have sharply declined as a result of various factors. Presently reliance on supplementary feeding has increased using large quantities of barley and processed feeds. Jordan is committed to extensive livestock production while simultaneously halting environmental degradation. These lands are subject to degradation and desertification due to the combination of harsh environmental conditions and misuse. Rangelands degradation is attributed to two major factors: 1) The exhaustive use of rangeland resources (e.g. overgrazing, uprooting of range plants, off-road driving, inadequate cultivation patterns and urbanization) and the abandonment of traditional grazing rotations (nomadic and transhumance) as well as traditional grazing rights (Hima) that used to allow recovery of natural vegetation growth and vigour, and 2) Severe climatic conditions. Major degradation symptoms include the following: (i) degradation of vegetation cover and composition (ii) rangeland contribution to livestock feed has dwindled (iii) soil degradation and (iv) disappearance of wildlife. Extensive livestock production systems, with approximately five million heads of sheep and goats, extend over more than 8 million ha. These animals depend on range produced forage with supplementary feeding during the dry season and, if condition of the range is poor in below normal rainy seasons, during winter months. This livestock population exceeds the potential carrying capacity of the rangelands and may adversely influence ecosystems on large scale. The

present situation of rangelands in Jordan warrants the need for efficient and spatially extended monitoring programme to ensure sustainable management and use. This paper attempts to review the present situation of rangelands, examines efforts made to monitor their condition, and proposes some future actions that can be taken to enhance rangelands condition and improve range monitoring in the country.

Information on Jordanian rangelands composition and productivity has resulted from a number of independent studies conducted by projects or national institutions. Studies related to rangelands monitoring are limited and fragmented. Detailed information is limited to range reserves and is mostly conducted over a short period of time. Unfortunately much of this information is not accessible to the public.

Remote sensing is particularly useful in extensive rangelands for tracking weather systems, ground cover and vegetation characteristics thus providing early warning of possible shortage of grazing and water when drought conditions prevail. This will furnish more valuable information when coupled with ground monitoring of environmental and socio-economic indicators. Although traditional ground truth methods provide information that cannot be completely generated by remote sensing yet the latter can still be a valuable tool for rangelands monitoring. In Jordan, few researchers have used remote sensing technology to study relationships between vegetation indices with some vegetation attributes or rainfall data. Studies on the use of remote sensing are still in their infancy and are faced by the problem of high reflective properties of Badia soils in the red and near-infrared wavelength as well as sparse vegetation pattern that make the conventional vegetation indices less efficient in monitoring these extensive arid rangelands.

Remotely sensed data indicated an expansion of cultivated and/or urban areas at the expense of rangelands. This expansion may be attributed to population growth, abandonment of traditional pastoral systems as well as the existing land tenure system that encourages the pastoralists to cultivate rangelands in order to claim title to the land. Reference should be made here to some changes that took place and accelerated this trend. They include increased livestock population and occurrence of drought. Both situations increased the demand for sources of feed other than range-produced forage. This has been coupled with sedentarization and the emergence of some sort of agro-pastoral production systems in which Bedouin households adopted cultivation besides raising small ruminants.

Several institutions are directly or indirectly involved in range monitoring. They include government departments, universities and non-government institutions. The present situation of Jordanian rangelands warrants the need to coordinate and collaborate in range monitoring activities. The primary challenge within this context is the initiation of collaborative range monitoring programme (RMP) at the national level. This collaborative programme should form an umbrella under which range monitoring is performed in a cost-effective way to generate the needed information and data. The RMP should include: a) Collecting and integrating all available data in relation to current rangelands, livestock, and land-use conditions in Jordan. This would be undertaken through formal collaborative agreements within the government and other institutions. b) Facilitating the collection, standardizing the procedures for processing, analysis, storage and retrieval of available data, and establishing a sound baseline for long-term monitoring and policy analysis. c) Producing productivity maps for rangelands in response to emerging weather conditions. These maps would be updated at appropriate time intervals and posted online. A permanent website could be established and managed by the RMP. d) Identifying and proposing potential interventions for rangelands rehabilitation programmes. At the regional level a collaborative programme is urgently needed to share experiences and

expertise among countries and provide additional opportunities for obtaining funding to conduct range monitoring activities. A good example to follow is the early warning system for livestock production (LEWS) in East Africa. The LEWS approach is point-based on a biophysical simulation of forage production selected across the landscape and represents different ecosystems covering the region under consideration. Further, geo-statistics methods can be used to extrapolate the simulated forage production and producing thematic map for simulated forage production at landscape and regional levels using NDVI data covering the region encompassed by the monitoring systems.

4.4. Rangeland Monitoring in Sudan

ElTom ElSadig Ali

Summary

The process of monitoring is an integral part of management. The outcome of this process has important implications for planning and management/improvement interventions. Its implementation under rangelands conditions depends upon the knowledge of the physical and biological characteristics of the land. Without sufficient knowledge of the condition of rangelands, interventions geared at developing this resource will meet limited or no success. The sustainable management of the extensive rangelands of the Sudan requires regular monitoring and objective information of short and long-term trends in natural resource condition.

In the Sudan the range vegetation surveys and mapping, which were carried out following that of Harrison and Jackson (1958), are fragmented activities limited to selected areas. Data and information of range vegetation parameters and condition have not been significantly updated on a national basis since the work of these two investigators. The Range and Pasture Administration (RPA) in its routine work use intensive terrestrial survey, remote sensing (aerial photography and satellite imagery), Global Positioning System (GPS) and the Geographic Information System (GIS) in monitoring programmes in selected areas. However, remote sensing, GPS and GIS are not usually practised on annual basis due to lack of funds and shortage of qualified personnel.

Relatively recent efforts were scattered in space and time covering limited projects areas or study sites. Lamprey (1975) studied vegetation change in western Sudan, using aerial photo-interpretation to detect the rate of desertification and identifying changes in Harrison and Jackson vegetation map. Several surveys and studies were subsequently conducted by different entities. The Range and Pasture Administration, through FAO TCP assistance, conducted a range vegetation survey during the period 1984-1986, using aerial photos as well as satellite image interpretation and produced vegetation map and land use map. The National Drought and Desertification Control Programme, Co-ordination and Monitoring Unit (NDDU) using NDVI (Normalized Difference Vegetation Index) data, rainfall data and ground-based data to quantify the magnitude of desertification in Northern Kordofan, concluded that variation in annual rainfall is reflected in low vegetation cover during poor rainy years.

Sampling vegetation for biodiversity and carbon sequestration evaluation was carried out, using satellite imagery, along sampling cluster points identified by the GPS system for the Community Based Rangeland Rehabilitation Project in Greigikh area, North Kordofan. In South Kordofan State IFAD SKRDP has recently carried out a study within which land cover, land use and changes in both parameters were mapped using satellite imagery and ground truth as well as processing of remote sensing data from different seasons during the years 1984 and 2000. Mapping of rangelands was achieved through the application of the FAO-AFRICOVER Land

Cover Classification System (LCCS) and the approach of the Spatially Aggregated Multipurpose Land Cover Database. The Sudan Resource Assessment and Development Project (SRAAD) funded by USAID, used satellite imagery to produce base maps and vegetation maps in some areas in western Sudan. In Southern Sudan, the Land Use and Physical Planning Unit conducted a satellite imagery interpretation study to provide an initial overview of the rangelands condition in the that region using Landsat Imagery and ground truth data.

In recent research to study vegetation cover changes in Butana area, the departure from the long-term average of peak NDVI was calculated using the Departure Average Vegetation Method. Similar work employed GIS to examine the relationship between rainfall and the NDVI in the context of the Sudan, and the value of NDVI as a tool for drought monitoring.

Access to dataset and satellite imagery, lack of trained and experienced national staff, and inadequate analysis of monitoring data on a continuous basis, are the main constraints of range monitoring in the Sudan. National institutions involved in rangelands and resource management and development have the additional challenge of ensuring regular range monitoring and upgrading the skills of technical staff performing such work.

Future development and actions should include; national range survey and inventory, and national research programmes to develop methodology for evaluation and monitoring of the range resources. Combination of the newly emerging technologies and ground-based data with pastoralists perceptions to monitor and evaluate rangelands, use of RS, GIS and GPS as main tools for range surveys should also be considered. Promotion of training programmes by national and regional Remote Sensing Centres for national staff in application of remote sensing, GIS and GPS in natural resource surveys should form an integral part of such efforts.

