ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA (ESCWA)

LAND DEGRADATION ASSESSMENT AND PREVENTION: SELECTED CASE STUDIES FROM THE ESCWA REGION

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Executive summary

The present report attempts to address some of the critical issues that policymakers, administrators, staff and stakeholders involved in combating and preventing land degradation may be confronted with when determining the successful implementation of related programmes. The report reviews some of the processes that can help to determine whether a programme implemented in selected countries in the region is successful or not. There is strong evidence that well-planned and well-implemented programmes to combat land degradation bring greater benefits to stakeholders and local communities at large. The evidence can be supported by a review of selected programmes and projects in which the major concern was to increase productivity and to enhance living conditions in the face of adverse climate, drought, fragile soils, inappropriate natural resource management practices, and other environmental concerns. In innovative programmes and projects, stakeholders and members of communities are embracing new practices that are substantially improving their productive capacity, their income levels in general, and their living conditions in particular, often without reliance on complex technologies or schemes.

The report is divided into five chapters, preceded by an introduction. Chapter I reviews the extent, causes and impact of land degradation and examines the complexity of assessing land degradation programmes, especially when the results of the assessment are comparable with similar programmes. In particular, it is stressed that programme assessment should be based on practical knowledge, wisdom and a benchmark on the basis of which a success could be compared and measured.

Chapter II reviews some of the major issues that allow the assessment of programmes. It is emphasized that successful programmes should entail certain criteria that would enable their stakeholders to judge easily their usefulness and to encourage their active participation in programme activities. The major criterion is predictability, which emphasizes the issues of credibility, stability and formal entitlements; promoting collective action and a participatory approach; and ensuring that the programmes should be replicable and/or transferable to new environments while still being implemented successfully.

Chapter III focuses on case studies from selected countries in the region, namely Egypt, Jordan, the Syrian Arab Republic and the United Arab Emirates. These case studies review the major challenges facing the selected areas, the major activities conducted, and their achievements based on the criteria identified in chapter II. The case study on Egypt concentrates on an area of the North-west Delta, traditionally a rangeland area, but which is now faced with coastal erosion and salinization, mostly as a result of the increasing urbanization process. The case study on Jordan reviews two programmes/projects, namely: the Al-Karak Agricultural Resource Management Project, located in the south central highlands, east of the Jordan Valley, an area characterized by gentle plateau and deep soils adjacent to barren slopes with indication of land degradation; and the Yarmouk River Basin project, an area located in the north-west corner of Jordan, which is an agricultural area highly affected by land degradation. The case study on the Syrian Arab Republic focuses on the rangeland area of the Bishri Mountains, located in a semi-arid to arid Badia zone and intensely affected by land degradation due to inadequate land management practices. The case study on the United Arab Emirates focuses on the Ras Al-Khaimah Emirate in the north, which is mostly arid and affected by salinization, moving sand dunes and water depletion.

Chapter IV reviews the lessons that can be learned from successful interventions and then provides some action-oriented recommendations. These are related to the process of identifying successful programmes, the replication and transfer of programmes, ensuring stakeholders and community participation, the promotion of peer mentoring (stakeholder to stakeholder) and finally, encouraging the adoption of resource conservation practices as well as avoiding the design of overly ambitious intervention programmes.

Chapter V presents the conclusions.

ABBREVIATIONS AND ACRONYMS

ACSAD	Arab Center for the Studies of Arid Zones and Dry Lands
AFESD	Arab Fund for Economic and Social Development
ALIC	Arid Land Information Center
ARMP	Agricultural Resources Management Project
BCM/year	billion cubic metres per year
CAMRE	Council of Arab Ministers Responsible for the Environment
CAPMAS	Central Agency for Public Mobilization and Statistics, Egypt
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
DPSIR	Driving forces-Pressures-States-Impacts-Responses
EEAA	Egyptian Environmental Affairs Agency
EPADP	Egyptian Public Authority for Drainage Projects
FAO	Food and Agriculture Organization of the United Nations
GCC	Gulf Cooperation Council
GDP	gross domestic product
GIS	geographic information system
GPS	Global Positioning System
GRC	Gulf Research Center
GTZ	German Agency for Technical Cooperation
HARS	Al-Hraniya Agricultural Research Station
ha	hectares
ICARDA	International Center for Agricultural Research in the Dry Areas
ICBA	International Center for Biosaline Agriculture
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
JD	Jordanian dinar
km	kilometres
LADA	Land Degradation Assessment in Drylands
m	metres
MAP	Mediterranean Action Plan
MAT	Moisture Absorbent Textile
mm	millimetres
NWRC	National Water Research Center (Egypt)
SESRTCIC	Statistical, Economic and Social Research and Training Centre for Islamic Countries
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNEP-PAP	United Nations Environment Programme-Priority Actions Programme
WASAMED	Water Saving in Mediterranean Agriculture
WDI	World Development Indicators
WFP	World Food Programme

Introduction

Policymakers, administrators, staff and beneficiaries[1] of programmes to combat or prevent land degradation need to draw lessons and learn from successful intervention programmes either within their own territories or elsewhere in order to replicate or transfer them, taking into consideration their national, local and cultural settings, in order to ensure that they will remain successful. National, local and cultural differences, as well as changing circumstances among stakeholders, may make it difficult to replicate or directly transfer successful intervention programmes into new settings without proper adjustments.

The main aim of this report is to assess the possible use of experiences acquired elsewhere in successfully designing and implementing intervention programmes for combating and/or preventing land degradation. The report presents some approaches for understanding and utilizing the successful intervention programmes. One practical approach is to build a database of successful intervention programmes; however, such a database may not integrate or expose the dynamics of various social, cultural and individual forces at play that affect programme implementation.

The report will review some of the processes of identifying successful intervention programmes and issues related to the transfer and replication of programmes by analysing a few selected programmes that have been implemented in Egypt, Jordan, the Syrian Arab Republic and the United Arab Emirates. There is strong evidence that a well-planned and well-implemented programme to combat land degradation can be of great benefit to key stakeholders and local communities at large. The evidence is supported by a review of selected programmes and projects in which the major concern was to increase productivity and to enhance living conditions in the face of adverse climate, drought, fragile soils, inappropriate practices and other environmental concerns. Innovative programmes and projects have been implemented in selected areas, and stakeholders and members of communities are embracing new practices that are substantially improving their productive capacity, their income levels and their living conditions, often without any reliance on complex technologies or schemes.

These improvements, obtained in most cases through the use of commonly known techniques, are also generating indirect social and economic benefits. However, these benefits are accruing only to a small number of communities, as successful programmes are still limited both in scope and number in the region. In these areas, the resource base is being preserved and fragile lands are being saved from over-exploitation. Thus there is reduced degradation of the environment and the economic burden is minimized for the concerned communities, the structure of the society is being maintained, and communities that were on the brink of extinction owing to outward migration are being revived thanks to increased demand for labour and the creation of opportunities at the local level.

The challenges are still great and differ in nature in the various communities. For instance, in the highland areas, measures to combat and prevent land degradation have been used for years, and sometimes for centuries, but new challenges such as the degradation of old terraces, increasing water scarcity and aridity, and the loss of the vegetative cover are still emerging. The semi-arid areas characterized by low and highly variable rainfall, high evapotranspiration, strong wind and low humidity are becoming more and more hostile environments for the survival of people, animals and plants. The establishment of new human settlements in the Badia is generating unforeseen problems related to the fragility of the land and the use of unsustainable practices. Communities on the fringe of the desert are struggling with shifting sand dunes, as there is little or no vegetative cover to fix sand dunes. A great deal of the productive land in the region is, in fact, marginal pasture, which is at risk of becoming irreversibly degraded if brought into cultivation. As such, the region is faced with serious environmental challenges, and these could easily translate into more degradation and desertification if timely action is not initiated.

The available evidence shows that the design and implementation of new and successful programmes is possible and can provide wide-ranging benefits. However, this does not imply that these programmes are cost-effective, are easily replicable or can simply be adapted to fit successfully in new settings. Nonetheless,

[1] Often referred to as key stakeholders.

most successful programmes have three major elements in common that are worthy of replication and can contribute to the success of other intervention programmes:

(a) They all have relied on and encouraged the use of local inputs and resources including staff and technologies, have been active for a long time and have provided regular benefits to their stakeholders (expertise, trust, stability and entitlements);

(b) They all have encouraged a coordinated action by groups and concerned communities at the local level by fully involving them in the decision-making and implementation process (collective action and participatory approach);

(c) They all have relied on the strong, well-planned and well-targeted support of public institutions, which worked in partnership with concerned stakeholders or beneficiaries (aspects easily replicable).[2]

Despite various negative forces working against the programmes, the above-mentioned success was achieved. These negative forces consisted mainly of non-conducive policy environments, and urban encroachment on agricultural and rural lands, as well as lack of strong support for environmental protection. If more environmentally friendly policies could be enforced, along with the application of positive lessons and experiences gained, then the sustainable reversal of land degradation and desertification is not beyond reach.

Numerous indigenous systems of land protection and conservation are well adapted to local conditions and survived for long periods of time. However, in most cases they are unable to reverse the degradation process, mainly owing to the fact that not all land is protected and not all degradation originated from the same source, such as farming of agricultural lands. Human settlements and other economic infrastructures are increasingly becoming the major sources of land degradation. Thus integrated approaches, together with the streamlining of coordinating efforts at the community level aimed at the same targets, are required to combat and prevent land degradation.

[2] J.N. Pretty, *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance* (Washington, D.C., 1995, Joseph Henry Press).

I. ASSESSMENT OF PROGRAMMES: ISSUES AND OPTIONS

A. LAND DEGRADATION IN THE ESCWA REGION

Land degradation is defined as a temporary or permanent decline in the productive capacity of the land, which occurs whenever the natural balance in the landscape is changed through misuse or overuse, usually by human activity, or through natural processes.[3] Land degradation is a universal problem, which occurs all over the world, but it is of major concern for dryland regions. Land degradation is one of the main environmental problems facing countries in the ESCWA region. This is especially true in those countries where the share of agricultural gross domestic product (GDP) in the economy is higher or equal to 10 per cent, such as in Egypt, Lebanon, the Syrian Arab Republic or Yemen. Desertification is affecting large areas, particularly in Iraq, Jordan, the Syrian Arab Republic, and most countries on the Arabian Peninsula. Many of these countries already have deserts, ranging from 10 per cent in the Syrian Arab Republic to close to 100 per cent in Bahrain, Kuwait, Qatar and the United Arab Emirates. Some 15.3 million hectares (ha) of the region's cropped lands are affected by land degradation; 42 per cent are slightly degraded and 12 per cent are severely to very severely degraded. The estimated annual cost of land degradation in the ESCWA region could reach several millions of American dollars per annum.[4]

The major type of land degradation in the region is soil erosion caused by wind and/or water. However, salinization, waterlogging and seawater intrusion are other major problems, particularly in irrigated areas and coastal plains, owing to the use of inappropriate practices and the depletion of aquifers. Other major types and causes of land degradation include deterioration of physical, chemical and biological, or economic, properties of soil, and the long-term loss of natural vegetation as well as deforestation. Land degradation could become a serious threat to food production systems and rural livelihoods, especially if the expansion of agricultural production on marginal lands continues at the current rates. With the rapidly increasing demands for water by sectors other than agriculture, and the continued inefficiency of on-farm water use, water availability and quality will be threatened and thus lead to the abandonment of cropland.

Many types of land degradation can potentially be reversed, even though this requires a long-term commitment. Land-improving investments and better land management practices should be encouraged through appropriate policies. Well-targeted public investments, better-designed programmes and an appropriate mix of policies can all be used to promote the conservation of the resource base. The broader policy context could also be made more supportive to promote rural development, institutional innovations, the correction of market distortions, the promotion of rural income growth and diversification, and the elimination of discrimination against marginal areas.

In many countries, measures to combat land degradation are not of prime concern. Resources (both financial and human) are disproportionately allocated to other sectors of the economy. In addition, most of the limited resources destined for rural areas are spent on activities directly related to crop and livestock development and on improving living conditions, while only a tiny share is allocated to the conservation of the resource base despite its rapid degradation.

With the increasing disparity between rural and urban areas and the degradation of the resource base, there is a strong case for a critical review of the planning and implementation of the development agenda. In particular, there is a need to prioritize this agenda, giving priority to programmes to combat and prevent land degradation, as both their direct and indirect contributions to sustainable development could be enormous. It is a call to better plan the development process in general in order to allocate more equitably the limited

[3] Food and Agriculture Organization of the United Nations (FAO), "Rehabilitation of degraded lands in Sub-Saharan Africa: Lessons from case studies", paper presented at the Workshop on Strengthening Regional Action-Implementation of the IPF/IFF Proposals for Action in Africa, held at Accra, Ghana, from 16 to 18 February 2004.

[4] H.E. Dregne and N.T. Chou, "Global desertification dimensions and costs" in *Degradation and restoration of arid lands* (Lubbock, 1992, Texas Tech. University).

resources since, most of the time, poorly planned programmes end up having outcomes that are far different from what was originally intended.[5]

Promotion of programmes that provide a strong foundation for sustainable development should be accorded high priority. These include programmes that enhance and promote the conservation of the natural resource base. These programmes would have the potential to provide an effective way to prevent or combat land degradation, based on selective criteria, and will contribute to the achievement of other development objectives. The ingredients for success in the implementation of programmes to prevent land degradation must be clearly identified, and a critical analysis of programmes should be carried out to determine their success, and what made them successful, in order to use their underlying effective mechanisms in the design and implementation of other intervention programmes.

B. ISSUES AND OPTIONS IN THE IDENTIFICATION PROCESS

In identifying factors that determine the success of a programme, emphasis could be put on approaches that favour full-scale region- or country-wide programmes, as opposed to those programmes that support models or demonstration schemes. The reason is that few of these models or demonstration schemes ever evolved to become full-scale programmes that can be implemented over large areas and that could provide benefits to a great majority of the target population.

Determining the success of a programme requires the conducting of appropriate assessments in order to ascertain that the selected criteria for evaluation are being met and that the programme is delivering its services in an efficient manner. The objective here is not to provide ready-made solutions, as these could lead to an overstatement of the level of accomplishment and, as such, negatively influence the decision-making process. Relying on accomplishments alone to determine policy course would be misleading, as it would imply that the conclusions generated provide definitive answers instead of a likelihood that they could work or not, especially since on-the-ground conditions for valid comparative evaluations would be hard to recreate.[6] Providing ready-made solutions could also prove dangerous in the long run, as they may separate the decision-making process from the policy arena, where major policy choices are made, and thus marginalize the active role and responsibilities of policymakers.

Determining what constitutes success is not straightforward and, in most cases, problematic as sometimes unrealistic assumptions are made that the concerned programmes have a clear and single purpose. Most often, in the real world, programmes have multiple objectives. For instance, the primary goal of a programme could be to arrest or prevent land degradation, while at the same time it would have other related goals such as improving productivity, empowering rural women, improving rural infrastructures, improving living conditions, increasing rural employment, and preventing out migration. These goals may not be equally as important as the major goal, but they would still have an impact on the programme's achievements and strongly influence the judgement commitments of the stakeholders. In addition, these secondary goals could be in line with, and would support, the primary goal, thereby facilitating the implementation of the whole programme. However, in most cases, these secondary goals would act as constraints, especially when, for instance, key stakeholders may choose to get more involved in the secondary goals at the expense of the primary goal.

When conducting a programme evaluation, pressure is usually put on the administrators and managers to specify clear and well-defined objectives that, in most cases, are not fully endorsed by all key stakeholders. Evaluations conducted on the basis of these objectives will lead to criticism, as some will contend that the real goals were not assessed. For instance, a programme could prove successful in arresting land degradation caused by water erosion through, among other things, constructing stonewalls and water-

[5] WCCIP, *Making a Plan for Program Stability*, Wisconsin Child Care Improvement Project, Inc., 2002. Available at: http://www.wccip.org/tips/business/program_stability.html.

[6] L.S. Robson and others, *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to Show Whether a Safety Intervention Really Works* (Cincinnati, Ohio, National Institute for Occupational Safety and Health, Centers for Disease Control, 2001) (henceforth known as "Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries").

harvesting structures. However, farmers could still feel that the programme did not achieve its intended goal, as it did not assist them in improving farm productivity, did not provide them with yield-enhancing inputs, or did not improve their income levels. Furthermore, although the overall goal may have been to achieve cost-effectiveness, in the process damages may have been inflicted on the surrounding environment. Thus, bringing such unexpected outcomes into the evaluation process may lead to different political perceptions and judgements.[7]

It should be noted, however, that not all "unanticipated" or "unexpected" consequences have to be undesirable. For instance, a notable result of some of the programmes in Jordan was that they developed the capacity of their beneficiaries in various areas, including small business development. This enabled stakeholders gradually to improve their incomes and standard of living, and those of their communities, through the creation of small-scale farming-related processing units that provided additional revenues and new and/or additional consumer products in the community. These indirect benefits to stakeholders and their communities would be hard to quantify and to include in the evaluation of the overall impact of the concerned programmes, but not impossible, as in fact they really had a positive impact and then could be attributed to the successful implementation of the intervention programme.

Knowing how a programme works is important, especially when one is trying to ascertain if it is successful. However, it might not be feasible to go through a full description of the underlying policies and implementation strategies of all the components of a programme, since what one might consider a core function might be different from another's point of view. Thus, what is central to the effectiveness of a programme may be far from obvious in many situations and, as such, the question would be to ask what could be modified in a programme without detracting from its effectiveness. Responding to this query would help to identify the type of changes that could be brought into the programme so that it could be successfully replicated.[8]

A programme could be evaluated by comparing the situation without the programme with the situation after the start of the programme or its full implementation. However, most of the time these comparisons are not conducted, owing to a lack of financial means and/or political will. Furthermore, not all benefits accrued in the effect stage could solely be attributable to the programme under consideration. For instance, successes in enhancing the status of women could be curtailed or improved by prevailing national policies. As such, adjustments would have to be made to factor in the impact of changing conditions and/or policies at local, national, regional and even international levels on the success of the programme, and this may not be an easy task.[9, 10]

Given these limitations, evaluators tend to rely on assessments that compare various programmes. These assessments are less expensive while still sufficiently reliable to provide overall guidance and as such are widely used in evaluating the effects of programmes. These assessments rely usually on an analysis of the data collected during the preparatory and implementation stages, on interviews with staff and stakeholders and on end-of-programme evaluation reports.

The conduct of a successful assessment would then require the evaluator to possess the following:

(a) Practical knowledge of the problem, knowing what is being done and how things work in real-life situations;

(b) Practical wisdom and the capacity to ask the right and most revealing questions and the ability to evaluate the answers objectively;

(c) A benchmark or baseline against which to measure success.

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[7] R.E. Grun, *Monitoring and Evaluating Projects: A Step-by-Step Primer on Monitoring, Benchmarking and Impact Evaluation*. Health, Nutrition and Population (HNP) Discussion Paper (Washington, D.C., 2006, World Bank).

[8] Ibid.

[9] Ibid.

[10] L.S. Robson and others, *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries*.

One of the main concerns with this kind of assessment, however, is that it is highly subject to the perception bias of those conducting them. This bias can be overcome by conducting several assessments using different experts, approaches and perspectives, and requiring that all judgements be substantiated by hard facts. Such assessments would require the availability of good records, including those on the conditions of users prior to the beginning of the programme, and knowledge of the activities that may have influenced the outcomes for users during and after the implementation of the programme. However, most intervention programmes do not usually maintain such detailed records in a ready-to-use format. Therefore, finding a proper way to assess accomplishments would have to be found.[11] In this report, assessments were conducted based on limited information from the concerned programmes and projects whenever possible, and they were complemented by desktop research from various sources.

[11] R.E. Grun, *Monitoring and Evaluating Projects: A Step-by-Step Primer on Monitoring, Benchmarking and Impact Evaluation*, Health, Nutrition and Population (HNP) Discussion Paper (Washington, D.C., 2006, World Bank).

II. A METHODOLOGICAL APPROACH AND CRITERIA FOR PROGRAMME ASSESSMENT

This chapter attempts to clarify what makes a programme effective or successful, and to identify the conditions under which it might thrive. Programmes to alleviate land degradation are usually complex, as in most cases they are not stand-alone programmes but are rather integrated into larger development programmes such as those to reduce poverty or those aimed at developing agricultural and rural areas in general.

A. PROGRAMME PREDICTABILITY

Predictability is one of the main issues that determine the success or failure of land degradation, agricultural and environmental programmes. It emphasizes, among other things, the notions of order, systemization, formalization, consistency, and/or methodical operation, as people perform better when they know what to expect in a given setting and at a given time. The better the level of predictability, the higher the level of collective action that will be induced and, as a result, the better will be the achievements in implementing the programme.[12]

"Predictability determines the success of a programme and is assessed through credibility and reliability."

Predictability can further be disaggregated into credibility and reliability.[13] Credibility implies the existence of a mutual relationship among those involved (beneficiaries and institutions), while reliability implies the presence of benefits that require beneficiaries (farmers and landowners) to work with service providers (usually public institutions). Reliability can further be split into stability and entitlement, as it is both a measure of quality and of consistency and repeatability. Although seemingly obvious, the above issues tend to be overlooked in the design and implementation of programmes, and this often leads to their underperformance. The aim here is to find ways in which relationships among stakeholders and institutions could be used to improve responses to programme implementation.[14]

The concepts of credibility and reliability should be continuously utilized for the entire duration of the programme. The extent to which they contribute to more effective programmes depends on the overall context. For instance, low levels of credibility and reliability (such as predictability) on the part of public officials may serve to stimulate useful collective action on the part of those adversely affected but, at the same time, high levels of credibility and reliability could also lead to the same effect–such as collective action–as stakeholders try to induce public interventions. Different types of predictability are, however, required to encourage and support different types of collective action.

1. *Programme credibility*

Credibility is the behaviour of public officials, as perceived by stakeholders, with trust and expertise. It is the extent to which officials implementing programmes can be relied upon to behave as good and knowledgeable partners or, in other words, to do their jobs in a credible manner. The issue of credibility can further be explained through a case example, the Highlands Project in Jordan, which is funded by both the

[12] G. Bloom and others, *Poverty Reduction During Democratic Transition: The Malawi Social Action Fund 1996-2001* (Centre for Social Research, Malawi; Institute of Development Studies, United Kingdom; and Norwegian Institute for Urban and Local Government Research, Norway; 2001).

[13] S. Meyer, *Enhancing the Credibility of Voluntary Environmental Initiatives* (Canada, Stratos, Inc., 2000); C. Alkire, *Emphasis on Conservation and Ecological Restoration* (Washington, D.C., Bureau of Land Management Budget, The Wilderness Society, 2004); M. Leach, R. Mearns, and I. Scoones, *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*. In *World Development* (United Kingdom, 1999, Elsevier), vol. 27, No. 2, pp. 225-247; and D. Mulvaney, *Review of Leach, Mearns and Scoones*, 2003.

[14] G. Bloom and others, *Poverty Reduction During Democratic Transition*, 2004.

Government of Jordan and the World Food Programme (WFP) and implemented by the country's Ministry of Agriculture. The programme/project has been operating in the highlands areas of Jordan since 1964.[15] Among other things, the programme/project gives a special focus to households led by women and disadvantaged members of the society and, as such, tends to support small-scale activities that can be handled by poor households with limited resources. In fact, some of the programme/project's largest activities include stone walls to reduce water erosion which, although small-scale in size, would still be a burden for most smallholders in the project area. The programme/project concentrates on farms with a maximum size of 25 dunams (about 2.5 hectares), located on slopes between 9 and 40 per cent, in areas with 200 mm or less of rainfall and with a maximum annual income of 500 Jordanian dinars (JD).

"Credibility is built through trust and expertise."