4.5. Range Monitoring in Morocco: Lessons and Outlook

Omar Berkat

Summary

The geographic location of Morocco and its topographic characteristics translate into a diversity of climatic conditions within the Mediterranean climate type. The annual rainfall ranges from less than 100 mm in the desert bioclimatic type to over 1200 mm within the humid bioclimatic type. This in turn, results in a high floristic (over 4500 taxa) and ecosystem diversity (about 114 major ecosystems). Rangelands extend over a large area (53 million hectares or 75% of the country's terrestrial ecosystems), and contribute approximately one third of the forage requirements of the livestock within the country, in addition to other products and services (water, fuel wood, honey production, medicinal and aromatic plants, landscape values, plant and animal diversity, carbon sequestration).

However, over the last century, the rangeland resources were subjected to increased pressure exacerbated during the last three decades as a result of: i) diminishing role of traditional institutions in resource management and monitoring, compounded by the nature of land ownership and multiplicity of jurisdictions. This weak role was not always fully compensated by modern management institutions; ii) increased demands from a growing human population; iii) reduced herd mobility; iv) changes in animal production systems, with an increased tendency for use of non-range produced animal feed, and sometimes fattening animals on rangelands; v) large-scale conversion of rangeland into cropland, even under unsuitable climatic and edaphic conditions; and vi) the frequency and severity of droughts during the 1980s, the 1990s and 2000s striking an already disturbed rangeland ecosystems.

The importance of rangeland ecosystems prompted awareness for the need for their sustainable management. This has been translated into: i) strengthening education in natural resources, mainly range science and management, forest sciences, watershed science and ecology; ii) the formulation of a national rangeland and livestock strategy, including an important monitoring component with field stations to cover the main rangeland ecosystems, as well as the necessary human and financial resources for data collection, analysis and maintenance of a database as a tool for management decision making; iii) the implementation of monitoring on a number of stations, generally within ongoing development and management projects and/or in collaboration with international organizations; iv) the promotion of range research in support of monitoring and management; and v) the promotion of information management utilizing GIS and incorporating local knowledge.

Despite the efforts made in range monitoring, this activity is still localized in space and limited in time. In order to build on the past and actual situation of range monitoring, an analysis of strengths, weaknesses, opportunities and threats is necessary. This is conducted taking into account the institutions involved, the possibilities for standardization and inter-institution information exchange, the design and the implementation of the monitoring, the resources channelled to monitoring, and the necessary meaningful data analysis (including choice of appropriate parameters and indicators, support in terms of coverage by meteorological stations and other measurements of environmental parameters, support in terms of research).

4.6. The Study of Rangeland Condition in Relation to Bedouin Communities Settlements in the Syrian Steppe (Badia)

Mohamed Al-Khatib, James Tiedman and Feras Sead

Summary

The effect of the distance from Bedouin communities' settlements in the Syrian steppe, on plant composition and soil degradation, has been studied. Fifty rangeland communities in six Provinces of the Syrian steppe (Aleppo, Hama, Damascus County, Homs, Raqa, and Dier Ezzor) have been surveyed. Three transects laid at different directions have been selected to cover most of the community rangeland. Along each transect, five points have been chosen giving a total of 750 points for all Bedouin communities settlements. The distance between successive points depended on the transect length and the community total area.

The vegetation composition and soil degradation in each rangeland community have been systematically studied. The settlement center was localized within the community borders. The starting point was fifty meters from the settlement, and the last point was on the community borders.

It has been found that most of the rangelands close to community centers were cultivated, and most of the perennial plants have been affected by settlements. The plant composition became more diverse as the distance from the settlements center increased. The degraded condition of the soil near settlements was attributed to over exploitation and overgrazing.

4.7. Impact of Rangeland Protection on Plant Biodiversity and Range Productivity of Sloping Marginal Lands in Northwestern Syria

Mohamed Al-Khatib, Francis Turkboom and Rema Al-Tarsha

Summary

This study was conducted during 2002 – 2003 at two fenced areas of sloping marginal rangelands at Al-huss and Shbieth Mountains. The effect of four years of protection from grazing on rangelands improvement, in comparison with unprotected surrounding areas, was monitored. The results indicate that number of annual range plants increased with protection from grazing. The numbers of perennials and biennials (herbaceous species) did not change under protection. Results obtained also indicated that shrub biomass doubled inside enclosures. There was also a clear increase in the proportion of vegetation cover made by species belonging to the Gramineae and Chenopodiaceae families under protection. *Carex stenophylla*, which belongs to the family Cyperaceae, increased outside the enclosures. This species is considered an invader and indicates deteriorated range condition. The results obtained prove that a period of four years of protection is not sufficient to make significant changes in plant composition, a parameter that greatly contribute to productivity of these marginal rangelands.

Management and Rehabilitation

4.8. Rehabilitation and Management of Rangelands during Past Decades in I. R. of Iran

Hossein Badripour

Summary

Natural Resources including rangelands were owned and managed by landlords dating back to the human history. The landlords usually had no livestock thus they leased rangelands to pastoralists. After the enforcement of the Natural Resources Nationalization Act in 1962, the Forest Organization (now called Forest, Rangeland and Watershed Management Organization, FRWO) replaced the landlords. Regardless of who controlled rangelands, pastoralists were the real land users and they are obliged to pay a grazing fee to the owner.

Since the landlords had relatively small areas of rangelands, there was effective control over the leased rangelands hence they were maintained in good condition. Unfortunately, when the act was passed, the government had a few competent and experienced technical staff to manage and control rangelands. Needless to say that less control leads to more degradation due to overgrazing, lack of observation of range readiness, fuel wood collection and other harmful practices. From the aforementioned it can be said that rangelands degradation in I. R. of Iran has accelerated since the early 1960s. Following the nationalization by the government, rangelands became a common property available for utilization by all users. Consequently the Forest and Range Organization initiated actions and rules to arrest the degradation process and subsequently to rehabilitate rangelands and ensure their proper use. The first measure undertaken by the Forest and Range Organization was to identify the actual rangelands users and issue grazing permits for them in order to control utilization and prevent any overgrazing. The second measure was development and implementation of range management plans. The early plans were developed for large areas with no regard to the socio-economic factors affecting range users hence these plans were a total failure. It was evident that these factors are critical for success and

sustainability of introduced interventions, thus have to be taken into consideration. A more realistic approach adopted was the development of plans for smaller areas. The developed range management plans addressed socio-economic aspects, technical issues such as climate, physiography, soil and botany. Finally range management guidelines including grazing system, range development and improvement projects were developed. The land users implement these projects but the Forest, Rangeland and Watershed Management Organization provide most of the inputs such as seeds.

Many studies have been carried out to assist the Organization to move towards more sustainable rangelands actions. Determining the optimum economic size of range management units and initiating range monitoring system are among these actions.

4.9. The Current Situation and Future Outlook for the Control and Development of Natural Pastures in Yemen **Jameel Al-Emad**

Summary

This paper examines the current situation and attempts to present the future outlook in conservation and development of natural pastures, which represents 47.5% of the total area of Yemen. Importance of rangelands in the livelihood of rural populations and nomads and their contribution to the national economy, providing 80% of the needs of livestock estimated at 17.6 million heads mostly goats and sheep, is outlined. Major ecosystems and their uses, pastoral systems and natural and human factors affecting them are discussed.

Weak institutional capacities, lack of range legislation, inadequate financing and lack of reliable data for range condition analysis that can be used by decision makers in planning and policy adjustments, needed for conservation and sustainable use of rangelands, are major constraints in Yemen's range and forestlands.

Future outlook of forest resource management and its role in combating desertification using a holistic ecosystem approach is outlined. Concurrently the importance of permanent monitoring programmes of both range and forestlands as a basis of sustainable resource management is emphasized.

Recommendations are made on the need for regional coordination and dissemination of information at the national, regional and international levels in the use of technologies and techniques aimed at sustainable use of range and forestlands.

4.10. Rangeland and Pastoralism in Mauritania: Management Methods **Moustapha Ould Mohamed**

Summary

With the exception of the area bordering the River Senegal, Mauritania could be considered as a country dominated by sylvo-pastoral ecosystems adversely affected by a variety of severe environmental problems.

During the last few decades, the combined effects of human pressures and recurrent droughts have led to the degradation of the sylvo-pastoral ecosystems and have induced deep changes in both the livelihoods of the local communities and the animal production systems. Sedentarization of the nomadic populations with their herds is witnessed leading to a severe degradation of the rangelands around the emerging settlements.

A national action plan was launched in order to address these problems, with the major objective of combating the advance of sand dunes and the restoration of the potential of agro-sylvo-pastoral production. The following actions are proposed:

- Curative interventions with the mechanical stabilization of sand dunes
- Preventive interventions and combating desertification through sound agro-sylvo-pastoral management.

The means proposed to achieve these objectives are heavy demanding and not easily reproducible by the local communities. For rangelands management to be effective and successful, it should be conceived within the framework of local dialogue and active involvement of the local communities and all the concerned stakeholders within a conducive institutional and legislative context.

In order to implement adequate rangeland policy, the country has put in place some agro-sylvo-pastoral management programmes for range improvement through protection, rotation, enrichment, water- harvesting and forage conservation. The involvement of the local communities was provided through participative management, with a management committee allocated for each site. Some of these actions have proven to be replicable by the local population. Others like harvesting and forage conservation require heavier investments and facilities local community cannot afford and that can only be achieved with the strong involvement of and contribution by the government. In all cases, along with the introduction of modern techniques, a strong knowledge of the traditional methods is required.

4.11. The Mediterranean Garden: A Concept to be Revived in Lebanon

Fady Asmar

Summary

In 2003-2005, the Ministry of Agriculture has undertaken a National Forest and Tree Resources Assessment, with the technical and financial support of FAO. Rangelands were not covered specifically by the assessment, as grazing is considered as one of the multiple land uses in the forests and other wooded lands. However, rangelands should be covered in the next assessment exercise, as they constitute an important aspect in land use. The following figures were provided through the assessment: Forests (13.3%), OWL (10.4%) and other lands with trees (10%).

Prior to this assessment, different figures were given, based on different definitions and statistical approaches. However, the agriculture census undertaken with the support of FAO has shown that non-agricultural areas cover 632,000 ha of which 520,000 or 52% of the total Lebanese area can be considered as rangelands, which include grasslands, mountains and natural pastures and scrublands. Livestock production especially of sheep and goats has traditionally been an integral part of the dryland agriculture in Lebanon. The sheep and goats belonging to the Awassi and Baladi breeds, respectively, are very well adapted to local conditions and can survive on scarce vegetation. Sheep numbers have stabilized around 200,000 heads (1970-1990) while goat numbers have increased from 300,000 heads in the 70s to approximately 500,000 heads in the 90s.

As in most of the rural areas in the Mediterranean region, the land in Lebanon was utilized since centuries or even millennia. The adopted patterns of utilization have impacted on and shaped the landscape. Most of the land being on steep slopes, the development of agriculture was only possible with the building of terraces which have increased both the surface to be planted and the water holding capacity of the soil.

Nowadays, the different forms of land use have lost their importance in most of the villages. The utilization of land for forestry is no longer viable; cultivation and pastoralism do not constitute a major source of income any more. Pastoralism is no longer perceived as an activity integrated in the rural space, but rather as a harmful type of land use and an aggression on the forest and on the natural vegetation. In spite of the potential of ecotourism as an environmentally friendly type of land use yet local inhabitants do not seem to understand the important role it can play in the socio-economic development of their areas.

Lack of interest in agriculture and the abandonment of the traditional systems have affected the configuration of the landscape and modified the biological dynamics by provoking the reappearance of the forest and later by the enrichment of the area with native animal and plant species. Ultimately the continued abandonment of agro-pastoral activities in the mountains would lead to a progressive closing of the melieu, causing a drastic modification of the landscape, an alteration of the biological equilibrium and a loss in biodiversity. The dramatic fires that occurred at the end of summer 2007 and the damage they have caused is the result of the thick layer of litter and dead biomass accumulating in the woodlands.

This situation is only true in part of the Mount-Lebanon Chain. This contrasts with the situation in Bekaa region, in the Anti-Lebanon Chain in some other parts of Mount Lebanon, where overgrazing is a problem. This irrational practice has destroyed the landscape by degrading the vegetation cover. In these areas, converting marginal lands into crop production, combined with the breakdown of traditional grazing rights, overstocking of the shrinking rangelands and the low productivity of local livestock have all contributed to overgrazing and accelerated the process of land degradation. No doubt the mismanagement of grazing and the irrational utilization of resources are strongly contributing to the destruction and deterioration of this landscape.

Although frequently accused of strongly contributing to the degradation of natural vegetation in Lebanon, goats have always played an important role in the life and survival of local communities. Unlike sheep and cattle, the local goat is very dynamic and well adapted to the landscape. Meat, milk and dairy products have always provided a reliable source of food to rural communities all over Lebanon.

Rangelands have a direct use as grazing lands for herds. In addition, they play an important role in soil conservation and groundwater recharge. In semi-arid areas such as the Northern Bekaa, intense rainfall events on degraded rangelands result in flash floods with dramatic on and offsite effects. Range rehabilitation in these areas would greatly improve water infiltration and groundwater recharge while alleviating flood events.

Both underutilization and overgrazing are problems of mismanagement, and should be addressed through a participative approach involving the local community groups and all the concerned stakeholders, leading to sustainable grazing, rational utilization and management of resources.

Equilibrium between forests, agriculture, rangelands and other uses should be found in the rural areas, with the integration of some modern dimensions like ecotourism and local industries, and the implementation of social and environmental services. The sound and progressive reintroduction of human activities into the landscape will allow for the revival of the local economy while respecting the landscape values and favouring the proper extension of the different components of the landscape.

The application of the concept of the Mediterranean garden combining the forests, agriculture and rangelands allows for the conservation of the landscape and the preservation of the natural, landscape and cultural heritage.

4.12. Natural and Improved Rangeland Production Evaluation Techniques in Tunisia **Salah Chouki**

Summary

Advanced technologies to investigate the dynamics of rangelands vegetation are necessary and nowadays imperative for predicting the future impacts of climate change and inappropriate utilization practices on vegetation and biodiversity. This paper will describe how conventional techniques are used to estimate the rangelands productivity and trends.

Experience of the past few years have indicated that implemented rangelands improvement techniques led to an important increase in the productivity and positive change in species composition of rangelands. Production estimates showed that the productivity of rangelands is highly improved from North to South depending on the applied technique. The productivity was raised from 250 to 600 FU/ha/year with *cactus*, and 250 to 800 with *Acacia* and *Atriplex nummularia* and *A. halimus* plantation. Reseeding and deferment raised the productivity from 300 to over 1000 and from less than 50 to 200-250 FU/ha/year. Rangelands species composition is also highly improved where many annuals and perennials enriched the vegetation cover. The paper concluded that establishment of long-term follow-up and prediction of rangelands production and early preparedness strategies are imperative to overcome feed resources deficits.

4.13. Development and Management of Rangelands in Iraq **Sabah Kawaz**

Summary

Rangelands covering about 75% of Iraq land surface play an important role in controlling national herd size through the amount of forage they contribute to meet livestock feed requirements. This contribution is dependent on climatic conditions that are characterized by low and variable rainfall. This latter factor determines vegetation cover and biomass production. In the northern and southern Badia (steppe) range productivity ranges from 60 to 80 kg/ha/year. During the grazing season forage produced in these two areas exceeds the requirements of sedentary livestock by three times.

The paper indicated that there are possibilities to greatly improve vegetation resources particularly if the required management is applied. It drew attention to the large quantity of renewable groundwater (2.3 billion m³) and the large aquifer containing an estimated 200 billion m³ in the desert from which only 11% is presently utilized.

Reference has been made to several strategic studies and projects implemented by the government in the past few years. Prominent among these efforts was the Hamad Basin Study that covered 32,000 km². The Study surveyed and evaluated the condition of natural resources, socio-economic aspects and furnished a general framework for a comprehensive development programme. The strategic studies also resulted in the preparation of a plan for the western desert to determine areas suitable for pastoral settlement, combating sand dune fixation as well as for preparation of a map to delineate areas proposed for investment in agricultural and pastoral activities. The government established oases and areas of improved pasture to function as sources of plant genetic resources (including range and other natural vegetation), and improving stock and domestic water supply to enhance settlement in specific areas.

The paper drew attention to the fact that surveys and monitoring revealed that there are more than 500 species out of which 110 are shrub species. It stressed the need to manage rangelands

and ensure their proper use and development. It also made reference to the importance of conserving basic resources (water, soil, livestock etc). Achieving this would require the preparation of topographic maps; detailed land use and land cover maps, and delineation of rangelands. Utilization of recent technologies in conjunction with ground truth is foreseen in order to document the present status of range and forest resources as well as to enhance sound planning.