In order to build confidence and trust, stakeholders willing to participate in the activities of the programme/project are requested to sign a contract or agreement that details not only the services that will be provided by the programme/project, but also what will be expected from the concerned beneficiary. Before signing the contract, both parties meet and agree on what will be or should be done based on the needs of the particular stakeholder. The agreement or contract stipulates, among other things, that stakeholders will accept and act upon the advice received from the programme/project staff with regard to improving his/her productivity and sustaining his/her resource base. The agreement sets also a specific time frame during which the work would have to be completed (usually nine months) before the contract would be void. At the completion of the work, the programme/project would pay the stakeholder in kind with food or farm implements as stipulated in the agreement. The signing of such a document puts both parties into a regulated relationship and, by their abiding by the terms of the contract, the programme/project reinforces its image, and stakeholders view it as a credible and/or trustworthy partner. This builds a strong long-term and healthy relationship, and leads to an enhanced willingness of stakeholders to further participate in the activities of the programme/project.[16]

Infrastructures for combating land degradation tend to be expensive, while their outcome often materializes long after the initial investment was made. If stakeholders, especially those without much means, are to invest their time, efforts and savings in such endeavours, and if these endeavours fail or cannot be completed, they would stand to lose a great deal and, most important, to lose confidence in current and future public initiatives. There is therefore a need to try always to enhance the perceived credibility of public institutions implementing programmes, as the willingness of stakeholders and their communities to participate in their activities will depend on this credibility. The Highlands Project, as well as a few other programmes/projects in Jordan, tried to avoid the trap of using active public relations-such as overstating results-as a way to persuade stakeholders to cooperate. Rather, they have relied on a passive type of public relations, whereby they set good records and good examples that improved their credibility and then banked on their growing good reputation to attract other stakeholders who, if they are to make a substantial commitment of time and resources, need to be confident in the outcome of the initiative. The credibility and reputation of implementing institutions are thus central to programme success.

2. *Programme reliability*

Reliability implies the notion of ensuring stability and providing formal entitlement. Programme stability is the extent to which the programme is stable over time, which is based upon factors including its lifespan, content, form and procedural requirements. Formal entitlement is the legal status of benefits

[15] Information collected through discussions with Eng. I. Sa'oub of the Technical Directorate, Ministry of Agriculture, Jordan.

[16] S. Meyer, *Enhancing the Credibility of Voluntary Environmental Initiatives*; C. Alkire, *Emphasis on Conservation and Ecological Restoration*; and M. Leach, R. Mearns, and I. Scoones, *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*.

expected from these programmes, or the extent to which intended beneficiaries are entitled to request alternative formal channels if the programme fails to deliver. The most formal entitlement is a legal right.[17]

Stability and formal entitlements act as incentives and, as such, they help to sustain popular participation even when there is a lack of trust between stakeholders and implementing institutions. Programmes should be designed in such a way as to allow stakeholders to have a choice to either participate or not. To achieve this, a set of rules and procedures needs to be put in place.[18] These would stress, for instance, that interested stakeholders could join the programme as they see fit, though they would have to register before a cut-off limit based on either a date or a maximum number of participants within a set time period. Other rules would also be introduced, including the type of rewards to which participating stakeholders would be entitled. In addition, rules would be set on the type of compensation stakeholders would receive if the programme did not materialize within a predetermined time period or if a burden were imposed on participating stakeholders during the course of the programme, such as crops forgone during and immediately after the terracing of a plot. Such rules would spell out in detail the type of assistance that would be provided to the affected stakeholders over and above the normal compensation for his/her work. This is done, for instance, in the Highlands Project of Jordan, as participating stakeholders receive additional food and seeds for both putting land conservation structures on their farms and for compensating for time and income forgone while involved in the activities of the programme/project. The programme/project does not provide direct cash payments but instead pays in kind with products including wheat, oil, palm fruit, seeds and fertilizers. As part of the compensation package, the programme/project also provides assistance in other major works, such as the construction of water harvesting structures, with stakeholders contributing only their labour. These are the kind of incentives that provide for stakeholders either to participate or not participate in a programme.[19]

Programme reliability implies the assertion of certain rights, both legal and administrative. These include the right to provide support within a given time period, the provision of ad hoc support to compensate for the loss of income due to programme activities, the provision of agricultural or other inputs, the provision of daily work norms, and the adjustment of support because of price changes. Programmes would also have to be regulated by law in order to ensure political intermediation through the courts if required. If, for instance, local authorities abuse their power or are not doing enough to advance the agenda of the programme (such as regularly under- or overspending), they could be ordered by the court to tackle the problems more efficiently.[20]

Land degradation prevention programmes are usually long-term, which means that the full benefits can accrue over several years or decades after implementation. As such, these programmes have to be institutionalized and operate over broad geographical areas, such as a watershed, as their impact, both positive and negative, could accrue outside the original area. Moreover, since the knowledge of how to

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[17] S. Meyer, *Enhancing the Credibility of Voluntary Environmental Initiatives*; C. Alkire, *Emphasis on Conservation and Ecological Restoration*; M. Leach, R. Mearns, and I. Scoones, *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*; D. Mulvaney, *Review of Leach, Mearns and Scoones* "*Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*", 2003, http://envs.ucsc.edu/pewg/PE%20Environmental%20Entitlements.doc; and W.M.K. Trochim, Reliability, 2006, http://www.socialresearchmethods.net/kb/reliable.php.

[18] WCCIP, *Making a Plan for Program Stability*, Wisconsin Child Care Improvement Project, Inc. Available at: http://www.wccip.org/tips/business/program_stability.html.

[19] M. Leach, R. Mearns, and I. Scoones, *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*; Economic and Social Research Council (ESRC), *Environmental Entitlements: The Institutional Dynamics of Environmental Change*, paper presented at the International Policy and Research Workshop, Institute of Development Studies, University of Sussex, United Kingdom, 1997; and A. Fabra, *The Intersection of Human Rights and Environmental Issues: A Review of Institutional Developments at the International Level*, paper presented at the Joint UNEP-OHCHR Expert Seminar on Human Rights and the Environment, 14-16 January 2002, Geneva.

[20] R. Gaiha, and K. Imai, *A Review of the Employment Guarantee Scheme in India*, Inter-Regional Inequality Facility, Overseas Development Institute (ODI), Manchester, United Kingdom, 2005.

manage these kinds of programmes increases over time, there would be a need to invest in developing this knowledge so that it could ultimately increase the level of confidence and ensure continuity after the end of the programme. Care should also be taken to ensure that all the accumulated achievements and experiences would not be lost owing to the discontinuation of the programme as a result of unforeseen factors such as a change in political leadership. This is one other reason why programmes should be unambiguously embedded into the legislation.

The Highlands Project has been in operation for over 40 years. Under the programme/project, a large area has been covered with land degradation control infrastructures, and many stakeholders have been able to protect their lands, improve overall productivity and diversify their sources of income. All key stakeholders involved are satisfied with the performance of the programme/project, the 40 years of service renewal serving as a proof of this satisfaction. Over these years, stakeholders have received substantial benefits and provided various inputs and thereby have come to view the programme/project as part of their daily lives. This has allowed them to exhibit a certain degree of ownership in planning and implementing their farm improvement work. Currently, most stakeholders join the programme/project in anticipation of future benefits and achievements, particularly those related to the construction of land degradation prevention structures and those to harvest water. In surveys conducted by the programme/project, its stakeholders indicated that they rely heavily, almost 100 per cent, on the programme/project in their endeavours to improve their livelihood, land resources and productivity.[21]

Stakeholders believe in the credibility and reliability of the programme, and this has positively affected its overall performance. The contribution of all these factors—the existence of intermediation opportunities based on rights (formal entitlement), a permanent, uniform presence (programme stability) and the building of trust and expertise (credibility)—have all ensured a great mobilization that in turn has guaranteed the success and effectiveness of the programme.[22]

"Reliability is a measure of stability and entrenched entitlements."

B. Collective action and participatory approach

Programmes in rural areas would achieve better results if the overall influence of the intended beneficiaries could be increased in both the programme conception and implementation stages. This calls for the promotion of greater collective action.

"Programmes should endeavour to promote collective action and not discourage it."

The alleviation of land degradation depends not only on the motivation of individual stakeholders, but also on the action of the whole community, and this makes it more challenging. The alleviation of land degradation cannot succeed without the participation and collective action of all stakeholders mostly because (a) the degradation of resources spreads easily from one plot to the other and from one area to the other; and (b) attempting to alleviate land degradation in a localized area will be counterproductive if the whole landscape is not taken into consideration. As such, there is a need to adopt a coordinated approach so that most stakeholders are included in the programme and, most important, are provided with a choice to organize themselves. This is especially true as farming and rural development are at least partially collective businesses, meaning that rural dwellers usually tend to adopt similar resource management practices and to support each other by such means as labour sharing and marketing.

For maximum impact, programmes need to be designed and managed in such a way that they positively stimulate among intended recipients the collective action that is needed to make them more effective and, if not, at least not to discourage it. Programmes work better and are more successful if the concerned stakeholders are engaged in collective action, invest their own resources in collaborating with the

[21] Based on discussions with Engineer I. Sa'oub of the Technical Directorate, Ministry of Agriculture, Jordan.

[22] M. Leach, R. Mearns, and I. Scoones, *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*; and ESRC, *Environmental Entitlements: The Institutional Dynamics of Environmental Change*.

programme, and ensure that the collaboration takes place on equal terms or as partners. If stakeholders are expected to be fully involved in the implementation of the programme, then they, individually and collectively, need a concordant relationship both in terms of trust and extensive cooperation in the implementation of all aspects of the programme.

As such, stakeholders' committees would have to be established and strengthened. These committees would assist in identifying, selecting, designing and implementing relevant activities as appropriate. Good examples of this system exist in both the Agricultural Resources Management Project (ARMP) in the Al-Karak area and the Yarmouk Agricultural Resources Development Project in the Irbid area and also in other programmes/projects. These committees give special attention to women, who represent one of the main users of natural resources, and involve local officials as they have a better grasp of local specificities. By linking the programme/project activities to the community life and structure, stakeholders become much more involved and are in a position to harness additional funding and/or support to complement the activities of the programme/project. The programmes/projects in Jordan were able to mobilize stakeholders mainly because the general principles on which the programme/project were built upon provided opportunities for local organizations, leaders and politicians to have a say in overall implementation. Programmes have to give an opportunity to grassroots leaders and authorities to speak out and show their worth by seizing on the opportunities for intermediation created by the special operational rules and asserting their rights. However, farmers and other stakeholder organizations also have to play a role even if local officials would have the dominant role. Ensuring this will positively benefit the implementation of the programme and will reinforce its achievements. This was the case in the Al-Karak governorates, where the ARMP gave prominence to local leaders and associations, such as the Shokaira Association in the village of Jgera, to lead or be in charge of part of the work at the village level, including the organization of women, the selection of springs to be developed and the mobilization of villagers and others. This proved especially effective since the 7,000 people living in the village came from a few families, and they knew each other, thereby reducing the transaction costs and the temptation for "free rides".[23]

C. PROGRAMME REPLICATION OR TRANSFER

"A good and successful programme should lend itself to replication and/or transfer."

The process of replicating a successful programme requires a careful identification of the components of the programme to be transferred, then readapting them to fit into the new environment and, finally, careful implementation and management of the programme so that it can flourish. Several issues have to be resolved in order to accomplish this task successfully. The objectives and goals of the programme would have to be clearly spelled out so as to allow only the introduction of those adjustments required to facilitate its adaptation in the new environment; all others would have to stay in their original form. This, however, would not be necessary if the programme already has a built-in "adaptive capacity" that would allow it to evolve to fit into new environments or circumstances it might be exposed to without losing its major aim and/or intended outcome.[24]

Before the transfer, appropriate analyses would also have to be carried out to assess whether the programme would fit in the new environment, especially if this new environment is less stable.[25]

The successful replication of the programme will not solely rely on its design and/or policies that will be adopted but also on the team of administrators whose dedication will have to be comparable to those in the original programme. This is because the dedication of the administrators plays a substantial, if not prominent, role in the success of a programme. To make the transfer really successful, there would be a need

[23] Information collected through discussions with members of the Shokaira Association in the village of Jgera, Al-Karak Governorate, Jordan.