4.14. Sustainable Range Management in Tunisia **Said Helal**

Summary

The total surface area of Tunisia is around 164,000Km², most of which (around 75%) is affected by aridity. Forests and rangelands cover an estimated surface area of 5.5 million ha, or about 1/3 of the country. They represent an important basis for rural economy, mainly in the relatively poor areas in the West. In general, the rangelands contribute about 15-35% of the nutritional needs of the national herd. The variability in the level of contribution is of course dependent on the amount and distribution of rainfall that fluctuate between years. This resource is vital for the livelihoods of the dependent agro-pastoral communities. Population growth and settlement of pastoralists and their herds coupled with the expansion of cereal crops cultivation and planting of fruit trees at the expense of rangelands contributed to environmental degradation and intensification of the phenomenon of desertification. In view of the impacts of these factors the government paid special attention to the sector by passing specific legislation to control and regulate its use. Concurrently it embarked, in 1990, on the implementation of a programme for range rehabilitation and improvement within the context of the national plan for reforestation, establishment of fodder shrubs on rangelands, water and soil conservation and arresting sand encroachment. This plan has been extended for a second ten years period covering 2002-2011 in order to consolidate the initiated programmes. To rectify degradation trends hundreds of thousands of hectares were rehabilitated using different techniques (protection, reseeded, plantations of cactus and forage crops and fodder shrubs), along with the improvement of water resources and stock water infrastructure to facilitate management of the rangelands.

Unfortunately results obtained, as a consequence of efforts made to achieve ecosystem restoration, did not meet expectations. This is mainly attributed to sectorial interventions that give priority to increased quantities and which do not focus on integration of the different components and on the complimentary relations and synergies with the different sectors to make use of available development opportunities.

It is obvious that rational management of natural resources, especially rangelands, by the agro-pastoral communities in the central and southern parts of the country, is confronted by several institutional, socio-economical and technical constraints. It is also realized that range resources development can only be achieved within integrated programmes that meet targeted communities needs and that are founded on: (i) a participatory approach (ii) gradual empowerment and (iii) delegation of responsibilities of control and right of use of resources to targeted groups and their legitimate institutions.

The experience acquired through the project on the integrated forest management (co-funded by Japan), the programme for the agro-pastoral development and the promotion of local initiatives in the South (co-funded by IFAD) and the pilot project on the demonstration of strategies to

combat desertification in the arid regions (SMAP-LCD) is interesting. These projects have achieved important results that should be augmented and expanded on a larger scale.

4.15. Holistic Management and Monitoring: Linking Livestock, Landscapes and Livelihoods in the Dry lands

Constance L. Neely

Summary

The most serious challenges we are facing today including climate change, desertification, biodiversity loss, increasing droughts and floods, and conflict over resources are but symptoms of a deeper problem. The root cause can be found in our incapacity to take decisions that simultaneously address the social, economic and environmental pillars of sustainability and subsequently our land management choices. Holistic Management offers a decision-making framework that adds value to current knowledge and systems processes. It builds on an understanding of the whole that is being managed, a holistic goal that defines how our lives must be and what has to be in place to support that long into the future (e.g. land, water, biodiversity, behaviours), an understanding of the four ecosystem processes (solar energy flow, water cycle, mineral cycle, and biological community dynamics) that support us, and provides a set of testing guidelines and a feedback loop that ensure that we chose actions that will take the person, organization, and community towards the desired outcome. Holistic Management builds upon four key insights which are highly pertinent to our management of range and forest lands, namely: the world operates in wholes (holism after Smuts, 1926); an understanding that overgrazing is a factor of time not numbers (after Voison 1988); an understanding the brittleness scale (ranging from high to low humidity through out the year) and how the environment responds to different tools; and the historical predator-prey relationship that kept animals bunched and on the move (both from Savory, 1999). In brittle environments which are found in many of the countries in the Near East Region, livestock grazing and animal impact serve as important tools for increasing range and forestland productivity and biodiversity by: breaking soil crusts (through hoof action), adding nutrients, improving soil organic matter and water infiltration and holding capacity, enhancing soil-seed contact and improving soil cover. An example for Zimbabwe (and replicated in many parts of the world) has shown that using holistic planned grazing (Savory 1999) of livestock alone (livestock in large herds handled by herders and no fencing) has vastly increased forage productivity and diversity of plant species; has replenished streams and boreholes; and greatly increased wildlife populations due to enhanced availability of food and water sources. This has greatly increased the resilience of the land and capacity to withstand meteorological droughts.

Monitoring is a key component of the decision making framework within the feedback loop. The holistic goal provides the why (support to desired livelihood and quality of life) as well as what we are managing for and towards (such as healthy landscapes and ecosystem processes to sustain us). Then monitoring is done in the context of the desired outcome. Using fixed-point photographs, transects for data collection (species, cover, biological life, soil chemistry, water infiltration rates, etc.) and satellite imagery among others, we can then monitor the situation in light of the desired outcome. Practices can then be put in place to move that whole in the direction of the desired future natural resource base. Thus the feedback loop includes four elements, namely: plan, monitor, control, and re-plan.

The holistic goal describes the desired outcome for that whole that is being managed and brings together the elements of potential trade-off in a way that raises awareness on sustainable practice. In other words, if you are managing for biodiversity and livelihoods, the land management decisions must be taken that will achieve these outcomes. The various means that may achieve this will be tested to ensure that they move the entity forward in both the short and long term.

While Holistic Management found its roots in livestock and wildlife settings, it is not limited to this. It offers a decision making framework that can be used by individuals, communities, organizations and institutions, businesses, partnerships, projects and policies to move toward stated desired outcomes that are sustainable, build transparency in decision making (using testing guidelines) and ensuring that actions address root causes (policies are particularly challenged with addressing symptoms).

Further information can be found at www.holisticmanagement.org and www.managingwholes.org as well as the text book and hand book (Holistic Management: A new framework for decision making (Savory with Butterfield, 1999); and Holistic management Handbook (Butterfield, Bingham, Savory, 2006). Training programmes are also available.

Combining Local Observation and Remote Sensing for Rangeland Monitoring in Arid Zones*

Nabil Ben Khatra, Mourad Briki, Sandrine Jauffret, Melanie Requier-Desjardins, Khatir Benhanifia and Sidali Hassani

Summary

Within the framework of a partnership programme, the Sahara and Sahel Observatory (OSS) and the Algerian Space Agency (ASAL) have developed a harmonized approach for environmental monitoring combining remote sensing and local observation. Based on the use of remote sensing-generated data provided by the ASAL satellite Alsat 1, land cover maps were produced on the tests sites of the ROSELT/OSS network (long-term ecological monitoring observatories network). Among the 12 sites of the network, 6 were retained to initiate this programme. These sites are mainly pastoral, but with various modes of management as influenced by their ecological and socio-economic characteristics. The maps drawn on the observatories of Mali (Bourem), Mauritania (Nouakchott) and Niger (Tondikandia) have already been validated while the validation of those of Algeria, Morocco and Tunisia is in progress. Thanks to the local observation data collected on the West African tests sites, the results obtained by remote sensing were globally validated. The adopted approach is thus reliable and its extension to the various levels (national, sub-regional and regional) can be considered by taking into account the lessons learnt from this experiment, which are institutional (partners involvement), methodological (extrapolation) and technical (capacity building). The approach developed within this framework is promising for the development of a monitoring system appropriate for application in arid and semi-arid lands where rangelands prevail. Finally the paper underlines the essential need for the system to be global and integrated, and should combine tools of local monitoring and spatial observation.

**Rehabilitation of Rangelands in Dry Areas: A Case Study of Bishri Area,
Syrian Arab Republic***
Ghufran Kattach and Haitham Daghistani

Summary

This paper is reviewing and describing the technical and socio-economic interventions implemented in Bishri area of the Syrian Arab Republic. Prospects for maintaining the positive derive and enhancing initiated efforts are outlined. This area is largely rangelands covering about one million hectares. It is classified as arid land with an annual rainfall of 140 to 190 mm. Inhabitants of Bishri area are Bedouin raising livestock, mainly sheep. Most of them are poor and their livelihoods are vulnerable to climatic variations and the negative impacts of below normal rainfall. Frequent droughts and mismanagement of natural resources, such as overgrazing and uprooting of shrubs for fuel; contributed to rapid land degradation of this fragile ecosystem. Range forage production is hinging on fluctuating and unreliable rainfall. As a result of all these influences rangelands lost part of their biodiversity, their vegetation cover decreased and most of the palatable plants disappeared. The ultimate consequence was the decline in productivity and the drastic reduction of grazing capacity. This aggravated living conditions, further reducing the inherent low income of Bedouin and induced migration of active age groups to urban areas seeking opportunities for employment to supplement household income.

This case study was implemented as part of a project of combating desertification in the Syrian steppe. Several interventions were carried out to improve the vegetation cover of the area. The techniques applied ranged from reseeding, planting of nursery-raised seedlings, periodic protection, water harvesting, sand dune fixation and erosion control. Remote sensing data was used to evaluate extent, distribution, dynamics and the trends of sand movement and vegetation cover. Regular socio-economic surveys were conducted to study the impact of rehabilitation measures on the livelihood of the local population.

As a result of rehabilitation measures the plant density increased from 1.02 plant /m² at the beginning of the project in 1995 to 101.5 plant/ m² in 2005. Shrub density increased from 0.057shrub/tree/m² to 5.8shrub/tree/m² during the same period. Plant species that were considered extinct have reappeared and regenerated. In 1995 only 35 plant species were recorded. They belonged to 27 genera and 8 families. In 2005 the recorded plant species increased to 102 belonging to 60 genera and 17 families. By 2005 plant productivity increased 8 times when compared to that of 1995. As a consequence grazing capacity increased from 0.35 head/ha in 1995 to 2.83 head/ha in 2005. Sustainable development and improved management of rangeland resulted in favourable growth of plant species. In order to maintain the achieved improvement trend future actions should focus on adopting a grazing management schedule based on the growth and regeneration requirements of desirable plant species.

5. MAIN ISSUES

The following main issues emerged from discussions and comments of participants and are subdivided into two categories namely problems/constraints and conclusions.

5.1. Problems/Constraints

The presentations and the elaborate deliberations highlighted the following constraints as hindering designing and implementing effective monitoring and rehabilitation programmes and benefiting from the valuable information and data they generate.

- A problem exists on how to apply protection on large scale with the acceptance and collaboration of local land users without reverting to expensive fencing and/or guarding, which are not always effective. Further successful range improvement and regeneration by protection requires provision of alternative feed to compensate for forage normally obtained from the protected site and ensuring that communities that have traditional right of use of the protected site benefit from improvement results. Acts, laws and different regulations are not always sufficient to ensure protection. The participants were reminded that if rangeland surrounding the protected site is not managed the resulting undesirable changes might cause deterioration of the protected site as a result of drifting sand which triggers undesirable shifts in vegetation composition. In arid lands it is advisable to apply proper level of utilization to avoid range deterioration and the occurrence of such shifts.

- The length of the grazing season is critical to the condition of a range site as the longer the period livestock stay on the range the more deterioration is experienced including uprooting of plants.

- The attention of participants has been brought to a case where government reserves and fenced range sites are poorly managed. They are subjected to destruction of part of the fence, intrusion by livestock and overgrazing. In some of these reserves both indigenous and introduced species are showing signs of stress and bare soil is common. The system of fencing and protection of range sites by government units and projects have met very little success in many countries.

- In arid lands a period of four years of rangeland protection is not sufficient to give the required indications about regeneration ability of the vegetation of that site due to the frequent occurrence of drought and years of below normal rainfall. Longer periods are required to encounter years of good, average and below normal rainfall. In such arid environments it has been noted that when protection starts with very low density of desirable perennial species response to protection is slow and recovery may take much longer.

It is advisable to measure the seed bank in the soil to assess site potential to regenerate reasonable cover of desirable forage species.

- Discontinuity of interventions and adopted techniques when projects and programmes are terminated is a problem encountered when these are planned and operated in isolation from relevant institutions and target communities.

- It is noted that watersheds are not consistently monitored because of fund limitations or they are not a priority. These areas, which are in many cases utilized for grazing by livestock and/or wildlife, should be monitored to detect changes in vegetation parameters, soil and water characteristics.

- A constraint common to many countries is the shortage or lack of trained manpower in remote sensing and GIS and the use of modern techniques in surveying and monitoring.

- There is a general agreement that research devoted to rangelands and pastoral systems is not receiving adequate attention in many countries. The need for research programmes on long-term basis is obvious so that identified problems are addressed and efforts to develop these lands and production systems are supported by reliable data and acceptable techniques.
- The emergence of commercial large scale producers, who are not traditional Bedouin raising relatively small flocks of sheep, is observed in several countries. These producers supported by mechanized facilities to transport feeds, water and livestock increased the period animals stay on the exhausted low productivity range. The situation is worsened by feed subsidies.
- Urban expansion and tourism supported by recent regulations and policies threaten areas under forest and accelerated encroachment by settlements as is the case of south western Saudi Arabia.
- Cactus can be a noxious weed on rangelands while in other cases can be an important source of livestock feed depending on the type used. The spineless cactus used in Tunisia is not propagated by seed (by cladodes) thus it is not a noxious weed as the spiny cactus found in Yemen. The seed of this latter type is dispersed by birds and in Somaliland by monkeys and baboons.
- **Several participants drew attention to the problem of limited funds, facilities and trained manpower which could place a major constraint on carrying out regular and efficient range monitoring activities. This situation is aggravated by limited institutional capacities as well as institutions instability due to frequent changes in ministries structures and responsibilities. In addition lack of coordination between institutions, which forms an essential and major step towards integration and harmonization, accentuates the adverse effects of funds limitations.**
- Unfortunately in many instances rangeland and range management is not a priority of governments and most technical assistance and aid agencies. This situation increased the marginalization of the resource and dependent communities.
- There is a general lack of policies that support sustainable rangelands management and pastoral development. In some cases government policies may operate to the disadvantage of range and forest resources. This is partially attributed to the lack of awareness of decision makers about the multiple values and uses of rangelands. Lack of national strategies and clear vision on sustainable management and development of rangelands and pastoral systems is common to most countries. The availability of land use maps at the national level to facilitate delineation of range and forest resources areas and planning for their sustainable management is also limited.
- With respect to range monitoring it is realized that the present situation and methodology used by national institutions and projects are characterized by: (i) lack of regular range monitoring practices in most cases (ii) lack of continuity of data collection (iii) lack of data analysis and drawing guidelines to assist management and planning (iv) lack of harmonization and standardization of methodology and techniques and (v) lack of selection criteria for appropriate range monitoring techniques.
- The situation is also characterized by lack of linking monitoring and management by determining the goal of monitoring; what are we monitoring; who will use the resulting monitoring data, suitable monitoring techniques; and when to monitor.

5.2. Conclusions

The participants reached the following conclusions concerning range monitoring, rehabilitation and coordinated range and forests programmes in the Region:

- An issue of interest and common concern was the need to foster regional cooperation within the framework of an efficient FAO Regional Programme and in collaboration with ACSAD, ICARDA and AOAD.
- FAO can provide the appropriate institutional setting to help connect/extend methods and techniques that have worked by compiling and disseminating information and results of range monitoring including lessons learned from field projects. Networking should be encouraged and assisted to enhance communication and exchange of experiences as well as for addressing common problems and challenges.
- Community participation and active involvement of local populations in rangelands and forests management and rehabilitation should be sought and local groups motivated to play leading role in these activities. Capacity of local community should be enhanced and their capabilities and skills upgraded. In this respect more attention should be given to women participation in sustainable management of natural resources in view of the various roles they play in water collection, harvesting of fuelwood and wood and grass for housing, and collection and marketing of non-wood forestry products particularly wild fruits, medicinal and aromatic plants.
- Local communities have their traditional methods of assessing the condition of the range but no use is made of their presence on the range or their methods. NGOs and CBOs have presence even in some remote areas and can shoulder some of the responsibilities of range monitoring and enhancing range and forest integrated interventions.
- Special interest was evoked among participants over documentation of indigenous knowledge and integrating traditional techniques into monitoring, management and rehabilitation of range and forest resources.
- A national approach for survey and monitoring of range and forest resources would be more appropriate. This should include a review of existing information and data, methodology and techniques employed, data storage, processing, analysis and retrieval. The objectives of survey or monitoring, indicators of change, parameters to be measured, time of measurement, sampling strategy, and frequency of monitoring should be indicated. Government units, projects, NGOs, CBOs and local communities should collaborate in conducting monitoring and data collection. The use of monitoring data should be encouraged as a way of promoting monitoring.
- Remote sensing, GPS and GIS are useful tools to be utilized, in conjunction with ground truth data, for collecting data and information, interpretation and processing.
- Consistency of data collection and long-term monitoring are important since it has been recognized that changes in vegetation attributes are expected to occur due to management, climatic variations and rehabilitation/improvement efforts.
- Monitoring of rangelands should be linked and coordinated with monitoring desertification which has adversely affected natural resources, agricultural lands and dependent communities in the Region.
- Sustainable management of range and forest resources should be oriented towards multiple use and improvement of local communities livelihoods. Integration of ecotourism in efforts for sustainable natural resources management streamlines with multiple use approach.
- Education of the public and decision makers and increasing their awareness about the socio-economic and environmental values and roles of forest and range resources as well as their importance for the well-being and proper functioning of other renewable natural resources and a variety of systems of production. Most importantly reference should be made to their roles in the conservation of biodiversity, carbon sequestration, combating desertification and fulfilling the goals of national environmental conservation strategies.