[24] REC, *Transferability*, The Regional Environmental Center for Central and Eastern Europe. http://www.rec.org/REC/programs/telematics/enwap/gp/transfer.html (last accessed April 2007).

[25] Ibid.

to embed the dedication of the previous team in the operational mode of the programme so as to avoid fundamental changes in management style. This is crucial as new places and new standards bring new problems, while in most cases the exact original conditions were not met anyway. Not all programmes are easily transferable and, as such, the aim would be to reach the next best alternative. A conservative aim would be to accomplish part of the programme at 100 per cent efficiency instead of trying to achieve 100 per cent of the programme at half the efficiency; in the end, success will be measured in terms of quality and not quantity.[26] Even when the dedication of the original administrators does not have much influence on programme achievement, location changing, in addition to scale and scope expansion, might lead to unforeseen circumstances, as will the new economic and cultural conditions. Thus, a one-size-fits-all approach will most probably not work here as differing backgrounds or socio-economic conditions will in most cases lead to differing responses. Expanding a programme into other locations will likely expose it to new negative forces such as inadequate administration or staffing and insufficient funding.

The following reviews two types of programmes that easily lend themselves to the replication process. In the first type of programme, emphasis is put on professional control, systematization and formalization, which require a rigorous environment and adherence to a given set of rules and procedures. The second type is a less structured programme, which gives great freedom to those implementing it in order to change or adapt it to fit in the given environment. This type of programme has been used in many parts of the world in various formats and circumstances.

1. *Systematized programmes*

These types of programmes offer effective, rigorous and detailed step-by-step procedures of how to implement them. These programmes are more relevant to highly structured and well-organized entities such as plants, laboratories, food or marketing chains, franchises and others in the same category. With appropriate modifications these programmes might also fit into other circumstances, including those concerned with land degradation and rural development. Even though this type involves programmes that can easily be replicated, several issues still have to be taken into consideration before programmes are transferred to or replicated in other locations. One of the major issues is the willingness of policy or decision makers to take the appropriate steps to mandate and, if necessary, to fund the transfer. This is not as easy as it looks, as it may not be possible to enact the required policies to change to a new mode of operation without being coercive. In addition, the lobbying of competing stakeholders could prove insurmountable, as their aim is to keep the level of funding at existing levels, especially when there are entrenched benefits that those stakeholders are unwilling to relinquish. Thus, before a programme is to be transferred, there has to be an assessment to confirm that there is a constituency advocating it and that it is politically attractive.[27]

> "These programmes emphasize systematization, formalization, consistency and/or methodical operation."

Another issue that would have to be taken into consideration would be that of cost-effectiveness. The new programme would have to be less expensive than existing ones, especially important if there is not much difference in performance compared with existing programmes. It could prove difficult to show that the new programme is or will be as effective as existing ones, especially among stakeholders who already have in mind the minimal type of service they need and who know the various facets of existing programmes. This would require the conducting of objective evaluations in order to identify the stakeholders who would most or least likely benefit from the programme. There would also be a need to know if all components of the programmes, which could be very complex in some cases, would be or would not be required in order to achieve success. A detailed evaluation of the programme might still not provide a meaningful answer to the above questions and, as such, most probably not all components of the programme would need to be replicated, especially if the cost is prohibitive. An inventory or listing of which component would not be required and which would be transferred or replicated would be useful to all involved parties.

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[26] Ibid.

[27] G. Ritzer, *The McDonaldization of Society - An Investigation into the Changing Character of Contemporary Social Life*, 1993, http://www.mcdonaldization.com/main.shtml (last accessed April 2007).

2. *Mentoring programmes*

> "These programmes are less formal but give more latitude to those involved."

Mentoring programmes are a form of tutoring in which stakeholders with similar characteristics (in this case, farmers) help each other to learn new techniques. There exist many variants to this system and both the participatory and the training and visit extension approaches are part of the system. The mentoring system consists of stakeholders who have received certain training or who have adopted a certain technique or technology, and who then tutor other stakeholders who are still at the exploration stage. All those involved usually live in the same community and differ only in that some have adopted the new technique/technology while others have not. Mentors may be volunteers, or it may be a requirement for participating in the programme. They may be paid a nominal fee for the work or nothing, but, most important, they must have all learned the technique/technology through the programme and become mentors themselves once they have mastered the technique and technology.

The mentoring system has had considerable success in various areas. It has been shown that in some rural low-income areas this approach has made a significant difference in improving productivity, and it has been used with success in environmental protection in some mountainous areas of Kenya. The system is easy to use and apply and is easily transferable to other areas and locations.[28] The mentoring system is likely to have positive outcomes because of the existing relationship between the parties involved, especially as the mentor is not a person of authority or a judge but someone who is like the mentee (person receiving the mentoring). The mentor is more likely to better understand the difficulty the mentee is going through in dealing with the new technique as he or she may have had a similar experience. As a result, he/she might be in a better position to address the issue in a language more familiar to the mentee.

The mentor also learns a great deal during the mentoring process, and it is even asserted that the mentor's gain in understanding is greater than that of the mentee. Attempting to communicate information to another, and to clarify ideas, sharpens and deepens the mentor's understanding of what is being advocated as, in general, those learning have fewer chances to rethink what has been learned in a different setting from that in which it was first heard. In addition, the mentoring system is said to contribute to a better overall climate in terms of building stronger relationships and common interests among those involved, as the mentor and mentee might have other common experiences to share. Thus, the whole system becomes more of a communal learning process as people become mentors and mentees in different fields or at different times. This kind of programme may then have a broader rather than a narrower effect.

D. POLICY ASPECTS

Programme credibility and reliability contribute to programme success and effectiveness and provide a check-and-balance mechanism as they induce collective action from stakeholders. However, making generalizations in such cases is risky as the large variations among programmes, and the potential contribution of stakeholders to the success of programmes in some cases, is ignored or downplayed by those delivering the service or administering the programme, whether public or private, governmental or non-governmental.[29] In particular, most programmes tend to put an emphasis on the issue of "participatory approach" or responsiveness to stakeholders' needs, but not all of those implementing the programme apply them in practice in order to avoid further scrutiny, and most programme implementers do not take into consideration the issue of credibility and reliability.

Policies should vigorously target the control and prevention of land degradation as a national priority. Among other things, the policies would have to encourage local initiatives through the involvement of stakeholders, local groups and institutions. This would require policymakers to ensure that national policies

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[28] J.N. Pretty, *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance*, 1995.

[29] J. Tendler, *Why are Social Funds so Popular*? Paper presented at the Expert Group Meeting on Social Funds and Poverty Reduction: Making Social Funds Work for Poor People, United Nations, Department of Economic and Social Affairs, 15-16 October 2003, New York.

in all public initiatives on land degradation assessment and prevention are predictable, credible and reliable in order to encourage stakeholders' involvement through collective action. Regular documentation and communication of such procedures or policy reviews could facilitate the replication of successful cases in other areas.

III. CASE STUDIES

A. CASE STUDY: EGYPT[30]

Egypt occupies an area of over 1 million square kilometres (km) characterized by an arid and hyperarid climate. The main agro ecological zones are the north coastal belts, including the north-west coastal area, the Nile Valley, which encompasses the fertile alluvial lands of Upper Egypt, the Delta and the reclaimed desert areas on the fringes of the Nile Valley, the inland Sinai and the Eastern Desert with its elevated southern areas, and finally the western desert, oases and southern remote areas. The population is concentrated along the Nile and within the Delta, where most of the country's agriculture is practised.[31]

1. *General setting and stakeholders*

The north-west coast of Egypt extends over 350 km, from west of Alexandria to the border of the Libyan Arab Jamahiriya, and is home to about 320,000 Bedouins whose livelihood depends largely on agriculture. The area has an arid climate with highly variable rainfall, ranging from 140-182 millimetres (mm)/year. The soils are generally shallow with an aridic soil moisture regime and hyperthermic temperature. Other limiting factors, notably for soil biomass production, include low soil moisture, high salinity and high phosphorus concentration, and low soil depth. Several areas are below sea level and are prone to subsidence. The presence of an impermeable layer obstructs the proper natural drainage, promotes secondary soil salinity and reduces soil productivity. With a Mediterranean climate, the coastal north-west Delta is characterized by a very short winter and a prolonged hot and dry summer. The average monthly temperature is 30.3 ˚C in August, while it is 6.3 ˚C in January. The annual rainfall is low at about 104 mm per annum while the relative humidity ranges between 59 and 81 per cent, with an average of about 69 per cent. In the summer, the northern winds from the Mediterranean Sea bring in moisture while between February and July the climate is dominated by the Khamsin winds blowing from the southern desert.[32]

The region of the north-west Delta lying west of the Nubariya Canal is among the most promising areas for development and has a total reclaimed area of 558,500 feddans, about 70 per cent of the area, which was previously an uninhabited desert. Overall productivity is still limited as a result of the low water-use efficiency and the lack of an efficient extension service to assist stakeholders. The area is experiencing rapid development accompanied by growing demand on both its surface and its groundwater resources.[33] Land management used to be regulated by traditional communities (tribes) or family interests, but it is now gradually being replaced by the private ownership of land. The area used to be characterized by extensive farming systems run by Bedouins which produced mainly subsistence winter crops together with figs and olives as well as raising small ruminants.

Recent efforts were aimed at greater agricultural intensification through mixed farming centred on horticultural crops.[34] However, the development of tourism in the area is pushing agriculture away from the coastal belt towards limited rainfall areas, which were traditionally devoted to grazing and barley production. This is resulting in increased pressure on the land owing to the lack of experience of stakeholders in

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[30] The case study on Egypt was extracted from an ESCWA consultancy report entitled "*Land Degradation Assessment and Prevention in the North West Delta Coast, Egypt*", 2007.

[31] R. Nicholls, M.H. Ahmed, and M. Yiehia, *Monitoring the Nile Delta: A Key Step in Adaptation to Long-Term Coastal Change*, 2nd International Conference on Earth Observation and Environmental Information, held in Cairo from 11 to 14 November 2000.

[32] F.H. Abdel-Kader, M.H. Bahnassy, and A. El-Menshawy, *GIS Analysis of Wadi El-Kasaba Watershed, Northwest Coast, Egypt*, 1998, Alex. J. Agric. Res Alex. (43): 303-321.

[33] A.S. Suliman, *Change Detection from Satellite Images in Nile Delta Coast, Egypt*, 2001, Alex. J. Agric. Res. (46): 177-188.

[34] S. Christiansen and others, *Private Rangeland Intensification in Egypt's Northwest Coast*, Sixth International Conference on the Development of Dry Lands, held in Cairo from 22 to 27 August 1999, *Desert and Dry Land Development: Challenges and Potential in the New Millennium* (Cairo, UNEP, ICARDA), pp. 275-280.

exploiting the new areas in a sustainable manner. On-farm training to better manage these desert soils being converted from rain-fed barley production and pastureland to intensively irrigated fodder crop production is still deficient. Moreover, agricultural development in the north-west Delta is hampered by land degradation, which takes the form of waterlogging, land contamination and salinization. The main causes of land degradation are the seepage of salty water and sewage into irrigation canals, inadequate drainage systems, inappropriate surface-flooding irrigation, and the use of low quality drainage water for irrigation.[35]

The density of the population in the area is very low, and estimated at only about one person per km^2, despite a doubling of the country's population since the 1960s. In addition, the population is unevenly distributed. About 48 per cent of the population live in the coastal zone, which covers less than 5 per cent of the total project's area; 41 per cent live in the middle zone, which covers more than 80 per cent of the total area, while the remaining 11 per cent of the population is located in the innermost zone, which represents less than 15 per cent of the area. The population is 53 per cent urban, more than half of whom are illiterate, particularly in rural areas. The two main categories of stakeholders are the Bedouins, who are mostly settled in rural areas, and the non-native people, who are mostly located in urban areas. The Bedouins, who are the most affected by land degradation, are involved in livestock production and the cultivation of barley and vegetables. Only a few have non-farm income sources such as commerce and public administration. Although the contribution of other sectors, particularly tourism, is increasing, agriculture remains the mainstay of the population of the area and as such the degradation of the resource base is directly affecting their livelihoods, particularly those of the Bedouins, thus increasing levels of poverty that are already among the highest in the country.

2. *Challenges*

The area of the north-west Delta is subject to different types of land degradation as a result of physical, chemical and biological processes.

Land degradation is due to the low natural resilience of the soil as well as various environmental and human pressures. The low soil fertility and weak structure are due to the overall characteristics of these soils, which are sandy and silty with low organic matter content. This makes these soils highly vulnerable to wind and water erosion. With the reclamation of the land, further deterioration of its quality is occurring as a result of misuse and mismanagement of land resources.[36] Productivity has been limited, in part, by high salinity levels and by the encroachment of urban settlements onto previously cultivated lands. The natural protection from coastal erosion and the formation of coastal lagoons were due to the high sand dunes. However, coastal erosion is being accelerated by the retreat of the shores resulting from the insufficient sediment load of the Nile River water discharged into the Mediterranean Sea.[37] In fact, the erosion rate of the shoreline of the north-west coast has increased in the past two decades and satellite images show that the areas already lost to the sea are in the thousands of feddans.

There are soil salinity problems, which are caused by the overexploitation of groundwater on the fringes of the north-west Delta; in addition, the prevailing soil resources and the physiography are of low quality, and there are inappropriate land management practices.[38] Waterlogging, and the mismanagement of irrigation coupled with restricted drainage conditions are leading to increased soil salinization and to soil

[35] A.A. Salam, E.H.A. Noufal, and H. Abdel-Azeez, *Monitoring irrigation canal and drainwater quality in the Egyptian Delta*, Sixth International Conference on the Development of Dry Lands, held in Cairo from 22 to 27 August 1999, *Desert and Dry Land Development: Challenges and Potential in the New Millennium* (Cairo, UNEP, ICARDA), pp. 210-214.

[36] M.A. Kishk, *Land degradation in the Nile Valley (Egypt)*, 1986, Ambio (15), 4: 26-230.

[37] A.S. Suliman, *Change Detection from Satellite Images in Nile Delta Coast, Egypt*, 2001, Alex. J. Agric. Res. (46): 177-188.

[38] F.H. Abdel-Kader, *Land Degradation and Conservation Measures in Egypt*, MEDCOAST LAND PROJECT, Workshop 1: *Ecosystem-based assessment of soil degradation to facilitate land users' and land owners' prompt action,* Adana. Turkey, 2-7 June 2003.

sodicity development.[39] Wind and water erosion are aggravating the problem and leading to a loss of plant cover and genetic resources. In the north-west coastal zone, the effect of tillage and inappropriate land use is leading to high annual soil losses (10.6 tons/ha), which are 93 per cent greater than losses occurring through wind erosion.[40] The use of pesticides and other agricultural chemicals is leading to the pollution of soils and to serious environmental hazards. For example, the use of chemical fertilizers increased fourfold in the past two decades, and the same holds true for herbicides, which are used to control submerged weeds and water hyacinths in canals and drains.

The expansion of irrigation into desert lands is increasing the pressure on the available and often non-renewable groundwater resources. The demand for water has been increased, due to the high population growth and to the development of irrigated agriculture, which has further aggravated the conflict for water. The overexploitation of groundwater resources is leading to an intrusion of seawater into coastal aquifers and this is causing deterioration of the quality of water, which is becoming more and more saline. Its use in irrigation further adds salts to the soil, and this is negatively affecting land productivity. The problem is more severe in the reclaimed areas of the north-west coast where groundwater is the main source of freshwater resources.

Over the upcoming decades, the coastal north-western part of the Delta is expected to be affected by climate change and a possible sea rise, the overall impact of which will largely depend on the degree of coastal alterations. An intensified use of land in the coastal region will inevitably be due to the continued growth of the population. The anticipated agricultural intensification and increased land reclamation, irrigation, urbanization and other activities that negatively affect the soil and water quality will amplify the negative impact that climate change and sea rise will have on the area.

Land degradation as a result of urban encroachment on the highly fertile agricultural land is one of the recent problems that have affected the agricultural sector of Egypt. Urban encroachment affected about 20,000 feddans of fertile lands in the north-west Gharbiya Governorate between 1992 and 1995, and this was attributed for the most part to the expansion of existing villages and towns.[41] There was also a surge in construction of summer resorts and villages in the coastal area. The available data show that urbanization in El-Mahalla El-Kobra in the Gharbiya Governorate increased at an annual rate of 10 per cent and 33 per cent, in the periods 1950-1987 and 1987-1995 respectively.[42] However, the overall average annual loss of agricultural land was about 0.4 per cent and 5 per cent in the first and second periods respectively. Similar data for Gharbiya Governorate showed that the urban annual growth rate in the period 1950-1987 was about 9 per cent, and doubled in the period 1987-1995. During the last 10 years, urbanization has removed almost 8,313 ha from agricultural production in the western desert, which is a 10 per cent increase in urban land use during the same period.[43] At the same time, the amount of cultivated lands in the regions increased by 43 per cent owing to land reclamation. The expansion of cultivated areas into rangelands and the cultivation of low productive land, prone to erosion, are causing a substantial loss in biodiversity and are reducing the grazing lands traditionally used by Bedouins. This is also affecting the total water balance and as a result might increase soil erosion. Serious, adverse and irreversible desertification processes are resulting from

[39] T.H.S. Kotb and others, *Soil salinization in the Nile Delta and related policy issues in Egypt*, 2000, Agricultural Water Management 43: 239-261; and A. Gad, A.G. Abdel-Samei, and M.A. Yehia, *Monitoring, assessment and combating desertification processes of irrigated lands in Egypt: Case reviews*, Second International Conference on Earth Observation and Environmental Information, Cairo, 11-14 November 2000.

[40] M.M. Wassif and others, *Wind erosion as related to some soil conservation practices in the Northwest Coastal Zone, Egypt*, Sixth International Conference on the Development of Dry Lands, Cairo, 22-27 August 1999, *Desert and Dry Land Development: Challenges and Potential in the New Millennium* (Cairo, UNEP, ICARDA), pp. 64-68.

[41] B.M. Khalil, S.T. Abdel-Gawad, and J.A. Millette, *Impact of controlled drainage on rice production, irrigation water requirement and soil salinity in Egypt*, Proceedings of the 8th International Drainage Symposium-Drainage VIII, 2004: 443-452.

[42] Ibid.

[43] M.P. Lenney, C.E. Woodcock, and J.B. Collins, The *Status of Agricultural Lands in Egypt: The Use of Multitemporal NDVI Features Derived from Landsat TM*, Remote Sens. Environ. 56:8-20 (1996).

scrapping the top soil layer for the manufacturing of bricks[44] since this layer contains organic matter and micro-organisms that favour soil fertility. This soil layer also contains the best-structured soil aggregates, containing pores that allow water to infiltrate, the oxygen to circulate and the root system to penetrate into the compacted deeper soil layers. The removal of this surface layer is reducing soil permeability and enhancing surface water run off, thereby further washing away soil nutrients.

3. *Programmes, activities and results*

In order to protect the resource base in the north-west Delta, the Government of Egypt, in collaboration with the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP), has set up the Fuka-Matrouh programme/project in the Fuka-Matrouh coastal area. The programme/project was initiated in 1993 with the overall aim of developing planning and management strategies for a sustainable development of Mediterranean coastal and marine resources, of promoting and supporting national coastal management initiatives and, as appropriate, building the needed institutional and human capacities.

The project area encompasses about 100 km of the coastline from Marsa Matrouh going eastwards to Fuka, and the coastal strip 10-20 km inland, characterized by white sandy beaches and crystal clear blue sea. The population density is very low (one person per km^2), the area has a semi-arid Mediterranean climate, characterized by a brief, mild, rainy winter and long warm summer months (May to September). The soil production in this area is very low, and water for irrigation is insufficient. Dense cultivation and pastures can only be found within a narrow coastal belt. Eighty per cent of the Bedouins are engaged in sheep and goat herding and the cultivation of vegetables and trees. About 15 per cent depend on trade as a source of living while the remaining 5 per cent work for the government or for private employers.

The basic problems identified in this area are:

(a) Uncontrolled development of tourism and exclusion of the local population as beneficiaries;

(b) Unsustainable use of coastal resources;

(c) Complex natural conditions, requiring appropriate agricultural policies, from which the native Bedouin population would benefit;

(d) Lack of protection of environmentally sensitive areas and of the cultural heritage;

(e) Absence of land-use planning and development control system, and of participatory approaches in development planning.

(a) *Predictability*

The predictability of the programme/project could be assessed through the building of trust with stakeholders, the expertise as reflected in the introduction of new concepts and strategies, the stability of the programme/project and the promotion of appropriate benefits to local communities. The programme/project proposed an innovative concept to create a development pole in the western coastal region.[45] Instead of favouring individual tourist resort programmes/projects, which may normally overlook the needs of the local population, the new concept advocated a comprehensive development of the region. The concept emphasized the rehabilitation of agricultural lands, including the restoration of rangeland, and the revitalization of rural communities (mostly Bedouin), taking advantage of their intimate knowledge of the local environment. Adopting such an approach helped to protect the area's natural and cultural heritage; as a result, agro-tourist complexes were built in coastal areas, and these were linked to local communities, which produced the fruits

[44] M. Hegazi, I.H. El Bagouri, and M.A. Kassas, *Arab Republic of Egypt, National Action Plan for Combating Desertification*, 2002, www.unccd.int.

[45] CAMP-PAP/RAC, *Coastal Management Programme. Fuka-Matrouh-Egypt*, Priority Actions Programme (PAP), Regional Activity Center (RAC), Egyptian Environmental Affairs Agency (EEAA), Final Integrated Report, Ministry of Cabinet Affairs, Egypt, 1998.

and vegetables the resorts needed, thereby promoting an integrated and sustainable development of the area, of its local Bedouin community, and protecting local natural resources. Mixing the grassland with perennial salt-tolerant plants and trees possessing deep and very deep rooting systems also helped sand stabilization and lowered the depth of the saline groundwater. This practice prevented salt rise and alleviated the soil salinity problem by improving the downward movement and leaching of accumulated salts.

Various water programmes that matched irrigation water supply with water demand by crops were tested and introduced. This has led, for example, to a shift in the cropping pattern from short-duration to long-duration rice varieties and this move has improved water savings by 25 per cent and led to an improvement in irrigation efficiency of up to 15 per cent. Additional water sources were sought in order to augment irrigation supplies. These included the reuse of water from intermediate drains and an improved management of urban wastewater. Research on improving the efficiency of water use is still ongoing even though it is faced with difficulties related to the transfer of technical know-how and the risk of mismanaging modern irrigation techniques at the farm level. However, these new techniques are needed as the current surface irrigation practices being used are leading to waterlogging and groundwater seepage into adjacent cultivated lands, thereby causing secondary soil salinity.

Significant efforts were exerted to reduce water use while increasing productivity, especially for the two high water-consuming crops, namely rice and sugar cane. The improved management and integrated production system increased the productivity of rice from 3.54 metric tons per feddan (mt/fd) in 1997 to 3.82 mt/fd in 2000, a gain of about 8 per cent. Rice productivity per unit of water applied rose by approximately 25 per cent, primarily owing to the adoption of short duration varieties and the reduction in water use. The yield of sugar cane under improved irrigation increased by about 25 per cent, from 4 to 7 mt/fd, while the water use was reduced by 15 to 20 per cent on most of the sugar cane pilot areas. Farmers have learned how to mix the freshwater from the Nile with drainage water in order to reduce soil salinity while improving its productivity. Land use and cropping patterns on the northern coast must be adapted to control the groundwater level and mitigate sea intrusion. Given the total available drainage water that can be involved in agriculture (8.5 billion cubic metres(bcm)/year), and the required balance to lower seawater intrusion and conserve the aquatic life in the northern lakes so that they can sustain fresh water fishing, there will be a need to reduce the area of rice cultivation by half.[46]

The borders of vegetation at different periods in the north-west coast were mapped, using satellite imageries and comparing them with the topographic maps of 1953 in which the vegetation cover was delineated.[47] The results showed that the reclaimed area totalled 620,055 acres for the 35-year period from 1953-1988. In addition, land use and land cover classification were carried out in the northern part of the Nile Delta using satellite images acquired in 1972, 1985 and 1988.[48] These images show a great improvement in soil productivity in the newly reclaimed and salt-affected soils. The analysis done between 1998 and 2000 showed that a 94 per cent improvement was achieved, and that there was a dramatic decrease in waterlogged areas owing to improved drainage and extensive reconstruction and rehabilitation works carried out.[49] A flexible land use change in the reclaimed lands to replace the high water-consuming summer sugar cane with the less water-demanding winter sugar beet and to shift from nomadic grazing to land cultivation in the Matrouh area should also produce positive changes.