- Support should be provided to rural poor through training, to improve their skills, and employment opportunities in order to secure income that will preclude them from encroaching onto marginal lands for cultivation and forests for wood cutting and charcoal making.
- Development of alternative sources of energy and building materials and making them available at reasonable cost for rural and urban populations is an important step to release pressure from dwindling forests and degraded rangelands.
- One of the main issues raised was the need for clear well-articulated and long-term policies for sustainable rangeland management and range dependent livestock production.
- Adoption of bottom-up approach in planning, implementation, monitoring and evaluation supported by multi-disciplinary team need to be given high priority.
- A number of participants have the view that there is enough capacity in academic and research institutions in the Region to conduct short-term and degree training.
- A firm consensus to focus on selection and utilization of native species and development of seed banks was established. Introduced species may have a role in filling some gaps, however, care must be taken as some exotic species may become invasive noxious weeds with adverse impact on native vegetation and the environment.

6. FOLLOW-UP ACTIONS

Taking into account limitations of funds and the need to build on Sub-regional presence of FAO/RNE in collaboration with regional organizations and research centers the following lines of action are proposed as a follow-up to this Consultation to guide the Regional Programme and to assist member countries in their efforts to monitor and rehabilitate rangelands:

- Supporting member countries in issues as capacity building and formulation of sound policies and strategies.
- Facilitation and coordination of the efforts on standardization and harmonization of monitoring techniques in collaboration with national institutions including universities. The Regional Programme will also consider facilitating meeting of experts from the Region to discuss and evaluate the outcome of standardization efforts.
- FAO, regional organizations and research centres should facilitate the exchange of practical experiences and proven technology in the fields of range monitoring including the use of remote sensing and GIS by national institutions. They should be prepared to provide support and technical assistance to a Regional E-mail group/network on natural resources/range monitoring and surveys. The group should comprise representatives of interested national institutions, regional organizations and research centers and consultants in relevant fields.
- Interested member countries should initiate, in collaboration with FAO/RNE and other interested organizations, the formulation and implementation of an integrated natural resources management pilot project to strengthen range and forest monitoring at national level for the purpose of enhancing bio-diversity conservation, carbon sequestration and sustainable management of natural vegetation resources. Its first phase should be funded from FAO TCP resources (one-two years). Its second phase (three-four years) should be funded by relevant funding agency, regional sources or international programmes such as GEF.

Annex I. Agenda

Day and Time	Agenda Item
Day One - Monday 26 November	
09.00 – 09.15	Welcome Assistant Director General FAO/RNE Welcoming Address Given by Pape Koné
09.15 – 09.45	Introductions
09.45– 10.15	Agenda (Mohamed Mirreh) Objectives and Expected Outputs (Mohamed Mirreh) Ways of Working (Constance Neely)
10.15 – 10.30	Stage Setting (Pape Koné, Mahgoub Zaroug)
10.30 – 11.00	Coffee
11.00 – 13.00	State of Monitoring Chair: Fady Asmar Presentations Range Monitoring in the Islamic Republic of Iran (H. Arzani) Rangeland Survey In Saudi Arabia (S. Al-Rowaily) Rangeland Monitoring In Jordan (M. Al Hamad) Rangeland Monitoring in Sudan (E. Ali) Capturing of Key Points
13.00 – 14.00	Lunch
14.00 – 15.30	State of Monitoring (continued) Chair: M. Al Hammad Presentations Range Monitoring in Morocco: Lessons and Outlook (O. Berkat) The Study of Rangeland Conditions in Relation to Bedouin communities settlements in the Syrian steppe (Badia) (M. Al Khatib) Impact of Rangeland Protection on Plant Biodiversity, range productivity of Sloping Marginal Lands in Northwestern Syria (M. Al Khatib) Capturing of Key Points
15.30 – 15.45	Coffee
15.45 – 17.00	Discussion
Day Two – Tuesday 27 November	
09.00 – 09.30	Report from Rapporteur (M. Zaroug) Check in (C. Neely)

Day and Time	Agenda Item
09.30 – 11.00	<p>Management and Rehabilitation Chair: H. Arzani</p> <p>Presentations</p> <p style="padding-left: 40px;">Rehabilitation and Management of rangelands in I.R. of Iran. (H. Badripour)</p> <p style="padding-left: 40px;">The Current Situation and Future Outlook for the Control and Development of Natural Pastures in Yemen (J. Al Emad)</p> <p style="padding-left: 40px;">Rangelands and Pastoralism in Mauritania - Management Methods (M. Ould Mohamed)</p> <p>Capture of Key Points</p>
11.00 – 11.15	Coffee
11.15 – 13.00	<p>Management and Rehabilitation (continued) Chair: S. Al Rowayli</p> <p>Presentations</p> <p style="padding-left: 40px;">The Mediterranean Garden – A Concept to be Revived in Lebanon (F. Asmar)</p> <p style="padding-left: 40px;">Natural and Improved Rangeland Production Evaluation Techniques in Tunisia (S. Chouki)</p> <p style="padding-left: 40px;">Range Management in Saudi Arabia (A. Al Assiri)</p> <p style="padding-left: 40px;">Development and Management of Natural Pastures in the Republic of Iraq (S. Kawaz)</p> <p>Capture of Key Points</p>
13.00 – 13.30	Lunch
13.30 – 14.45	<p>Management and Rehabilitation (continued) Chair: M. El Khatib</p> <p>Presentations</p> <p style="padding-left: 40px;">Development and Sustainable Management of Natural Pastures in Tunisia (S. Helal)</p> <p style="padding-left: 40px;">Brief Survey about the Forestry Wealth Situation in Syria (B. Selloum)</p> <p style="padding-left: 40px;">A. Darkalt (AOAD)</p> <p style="padding-left: 40px;">Holistic Management and Monitoring (C. Neely)</p>
14.45 – 15.00	Coffee
15.00 – 15.15	

Day and Time	Agenda Item
	Capture of Key Points
15.15 – 17.00	Discussion Session

Day Three – Wednesday 28 November	
09.00 – 09.30	Report from Rapporteur (M. Zaroug) Check In (C. Neely)
09.30– 11.00	Group Work
11.00 – 11.15	Coffee
11.15 – 12.00	Group Reports
12.00 – 13.00	Emerging Recommendations
13.00 – 13.15	Coffee
13.15 – 15.00	Conclusions and Next Steps
15.00	Closing

Annex II. List of Participants

JORDAN

Mohammad Noor Alhamad, Ph.D.
Assistant Prof. of Rangeland Ecology
Department of Natural Resources & the Environment
Faculty of Agriculture
Jordan University of Science & Technology
P.O. Box (3030) Irbid, Jordan (22110)
Phone: 962-2-720-1000 Ext: 22073
Fax: 962-2-720-1078
Email: malhamad@just.edu.jo

SUDAN

EL Tom EL Sadig Ali
PhD Range Management
Associate Professor
University of Khartoum, Sudan
Tel: 0911609
Email: tomsadig@yahoo.com

IRAN

Hossein Arzani
Chair- Department of Mountainous and Arid Zones Improvement
College of Natural Resources - University of Tehran
P.O. Box 31585-4314 Karaj- Iran
Phone: 0261 224 9313 – 0912 363 4046
Fax: 0261 2249313
Email: harzani@ut.ac.ir

Hossein Badripour
Expert – Bureau of Range Affairs
Forest Rangeland & Watershed Management Org.
No. 131, West Zartosht St., Vali Asr Ave.
Tehran, I.R.Iran
Tel: +98 21 88 95 19 45-6
Fax: +98 21 88 95 19 44
Mobile: +98 912 644 93 08
E-mail: badripour@yahoo.com