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[46] R. Abdel-Azim and M.N. Allam, *Agricultural drainage water reuse in Egypt: Strategic issues and mitigation measures*, 2006, Options Méditerranéennes, Série B: Studies and Research, No, 53: 105-117, Proceedings of the 3rd WASAMED (Water Saving in Mediterranean Agriculture) (Non-Conventional Water Use) Workshop, Cairo, 7-10 December 2004, International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM).

[47] Sh.A. Sadek, *Use of Landsat Imagery for Monitoring Agricultural Expansion of East and West Nile Delta, Egypt*, 1993, Egypt. J. Soil. Sci. (33): 23-33.

[48] S.J. Abdel Rahman and Sh.A. Sadek, *The Application of Multispectral Remote Sensing to the Assessment and Evaluation of Soil Productivity in North Nile Delta, Egypt*, 1995, Egypt. J. Soil Sci. (35): 147-162.

[49] Alexandria University, *Land Resource Assessment of West Nubariya-Bustan Using RS/GIS technique*, Department of Soil and Water Science, Faculty of Agriculture, Alexandria University, Bustan Agricultural Development Project BADP. EC., 1998-2000.

Two main concerns face the sustainable development of the north-west coast. These are the efficient use of fresh water, and the effective use of groundwater, as excessive pumping is increasing salinity problems and causing a substantial drop in the water table[50]. An improvement in water use efficiency, which currently stands at 71 per cent only, has reduced the flow of drainage water and secured additional fresh water resources that could be used in the newly reclaimed lands on the Delta fringe. The introduction of modern irrigation techniques, new water use and management techniques, improved land productivity and reduced water loss has also contributed to an improvement in water use efficiency, particularly in the earthen canals.[51] Old water distribution structures have been renewed, and this has improved water conveyance efficiency by up to 98 per cent in the third level canals also known as Mesqas. Land levelling was introduced to improve on-farm water management practices to avoid waterlogging and water stress and to reduce run-off.[52] The new Mesqas secured land saving practices, substantially increased crop yields and reduced irrigation time and cost.

The improved Mesqas were also intended to reduce water seepage. However, even better results were achieved by adopting closed tubes in a pressurized system, which eliminates losses through seepage and evaporation. Modern irrigation systems are growing in popularity in the newly reclaimed areas as they have better water application efficiency which, if complemented by forecast units and appropriate decision support systems, should lead to even more efficient water operation and distribution systems. Nevertheless, there will be a need to implement institutional reforms and to involve water users in the decision-making and planning process.[53]

(b) *Collective action and participatory approach*

In order to alleviate poverty and to ensure a long-lasting impact of the programme/project, it is crucial to promote farmer and other stakeholders' participation. This was achieved through on-farm experiments and demonstration plots aimed at promoting the sustainable management and efficient use of irrigation water. Farmers' participation in improved irrigation management led to a 30 per cent crop yield increase owing to improved water availability and ensured capital cost recovery. Groundwater management associations were created in the western desert to advocate procedures to improve water management with the help of the extension services offered by agricultural cooperatives.

Efforts by the Government of Egypt to reduce poverty among Bedouins by providing them with better opportunities, notably additional income-generating activities, were successfully implemented by encouraging the shifting of the farming system from small ruminant livestock supplemented by rainfed winter crop production to a more intensified mixed farming centred on horticultural crops and irrigated cereals. A better extension service and appropriate institutional and technical support ensured the long-term success of policies. The promotion of capacity-building, enhancing the role of women and youth, and the adoption of a participatory approach that involved all stakeholders in the planning, initiation and implementation stages helped to alleviate poverty. A prelude to an integrated water management approach was the adoption of equitable water-sharing and efficient management systems regulating fresh water and the reuse of drain water. This participatory water management system could strengthen and enhance farmers' skills to adopt modern irrigation techniques and to utilize water-saving crops and practices. Furthermore, an institutional reform tightening the links of farmers to their old and newly reclaimed lands will contribute to

[50] A.Z. El-Bably, *Advanced and integrated approaches for crop tolerance to poor quality irrigation water in Egypt*, 7th International Meeting on Soils with Mediterranean Type of Climate, Bari, Italy, 2002, CIHEAM 363-378.

[51] M.N. Allam, *Participatory Irrigation Water Management in Egypt: Review and Analysis, 2004,* Options Méditerranéennes, Série B, No. 48: 123-131, Proceedings of the 1st WASAMED Workshop, Şanliurfa, Turkey, 15-19 December 2003, CIHEAM; and A.R. Shalby, F. El Gamal, and H. Ali, *Participatory Water Management In Egypt: Country Review*, 2004, Options Méditerranéennes, Série B, No. 48: 113-122, Proceedings of the 1st WASAMED Workshop, Şanliurfa, Turkey, 15-19 December 2003, CIHEAM.

[52] M.N. Allam, *Participatory Irrigation Water Management in Egypt: Review and Analysis*, 2004.

[53] B.M. Khalil, S.T. Abdel-Gawad, and J.A. Millette, *Impact of controlled drainage on rice production, irrigation water requirement and soil salinity in Egypt*, 2004.

the dissemination of indigenous farmer knowledge and encourage the sharing of experiences with regard to new techniques for coping with water shortages and drought.

(c) *Replicability and transferability*

The Fuka-Matrouh programme/project was aimed at the rehabilitation of degraded rangelands once used as pasturelands by expanding the area of irrigated fruit trees and feed crops. It was also aimed at transferring improved irrigation skills to local communities to ensure effective water use, especially under saline conditions. The programme/project has advocated the creation of a development pole in the western coastal region, as a solution to a comprehensive development of the area. The programme/project proposals include the following:

- Development of lands suitable for agriculture and restructuring of rangelands;
- Revitalization of rural, mostly Bedouin, communities;
- Diversification of tourism activities to foster increased employment opportunities;
- Protection of natural and cultural heritage.

In order to ensure a wider use of the programme/project results and methodologies applied, as well as to provide for improved coordination and integration of the decision-making process, the programme/project recommended:

- The integration of the programme/project results into the national coastal management process;
- The establishment of a National Committee for the Fuka-Matrouh programme/project;
- A number of proposals and measures for the follow-up of the programme/project.

The Fuka-Matrouh programme/project is part of a larger programme of the UNEP Priority Actions Programme (UNEP-PAP) in the area of integrated management of coastal areas. Other closely related programmes are being implemented in various countries of the Mediterranean region, and all share fairly similar goals and objectives to achieve sustainable development in coastal areas, within the constraints of physical, social and economic conditions and the legal, financial and administrative systems and institutions. Among these countries are Lebanon and the Syrian Arab Republic, as well as most of the Arab countries of North Africa. As such, the programme/project is readily replicable and/or transferable to other areas using the already proven and working methodology of UNEP-PAP.

B. CASE STUDY: JORDAN

For the case of Jordan, two programmes/projects, namely Al-Karak and Al-Yarmouk, have been reviewed. One of the common objectives of the two programmes/projects is to arrest land degradation and to optimize the long-term productive capacity of the land and water resources. In both programmes/projects, emphasis is put on a close partnership with and/or an active participation of beneficiaries. The contributory causes and potential means for reducing resource degradation are addressed through a comprehensive integrated approach to resource management, involving all the population living in the area and making use of the natural resources.

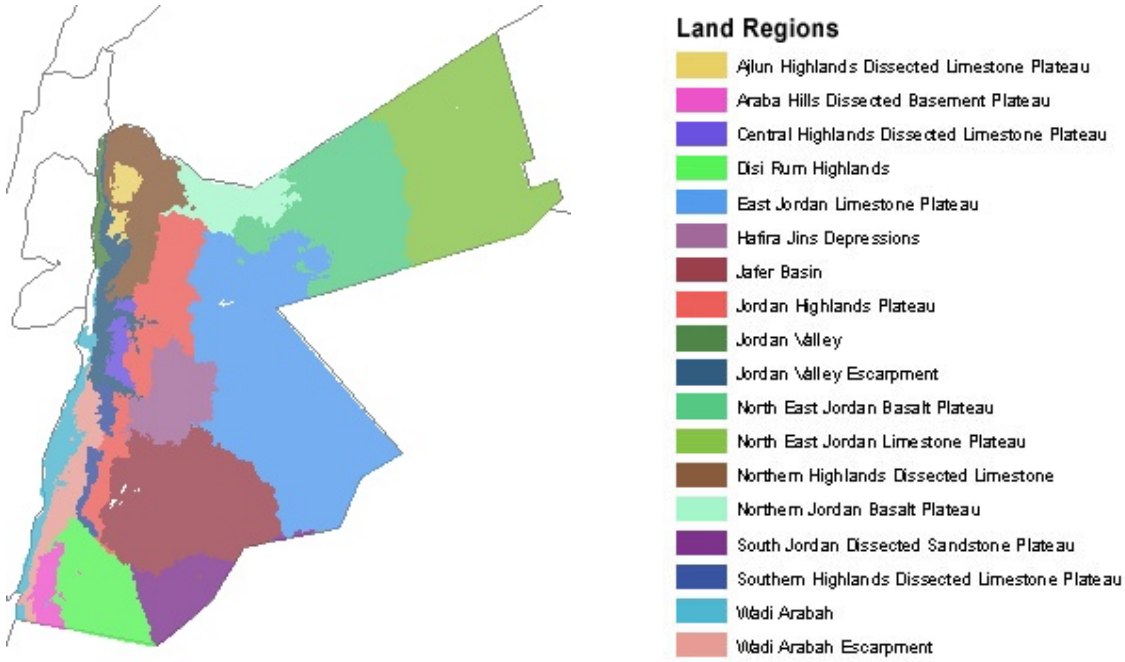
The average population growth in Jordan is about 3 per cent. The country has a high birth rate which, coupled with the high migration rate from neighbouring countries, has led to an increase of the population from about 3 million in the 1990s to about 6 million currently.[54] About 12 per cent of the population is thought to be below the government-defined poverty line; the reduction of poverty is therefore a top priority. Moreover, a relatively high population growth rate combined with a slow rise in GDP, means that poverty is likely to increase in the short term unless the underlying causes of this poverty are addressed. The poor are the disadvantaged, resource-poor farmers who have limited access to alternative sources of off-farm income. Few opportunities exist for diversification of farm enterprises owing to adverse physical circumstances, such

[54] United Nations, *World Population Prospects: The 2006 Revision* (Sales No. 07.XIII.3), available at: http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm.

as no access to a close water point or adverse soils or topographic conditions, in addition to restricted access to financial resources and unavailability of suitable land to justify long-term investments.

According to figures from the World Bank, Jordan has a relatively small economy of about $12.9 billion per annum and a per capita income of around $2,500 (Atlas method). The country has limited natural resources and is highly dependent on imports, particularly of oil and foodstuffs. Agriculture makes up about 2 per cent of Jordan's GDP but generates around 25 per cent of its exports, principally in the form of food, livestock and dairy products, eggs, fruits, nuts and vegetables. The agricultural sector provides a livelihood for 20 per cent of the population and employs about 7 per cent of the labour force. Even though the sector's contribution to the economy is low, it is important not only for the production of tradable goods but also for the strong up- and downstream linkages it generates, as a result of which an estimated 28 per cent of GDP is considered agriculture-dependent.[55] There is irrigated agriculture in the Jordan Valley, but most farming systems rely on rainfed agriculture, which is practised in semi-arid areas that receive only 200-350 mm of rainfall. Most farming systems include livestock production, with flocks usually grazing on semi-arid and arid rangelands and on crop residues or uncropped lands. Rainfed farming must cope with low to average precipitation that varies widely from one year to the other. Finding farming strategies that make maximum use of the available moisture and provide assurance of at least some production and income in a dry year is very important.[56]

Figure. Jordan land regions and soil types



Source: University of Arizona, *Jordan Soils and Land Management: Land Regions-Soil Types (*University of Arizona, United States, 2006, Arid Land Information Center [ALIC]), http://alic.arid.arizona.edu/jordansoils/land_regions.html (last accessed in April 2007).

[55] World Bank, *Key Development Data and Statistics* (Washington, D.C., 2005), http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html (last accessed April 2007); and World Bank, *World Development Indicators 2006*, http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20899413~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html (last accessed April 2007).

[56] D. Hughes and others, *Economic Analysis of the Long-Term Consequences of Farming Practices in the Barley Cropping Area of Jordan, in Agricultural Systems 47*, pp. 439-58, (United Kingdom, 1995, Elsevier Science Ltd).

Of Jordan's total area of 8.9 million ha, only 4.3 per cent, mainly in the highlands and the Jordan Valley, is cultivable. Jordan is one of the world's driest countries, with the lowest per capita availability of renewable water resources (150 m^3/capita in 2002). The scarcity of water is becoming a major constraint on growth and a threat to the agricultural sector, which suffers from an over-abstraction of groundwater resources, particularly in the highlands, and a flow of polluted wastewater to the Jordan Valley. Present water use in Jordan exceeds renewable freshwater resources by more than 20 per cent.[57]

1. *The Agricultural Resources Management Project - Al-Karak*

The programme/project is implemented as part of the Government of Jordan's strategy for the development of rainfed farming. One of its major objectives is to improve the income of vulnerable, resource-poor farmers while at the same time safeguarding and improving the productive potential of their natural resources and enhancing their return to labour. This is achieved through measures including the arresting of soil degradation and restoring of soil fertility, promoting the status of women, and strengthening the capacity of local staff of the Ministry of Agriculture in implementing those measures and meeting the needs of farmers. The programme/project objectives also include promoting community development and the efficient use and improved management of soil and water resources. As such, the programme/project provides technical and financial support for the following:

(a) Building soil and water conservation structures and improving agricultural production through the active participation of the beneficiaries;

(b) Promoting sustainable land and water management practices and environmental monitoring;

(c) Promoting rural microfinance for on and off-farm activities;

(d) Strengthening the capacity of the programme/project management unit and the agricultural directorates in the project area.

(a) *General setting and stakeholders*

The project area is located in the south-central highlands, which run in a north-south direction east of the Jordan Rift Valley. It covers an area of approximately 6,540 km^2 and covers the administrations of the Governorates of Karak and Tafila and part of the Ma'an Governorate. The project area is less physically endowed than areas in the north of the country.[58] Rural households in the project area are reportedly among the poorest in Jordan, and most farms are small and risk-averse, especially since rainfall is very uncertain. Agriculture remains the mainstay of the local economy.

The area is characterized by steep topography towards its western part, and then becomes gradually less steep at the top and, towards the east, forms a gentle flat plateau. Deep soils adjacent to barren steep slopes, and the presence of soil relics, characterize the whole area. The landscape, which is dominated by rounded-edge mountains, is an indication of a weathering process that happened under dry conditions. The soil has an accumulation of calcareous silt in its top layers, and this tends to favour the desertification process, particularly in arid conditions. The process can lead to the disappearance of plant species that are less resistant to arid conditions, and this in turn would leave the soil surface even more vulnerable to erosion by wind and water. Until the early 1990s, farmers were encouraged to increase crop production and livestock owners were encouraged to increase the size of their herds with little regard for water consumption. Consequently, and as in most areas of the country, water shortages increased while at the same time good

[57] International Fund for Agricultural Development (IFAD), *Report and Recommendation of the President to the Executive Board on a Proposed Financial Assistance to the Hashemite Kingdom of Jordan for the Agricultural Resource Management Project-Phase II*, Executive Board, 83rd session, Rome.

[58] Ibid. and IFAD, *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project, Interim Evaluation*, Report No. 1559-JO (Rome, 2004).

pastureland was being converted into cultivated land, thus subjecting the fragile soils to increased degradation.[59]

The area has a Mediterranean sub-humid to semi-arid type of climate with cool temperatures in winter and mild ones in summer. The rainfall is highly variable, with frequent scattered showers and thunderstorms; the annual rainfall can reach up to 600 mm in some areas but, in most cases, it is usually less than 200 mm. Thus water is a major limiting factor. A few dispersed forests are found, but the dominant vegetation is short grass with sporadic small shrubs. The area has poor vegetative cover regeneration, as observed through the interspersed plant cover. Attempts to regenerate this vegetative cover have proved difficult because of a lack of sufficient water. Owing to the sparse vegetative cover, the area is greatly affected by wind and water erosion. Erosion by water is the dominant form of degradation and is characterized by exposed rock surfaces adjacent to deep soils, thus suggesting that the eroded material did not accumulate far away. The flat topography, which dominates the plateau, favours strong wind activity and thus wind erosion, particularly during the period between April and May.[60]

The total population in the project area is estimated at about 258,000, with a household size ranging from five to seven members, living in about 120 villages of 100 to 2,000 households. The main socio-economic characteristics of the population in the area are as follows: (a) a large portion of the population (86 per cent) is non-resident on-farm; (b) about 50 per cent of the population depends on agriculture to varying degrees (10-80 per cent); and (c) the average family income is derived from salaries, wages and pensions (45 per cent), from agriculture (20 per cent), from livestock (12 per cent), and from the National Aid Fund (12 per cent), while income from other activities account for 11 per cent. The programme/project covers around 22,300 households or 134,000 inhabitants, representing 75 per cent of the population in the area covered; 13,500 of those households are small and medium farmers, 2,700 rural landless and 6,100 comprise other disadvantaged households. Women make up about 10 per cent of the small farmers category and, even though the percentage of women owning agricultural land is low, they receive much greater attention, as they constitute 70 per cent of the landless and 60 per cent of the disadvantaged groups. The estimated number of rural households living below the poverty line in the project area is estimated at about 7,000.[61]

(b) *Challenges*

The Al-Karak area is principally a highland plateau with, in most parts, flat upland plains with low and sparse grassland, and very sparse tree cover (less than 5 per cent).

Land degradation in the area is a result of various physical, chemical and biological processes. There are visible instances of sheet erosion, off-site sediment deposition, soil nutrient and fertility depletion, and loss of biological diversity. There is also evidence of rill erosion, high soil alkalinity, low organic matter in the soil and loss of land cover and biomass. The major driving forces and pressures of land degradation are the climatic variability and water insecurity. These are characterized by frequent drought, the erosive impact of the low rainfall and surface run-off, the increased distance to water supply and collection and the lack of streams. The above characterization of land degradation can be extrapolated to most of the Al-Karak area, as the plot seemed to represent the general physical aspect of the area.[62]

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[59] M.A. Settah Al-Jaloudy, *Country Pasture/Forage Resource Profiles: Jordan*, in *Grassland and Pasture Crops*, ed. J.M. Suttie and S.G. Reynolds (Rome, 2001, FAO); and A.Y. Taimeh, *Climatic and Agroecological Desertification in Jordan*.

[60] University of Arizona, *Jordan Soils and Land Management: Land Regions and Soil Types*, Arid Land Information Center (ALIC), University of Arizona, 2006; and T.G. Al-Zabet, *Integrated Agricultural and Water Management in the Jordan Valley, in Modern and Traditional Irrigation Technologies in the Eastern Mediterranean*, ed. O. Mehmet and H.A, Biçak, (Canada, 2002, IDRC); and D. Hughes and others, *Economic Analysis of the Long-Term Consequences of Farming Practices in the Barley Cropping Area of Jordan, in Agricultural Systems*, 1995.

[61] IFAD, *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project, Interim Evaluation*, Report No. 1559-JO (Rome, 2004).

[62] General Corporation for the Environment Protection, *The Hashemite Kingdom of Jordan National Report on the UNCCD Implementation*, 2002.

As noted above, the incidence of poverty in the project area is among the highest in Jordan. The project's agricultural area is characterized by mostly dry farming systems, under conditions of low rainfall and harsh topography, low levels of production and productivity, and small size of farms, with irregular and precarious agricultural income. The ratio of dependency on agriculture and the rate of contribution of agriculture to the local economy are good poverty indicators. When non-agricultural income is relatively high, it means that the household or the concerned village is benefiting from outside money transfers and it would thus be less disadvantaged or in a less precarious economic situation. A survey was conducted based on the above-mentioned indicators, and the findings showed that an average of 60 per cent of the households depend on agricultural activities to different degrees (from 10 to 80 per cent depending on the village). The ratio of dependency on agriculture income also varies from one Governorate to another, and was 50 per cent in the Al-Karak Governorate, 73 per cent in Tafila and 79 per cent in Ma'an.[63] Farming plays, and will continue to play, a significant role in sustaining the rural poor in the area. For this reason, improved agricultural practices could help to reduce poverty, arrest land degradation, restore soil fertility and improve water-use efficiency.

Most farmers are also livestock owners and their herds graze on low productive rangelands, on crop residues. The prevailing farming practices in the project area return very few nutrients and organic matter to the soil and provide little protection from the endemic wind erosion. Livestock grazing of virtually all crop residues is particularly problematic.[64]

(c) *Programmes, activities and results*

The ARMP financed by IFAD and the Government of Jordan, with the active participation and contribution of beneficiaries, is one of the main programmes aimed at combating resource degradation in the Al-Karak area. It was established in 1997 and is currently in its second phase, which started in 2006 for a 10-year period.[65]

(i) *Predictability*

In order to meet its objectives, the programme/project endeavours to promote credibility and reliability by building trust, using appropriate expertise and designs, ensuring stability and providing appropriate benefits to its stakeholders. As such, the programme/project promotes community development and the efficient use and improved management of soil and water resources. It provides technical and financial support aimed at (i) building soil and water conservation structures and improving agricultural production; (ii) promoting sustainable land and water management practices and environmental monitoring; and (iii) promoting rural microfinance to support on- and off-farm activities. It assists in planting trees, building cisterns and dams for water harvesting, enhancing animal husbandry, constructing stonewalls to collect water while stopping soil erosion, and planning for the area's land resource use and management. The programme/project also assists with the maintenance of springs and canals for irrigation, the improvement of the living conditions of all stakeholders, particularly women, through the provision of small loans to help to start small-scale processing units, such as milk processing, and supporting small animal husbandry units. Activities for agricultural development include planting trees (mainly olive), tree rehabilitation or

[63] IFAD, *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project, Interim Evaluation*; and B. Hattar, *Improvement of Agricultural Productivity in Arid and Semi-Arid Zones of Jordan (JAZPP Project), in Workshop Proceedings, Ecosystem-Based Assessment of Soil Degradation to Facilitate Land Users' and Land Owners' Prompt Actions*, Adana, Turkey, 2-7 June 2003, ed. P. Zdruli, P. Steduto, S. Kapur and E. Akça, Medcoastland Project, Bari, Italy.

[64] D. Hughes and others, *Economic Analysis of the Long-Term Consequences of Farming Practices in the Barley Cropping Area of Jordan,* 1995.