IRAQ

Sabah Saleim AL-KAWAZ
General Director of Horticulture and Forestry
Ministry of Agriculture
Al-Karada Al-Sharkya Area
901\35\Building No.3, Baghdad
Tel: +964-1-7175212\7401890
Fax: +964-1-7174898
Mobile: 07901105447
E-mail: kawazsabah@maktoob.com
Kawazsabah@yahoo.com , hart_and_Forestry@yahoo.com

KSA

Dr. Saud Al Rowaily
Assistant Professor - Plant Production Dept.
College of Food and Agriculture Sciences
King Saud University
P.O. Box 2460, Riyadh 11451
Kingdom of Saudi Arabia
Tel: ++96614678455
Mob: ++966503462093
Fax: ++96614678467
Email : srowaily@ksu.edu.sa
<http://faculty.ksu.edu.sa/Al-Rowaily>

Mr. Taqqi-Eddin Hassan ADAR
Director of Rangeland Dept.
Ministry of Agriculture
Riyadh, KSA
Tel: 014180199
Mob.: 0506403286
Fax.: 014033702

Abdu Al Assiri
Director General of Natural Resources Department
Ministry of Agriculture
P.O.Box 15620 ,Riyadh 11454
Riyadh, Kingdom of Saudi Arabia
Tel&Fax:+96614033702
Mob.: +966 505 493688
Fax: +966 14033702
E-mail Abdo_hashem@agrwat.gov.sa or Abdu646@hotmail.com

SYRIA

Dr. Mohamed Al-Khatib
Rangelands scientist
University of Aleppo
Faculty of Agriculture
Department of Ecology and Forestry
Tel (Mob) : 0933 120 947
Email : mhmd_khtib@yahoo.com

Bassem Salloum
Ministry of Agriculture and Agrarian Reform
Al Abed Street, Damascus
Tel: 00988 274942
Email: bms_sma@yahoo.com

AOAD

Ahmad Darkalt
Director of Arab Forest & Range Institute
Lattkia , Syria , P.O.Box 142
Tel: +963 41 422000
Mob : + 963-9333-300357
Fax: +963-41-418459
Email: ahdarkalt@yahoo.com

LEBANON

Fady Asmar
Forestry Expert
FAO
Beirut , Lebanon
Tel: +961 5 452931
Mob.: +961 3 259818
Email: Fadyasmar@terra.net.lb ; Fadyasmar@gmail.com

MAURITANIA

M. Moustapha Ould Mohamed
Coordinateur National du Projet GCPR/MAU/022/BEL
Direction Protection Nature
Ministere Delegee Chege de L'environnement
Tel: 00222 5290115 / 5253157
Mob: 00222 6412155 / 6223415
Email: aidaramoustafa@yahoo.fr

MOROCCO

Omar Berkat

Formerly Professor, Rangeland Ecology and Management

Département d'Ecologie Végétale

Institut Agronomique et Vétérinaire Hassan II

BP 6610, Poste Madinat Al Irfane

Rabat, 10000, Morocco

Tel: 00 212 68493066

E-mail: berkatomar@yahoo.fr

Darfaoui El Moustafa

Head of Range Division, ORMVAT

ORMVA – TAFILALET

Cité ORMVA-TF, BP. 17,

Errachidia, Maroc

Tél: +212 35572089

Mobile: +212 68148665

Fax: +212 35572252

E-mail: emdarfaoui@menara.ma

elmdarfaoui@caramail.com

TUNISIA

Said Helal

Head of Socio-economic Department for the Development of Forest Population

General Directorate of Forestry

30 Rue Alain Savory 1002

Tunis – Tunisia

Tel: +216-71 283727 - 98317236

Fax: +216- 71 283727

Mobile: +216-983 17236

E-mail: said.helal@topnet.tn

Salah Chouki

Regional Director (Kairouen)

Ministry of Agriculture

Office of Livestock & Pasture (OEP)

OEP, 30 Rue Alain Savary

1002 Tunis, Belvedere, Tunisia

Tel: +216 77 301 983

Mobile: +216 97 646 004

Fax: +216 77 301 627

Email: chouki_s@yahoo.com

YEMEN

Jamil Abdul Samad Emad
Head of the Protected Areas Department
General Directorate of Forestry Desertification Control
Ministry of Agriculture & Irrigation
Sana'a , Yemen
Tel: +967-733721329
Mob.: +967-733721329
E-mail: jameelalemad@yahoo.com

CONSULTANTS

Ms Constance Neely
E-mail: cneely@holisticmanagement.org

Dr. Mahgoub Zarouq
E-mail: amunaint@hotmail.com

FAO

Pape Koné
Senior Forestry Officer, FAO/RNE
E-mail: djiby.koné@fao.org

Mohamed Mirreh
Range Management Officer, FAO/RNE
E-mail: Mohamed.Mirreh@fao.org

Annex III. ADG FAO/Regional Representative Opening Address

By

Dr. Mohamad I. Albraithen

Assistant Director General

Regional Representative for the Near East

Distinguished guests,

Dear Colleagues,

Ladies and Gentlemen,

It is a great pleasure for me to address this gathering of critical mass of scientists from the Near East and North Africa, who are meeting to discuss the important issue of rangeland and rangelands under forests in the Region and particularly their monitoring and rehabilitation.

On behalf of the Food and Agriculture Organization of the United Nations, I would like to thank you most sincerely for kindly accepting our invitation, and warmly welcome you to Cairo.

As you are no doubt aware, pasture and rangelands including rangelands under forest cover, are the largest areas under one kind of use. These lands are host to very large population of livestock and wildlife and are major sources of livelihoods for a large segment of the population in this Region, especially rural communities.

These lands however, have been subjected to long years of unregulated use by sedentary, nomadic and transhumant flocks and herds, thus exacerbating the impacts of harsh climatic conditions.

In the past few decades, because of complexity of factors, they have witnessed drastic changes that resulted from excessive use of the grazing resources. The most prominent contributing factors include:

- The high increase in both human and livestock populations;
- Vegetation clearance for cropping, irrespective of land capability and environmental conditions to support cultivation;
- Unsustainable cutting and uprooting of woody species in the absence of sound regeneration programmes;
- Unrealistic policies regarding the distribution of livestock watering stations, subsidized feed and socio-economic influences.

Colleagues,

Ladies and gentlemen,

Natural droughts and periods of dry spells are common to the predominantly arid and semi-arid rangelands of the Region. Recently, due to the concurrent adverse effects of the above-mentioned factors, the occurrence of successive periods of drought has intensified the pressure of the limited natural forage resources and consequently accelerated the rate of their degradation. In many areas, land became desertified and rural life deteriorated with subsequent massive migrations to urban centres.

Governments in the Region established institutions, national programmes and projects aimed to improve and conserve range and forestlands. FAO is providing continuing support for the

achievement of these national goals and several actions were undertaken such as initiating regional studies, and formulating various projects for range management and improvement.

The Near East Forestry Commission, established since 1953, kept raising awareness, providing advice and addressing recommendations to FAO and Governments of the Region on issues pertaining to sustainable use and management of forests and rangelands.

FAO has also approved several Technical Cooperation Programme (TCP) agreements to facilitate on-going activities or create new projects to support forest and range development, as requested by member countries.

Taking into consideration FAO's past and current experience in the Region and the various programmes being implemented by member countries alone or through international assistance; it became obvious that a continuous rangeland monitoring programme is essential for policy decisions in resource conservation. These policy adjustments will not only encourage sustainable forage production, but also will contribute to conservation of biodiversity, combating desertification, assistance in carbon sequestration, and therefore contribute to the global effort in CO₂ reduction and adaptation to climate change.

Dear Colleagues,

You are expected to examine the various ways and means for accomplishing the goals set for this consultation. As authorities in your own fields, you bring a variety of experiences which can, together with that of FAO, form a strong basis for moving the agenda of sustainable natural resources management and the use of monitoring for policy adjustment and guide resource management and conservation.

I have no doubt that your recommendations will guide our regional programmes in fulfilling the expectations and needs of this Region.

Your participation in this Consultation is much appreciated.

Once again, you are most welcome and while wishing you fruitful discussions and successful sessions, I also hope you will appreciate your stay in Cairo.

Thank you for your kind attention.

Annex IV. Rapporteur's Reports

The purpose of these notes is to highlight some points and issues which lend themselves for further thoughts and discussions between participants, some constraints voiced by several speakers and some approaches and experiences introduced in presentations that can be adopted by other countries.

a) Summary of Comments on the First Day Presentations

- A holistic view of rangelands and forests within the context of the whole landscape and concurrently their interactions and complementarities with other natural resources seems more appropriate to enhance adoption of integrated approaches to the sustainable development of these resources.
- During discussions and interactions participants should give serious consideration to how range monitoring can support the goals of biodiversity conservation, combating desertification, climate change (carbon sequestration) and national environmental conservation strategies.
- Pastoralism and utilization of rangelands are crosscutting with several other sectors and at the same time pastoralists have their traditional knowledge and experiences. It worth thinking how to consider interactions with other sectors and incorporation of this knowledge in regular monitoring and employing it for data collection.
- Cooperation and coordination between national institutions, NGOs, CBOs and local communities at the national level and with international organizations, regional organizations and research centres at the regional level is vital in guiding the way forward and supporting sustainable programmes.
- There are various positive aspects of Iran's experience of launching a national project for establishing a range monitoring system. Most prominent among these is bringing all monitoring activities under one umbrella. This is expected to enhance coordination, standardization and building reliable database on range attributes for the whole country. This experience has further introduced two additional benefits/innovations namely (i) distribution of information and data obtained and making them available to range users, decision makers and government units and (ii) organizing rangeland day to directly inform range users and increase their awareness about the value and benefits of range monitoring.
- The early warning system for livestock production (LEWS) and the utilization of simulation for forecasting forage production in different ecosystems has been introduced as an example of collaboration between countries in east Africa. Attention was also drawn to the Regional Centre for Mapping Resources for Development established by some east and southern African countries with international assistance and now operated and funded by those countries. It is a main player in surveys and mapping utilizing RS, GPS, GIS techniques and ground truth. It also plays an important role in training technicians from member and other countries in its fields of competence.
- Attempts to resolve fund limitations may follow several approaches and routes including assistance from international organizations, funding agencies and bilateral aid. However, raising funds from national sources should lead these attempts. Efforts to inform decision makers and increase their awareness about monitoring and database establishment for enhancing national planning and sustainable resource management should be escalated in order to gain their support to monitoring programmes by allocating sufficient financial resources.
- The Regional Range Management Project (UNDP/FAO RAB/025) has attempted to introduce a holistic resources management formula to its activities. This lead to the preparation of phyto-

ecologic and socio-economic surveys together with the preparation of natural resources planning manual. Its experience and outcome need to be brought to the attention of range management specialists in the Region and should be subjected to more analysis and evaluation. Holistic resources management should be tailored to local environmental, institutional framework and socio-economic realities.

b) Summary of Comments on the Second Day Presentations

- Several survey and monitoring interventions introduced by internationally assisted projects ceased directly after termination of these projects and their data, maps and relevant materials have been partially or completely lost. Hence it is vital to build project planning and implementation processes into the regular national institutions activities to ensure continuity of initiated programmes and maintenance of its outputs.
- Water is a scarce resource in the Region. There is an urgent need to inform decision makers about the intimate relation and interactions of range and forests with water and soil resources. The role of natural vegetation resources in soil conservation, watershed protection and water resources characteristics, is vital. Degradation of natural vegetation resources impacts negatively on water resources: rate of infiltration, groundwater recharge, volume and velocity of runoff, sediment load and water quality. Hence monitoring should include soil pH, EC, soil moisture, soil organic carbon, rate of water flow, sediment load, and water quality
- Government units, because of funds and/or staff limitations, can no longer carry out monitoring all over the country. Some countries have well equipped NGOs closely working with communities and actively engaged in environment and natural resources conservation. Therefore both NGOs and CBOs should be encouraged and motivated to collaborate in monitoring range and forests in areas where they have presence and field activities.
- Socio-economic influences on range and forest resources are many covering: (i) participation of local communities (ii) indigenous knowledge (iii) traditional rules and resources control (iv) grass and wood utilization for fuelwood, charcoal making, building materials, local tools, and handicrafts (v) forestry non-wood products and (vi) grasses as a source of food/grains. This makes it necessary to monitor socio-economic aspects/indicators.
- In arid and semi-arid regions forests and rangelands are considered one resource subjected to multiple uses and providing a wide range of products and services. Forest grazing is an important use including: forest for dry season grazing, forest for drought period grazing, and collection of pods for household livestock or for sale as animal feed.
- The Region's experience in establishing fodder shrubs comprised introduction of exotic species, re-establishment of indigenous ones, and planting nursery-raised seedlings or direct seeding in combination with soil moisture conservation techniques. However, management and proper utilization of established stands was not always considered from the planning stage hence problems have been encountered in this regard in several areas.
- Wetlands (swamps, seasonally inundated lands, river banks, coastal marshes and mangrove stands) are important grazing areas, hence should be covered by monitoring activities. This links monitoring to RAMSAR, which focuses on wetlands and their sustainable use.
- It is encouraging to note that the system of issuing permits to pastoralists to graze their livestock in specific areas for specific duration by a determined number of animals is still functioning in Iran. The latest official record indicated that permits have been issued for over 300.000 pastoral households. Such an experience should be the theme of a Regional meeting to witness how it is

functioning, discuss its elements and consider its introduction to interested countries after modification to suit local environmental and socio-economic conditions.

- Al-Mahjour/Hima is still effectively functioning in Yemen with well-articulated regulations and rules for management and utilization, and fines and punishment of offenders. Although limited, Hima is claimed to be practised by individuals or some tribes in south west Saudi Arabia.
- It is interesting to note that the efforts to introduce Hima in Lebanon are lead by an NGO. Although the NGO is mainly concerned with protection of habitats and sources of food for birds yet grazing by livestock has been allowed for herds of neighbouring local community as an incentive to engage them in sustainable development of the site. The success of this pilot intervention may pave the way of expanding it in Lebanon and possibly in other countries.
- Camels graze mangroves. They are also important habitats for birds and play a vital role in marine life and food chain. Their stands are threatened due to fuelwood collection, excessive browsing and disturbance of coastal habitats as a result of human activities. These stands should be covered by regular monitoring activities to document their condition and detect changes.
- Insect pests (desert locusts, grasshoppers, caterpillars) and diseases impact negatively on herbaceous and woody vegetation. They should be monitored to determine and document their effects on plant composition and productivity.
- Combating desertification and sand dune fixation, which are important activities in the Region, emerged prominently during the presentation from Mauritania. Successful efforts in these areas require collaboration and close interaction between natural resources disciplines, most importantly foresters and range management specialists, and socio-economists.
- Conflicts over resources are intensifying and resulting in some cases in armed confrontations e.g. Darfur conflict. Pastoralists are in the middle of most conflicts and are frequently affected adversely and emerged disadvantaged. Conflict resolution mechanisms are essential including traditional ones, which are more effective and their rules most acceptable.
- Bedouin and pastoralists settlement has been attempted and frequently raised by planners and decision makers. Failures are many and success is very limited. There is a need for a study on this issue to document the various experiences within and outside the Region to be presented in a regional meeting.
- Very encouraging information emerged from Morocco on the issue of integrating indigenous knowledge in resource survey and monitoring.

- It is important to remember the issues of land tenure, users' rights and institutional capabilities and include them in our plans and interventions for range monitoring, management and rehabilitation.
- Instability of institutional framework and frequent changes and shifts in government units are a problem interrupting planning and implementation and confusing staff.
- The positive impacts of introducing cactus into marginal cereal producing lands in Tunisia is an occasion to remind participants of a promising trial of FAO Range Management Project in Libya that introduced strip cropping of barley, annual medic and fodder shrubs (Atriplex and Australian Acacias). The barley crop and medic are rotated between plots while the perennial fodder shrubs were established on long-term basis.
- Realizing the location, infrastructure and facilities available, Al-Jouf Range and Livestock Research Centre in Saudi Arabia, should be developed into a regional research and training facility.

- Consistent efforts should be made to increase awareness of decision makers about natural resources and the need to launch integrated and sustainable management programmes as well as changing mentalities with respect to the importance and roles of these resources and their development funding requirements.
- Considering range and forest rehabilitation more consideration and priority should be given to indigenous species then look for introduced and adapted one to fit into certain niches and fill gaps when suitable indigenous species are not available.
- Planning and re-planning is a useful message to remind us of the need to consider this in our efforts for integrated natural resources management. Normally plans are formulated BUT not monitored, evaluated or re-oriented.
- Building transparency in our partnership is another useful message which should be complimented by building confidence and trust in our professional relations.
- The issue of inconsistent and variable terminology used may require a joint effort by FAO, ACSAD, AOAD and ICARDA to compile and publish an Arabic/English/French glossary for natural resources terminology.