[65] IFAD, *Report and Recommendation of the President to the Executive Board on a Proposed Financial Assistance to the Hashemite Kingdom of Jordan for the Agricultural Resource Management Project-Phase II*. Executive Board, 83rd Session, Rome, 2004; and IFAD, *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project, Interim Evaluation*, Report No. 1559-JO, Rome, 2004.

rejuvenation, including deep pruning and supplying fertilizers and pesticides, and providing advice on improving agricultural practices.[66]

Special emphasis is put on protecting the soil and conserving water, and both on- and off-farm structures are being constructed in order to arrest land degradation and make water available all year round. The structures that are being built include stonewalls for wadi bank protection and dams, all of which control and protect against surface water run-off and decrease the impact of floods. To enhance water availability, the programme/project has built structures to store seasonal water, which can then be available for both domestic usage and supplementary irrigation. The structures include on-farm storage facilities, such as cisterns, but also off-farm structures such as reservoirs and mini-earth dams. Other works include the rehabilitation of wells, the protection of springs, the rehabilitation of irrigation systems, and assisting and training water users on the proper operation and maintenance of irrigation systems and on the efficient use of water. Sustainable land management was given prominence owing to the fragile environment of the area. Focus is also put on the enhancement of the policy- and decision-making processes and on the promotion of the concept of integrated land-use planning and mainstreaming of sustainable land management into the planning process.

The programme/project raises awareness of the negative impact of land degradation and desertification while at the same time showcasing the effectiveness of some of the mitigating measures that could be used to alleviate land degradation and desertification. It greatly expanded the area covered with soil conservation structures, including state and communal lands, as these must be part of a large scheme to protect against land degradation and to keep the integrity of the watershed. The programme/project introduces and develops the notion of environmental monitoring and has proposed ways to enhance the accompanying institutional support and capacity-building.

Some of the major achievements of the programme/project include:

- The construction of soil and water conservation measures on beneficiaries' lands, particularly on hilltops;
- The stimulation of an active participation and contribution of farmers to manage and conserve their own natural resources;
- The adoption of a community-based approach to resource conservation and management;
- The consolidation of fragmented landholdings whenever feasible and practical;
- The adoption of an integrated approach to resource management, whereby physical and biological conservation measures were taken into consideration in order to complement each other.

The programme/project's work in soil and water conservation has helped its target beneficiaries to protect at least 25 dunams (2.5 ha) of farmland. Farmers with more that 25 dunams were encouraged to apply for subsidized loans, which were provided in conjunction with other benefits related to agricultural development, such as orchard rehabilitation. On communal land used for grazing, the approach adopted was to construct erosion control structures and water harvesting structures in order to enhance the livestock carrying capacity.

Another major focus of the programme/project is the constructing of small reservoirs, also known as *hafira*.[67] These reservoirs retain run-off water and store it for later use. The beneficiaries do not contribute

[66] IFAD, *Report and Recommendation of the President to the Executive Board on a Proposed Financial Assistance to the Hashemite Kingdom of Jordan for the Agricultural Resource Management Project-Phase II; The Hashemite Kingdom of Jordan: Agricultural Resources Management Project-Interim Evaluation*; and *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project in the Governorates of Karak and Tafilat* (Rome, 2001), available at: http://www.ifad.org/evaluation/public_htm/ekyst/doc/agreement/pn/jo_329.htm.

[67] The *hafira* is built based on the demand from stakeholders, who also help to identify the most appropriate area where it could be built, so that it could benefit the largest number of farmers. A hafira is about 4-5 metres deep and could contain up to 3,500 cubic metres of water for a cost of about JD 30,000 for both the hafira and the dam, excluding maintenance.

to its cost, but they must ascertain that maintenance will be carried on without the assistance of the programme/project. Farmers rely on the *hafira* for about 50 per cent of their water needs, but in dry months the dependency rate reaches 100 per cent.

The other advantage of the *hafira* is that it has a positive impact on the surrounding environment. The *hafira* protects against soil erosion caused by run-off rainfall, and it protects the surrounding biodiversity and most notably the grassland, which fixes the soil against further erosion and land degradation. It also serves as an animal watering and grazing point. In the village of Jgera, Governorate of Al-Karak, a discussion with the beneficiaries showed that the whole village benefits from the rehabilitation of springs and the construction of the *hafira*, but they only contribute their own labour to the maintenance of the channels and the *hafira*. At the end of the programme/project, farmers are expecting to carry on the maintenance of these infrastructures themselves because it is in their best interest. Without the water they get from the springs and the *hafira* their community would not survive.

As a result of these improvements, the whole community has benefited from a more vibrant agricultural sector, from local processing of produce and value added, better access to financial services, and a more sustainable use of its natural resource base. About 5,350 households have benefited from the various soil and water conservation measures that were introduced. The spring protection and/or rehabilitation programme has also benefited about 1,000 households. The improved agricultural extension service is estimated to have reached about 22,300 households, while the provision of loans and support in the development of alternative income-generating activities has benefited more than 5,000 women and landless farmers. The benefits of the various investments in soil and water conservation measures have reduced, and will continue to reduce, the degradation of the fragile ecosystem in the project area while improving the vegetative cover, reducing run-off and soil loss, and improving soil fertility.

(ii) *Collective action and participatory approach*

The community-based participatory approach that was adopted by the programme/project was based on the principle that the communities themselves should elaborate and implement, in partnership with the programme/project, their village development programme. Thus communities are directly involved in all phases of the programme/project cycle and beneficiaries are jointly selected by community members and the Project Management Unit. Each community establishes its own criteria for identifying the poor and disadvantaged households. All project interventions in the targeted villages are planned and implemented on the basis of community demand, as reflected in Community Action Plans and Annual Work Plans. The programme/project is also implementing a capacity-building programme aimed at developing effective mechanisms to enhance the participation of stakeholders in the decision-making process as this could enhance their self-reliance and sense of ownership of project activities, and therefore the likelihood of sustained efforts after the end of the programme/project. Great prominence is given to the participation of women, as the programme/project is trying to enhance their role in order to allow them to integrate more fully into the community development process. Women's particular needs in areas such as literacy, on- and off-farm income-generating activities and credit are being addressed.[68]

(iii) *Replicability and transferability*

The programme/project is readily replicable and/or transferable as it uses a management style that is common to most development programme/projects, in which a project manager is assisted by a team of technicians and supported by a network of extension agents. The programme/project relies mostly on national experts and human resources available locally or within the country in order to achieve its aims. A replica of the same programme/project design has already been adopted in the Yarmouk area, as explained below.

[68] IFAD, *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project in the Governorates of Karak and Tafilat* (Rome, 2001), http://www.ifad.org/evaluation/public_htm/ekyst/doc/agreement/pn/jo_329.htm.

2. *Yarmouk Agricultural Resources Development Project - Irbid*

In order to alleviate the pressure on the rapidly degrading land resources in the Irbid area of Jordan while at the same time promoting rural development, the Yarmouk Agricultural Resource Development Project was launched in 1999 for a period of 10 years by the IFAD, the Arab Fund for Economic and Social Development (AFESD) and the Government of Jordan, with the active participation of the beneficiaries. The target beneficiaries comprise the whole population in the project area, but special attention is given to the poorest and most disadvantaged, including women and disabled people. The programme/project endeavours to enhance the income and quality of life of the population of the area, to put in place soil and water conservation measures, to protect and/or rehabilitate springs and to enhance the generation of alternative sources of employment and income, particularly for women and the most disadvantaged, through the development of small-scale rural businesses. As such the programme/project intends to improve the food security and income of target beneficiaries, to arrest the degradation of resources and to restore soil fertility, thus allowing for the sustainable use of the land and water resources of the area. To achieve the above goals, the programme/project provides technical and financial support to target beneficiaries to encourage them to implement soil and water conservation measures and improve agricultural production.

(a) *General setting and stakeholders*

The programme/project operates in the north-west corner of Jordan and covers an area of about 1,230 km^2 in the south-western part of the Yarmouk River Basin, at elevations ranging between 200 m below sea level and 1,150 m above sea level. The climate of the area is Mediterranean, with an average annual precipitation ranging between 200 and 500 mm and a rainy season extending from November to March. Mean temperatures range from 5-9 °C in winter to 22-29 °C in summer. The region is one of the main farming areas in north-western Jordan.

The soils of the area are rocky and they are a result of deposits. Most are of the dryland type (Aridisols), have a high clay content that crack in dry conditions (Vertisols) and are not well developed (Inceptisols). Climatic changes from past historic periods have lead to the development of unfavourable soil properties, which have accelerated the disappearance of many plant species and, coupled with the effect of drought and human practices, the complete destruction of the vegetative cover in some areas. The soil is highly alkaline with a low organic matter content estimated at about 1 per cent in the surface horizons.[69]

The project area has an estimated population of about 312,000 and a population density of 256 persons/km^2. The rural population makes up 26 per cent of the population, which is above the national average of 21 per cent. Poverty is prevalent in these northern highlands, where the majority of households are dependent on low-input farming, which generates limited output owing to the low and uncertain rainfall. Farming plays, and will continue to play, an important role in sustaining the rural poor.[70] The disadvantaged stakeholders in the project area are those with limited land resources who cannot afford to make long-term investments, and whose access to alternative sources of off-farm income is limited. The disadvantaged stakeholders also have few opportunities for diversification of farm enterprise owing to various physical constraints such as: (a) poor soils, a lack of water or location of land on steep slopes; (b) limited access to financial resources to invest in farming activities with high income-generating potential; (c) a household size of seven or more people; and (d) a high dependency rate owing to the large percentage of young and non-productive members (35 per cent below 15 years of age) in households. Women, who carry the dual responsibility of traditional household roles and farm production, have neither the time nor the means to

[69] S.A. Khresat, Z. Rawajfih, and M. Mohammad, "Land degradation in North-Western Jordan: Causes and Processes", Journal of Arid Environments (1998) 39: 623-629; M.A. Settah Al-Jaloudy, *Country Pasture/Forage Resource Profiles: Jordan,* in Grassland and Pasture Crops, ed. J.M. Suttie and S.G. Reynolds (Rome, 2001, FAO); and D. Hughes and others, *Economic Analysis of the Long-Term Consequences of Farming Practices in the Barley Cropping area of Jordan*, in Agricultural Systems 47 (1995).

[70] IFAD, *Report and Recommendation of the President to the Executive Board on a Proposed Loan to the Hashemite Kingdom of Jordan for the Yarmouk Agricultural Resources Development Project*, IFAD Executive Board, 66th Session, Rome, 28-29 April 1999.

access available support services. Furthermore, women who lack title to their land or solid collateral have limited chances of meeting the eligibility criteria to receive credit.[71]

Agriculture as practised in the project area results in low average yields, low moisture utilization efficiency, and high year-to-year variability in production and income. The use of yield-enhancing technologies is limited, and the general tendency is to use farming practices that return very little nutrients to the soil and provide little protection against both wind and water erosion. The feeding of all crop residues to livestock is an additional concern because it does not help to improve the organic content of the soils. The soil resources have been and continue to be depleted and degraded. The area has some vegetation to support grazing, but overgrazing is a major concern.

The shortage of labour is a problem in the project area as it is in most other agricultural areas of Jordan, primarily because many young labourers tend to move to cities where employment opportunities are usually better and wages are higher than in rural areas. The labour shortage is especially acute at harvest times when labour requirements are at their highest.

(b) *Challenges*

The hills near the city of Irbid (Governorate of Irbid) are characterized by steep slopes and sparse vegetative cover, including trees.

The area is characterized by intense water erosion, which is leading to the formation of rills and gullies,[72] and moderate wind erosion. There appears to be an intense chemical process as a result of the high alkalinity and pH of the soil, and there is a lack of adequate soil nutrients, in addition to fertility depletion observed through the soil colour and the differential crop and vegetative cover growth pattern. The soils of the area are also characterized by an intense biological degradation process, notably a loss of land cover and biomass, a loss of organic matter and a loss of biological diversity. The main driving forces and pressures include the climatic variability, the adverse landscape conditions, a decline in primary productivity (inadequate soil nutrients, mining and depletion), water insecurity, demographic changes (high population growth and rapid urbanization), insufficient water (lack of water streams as well as inadequate sewerage), and high animal population (causing soil compaction).

The high alkalinity of the soils in the project area means that they have a slow weathering and a slow soil development rate, and this is also a potential source of land degradation. Salinity is not a major problem in the area but the soils have carbonate accumulation. The calcareous nature of these soils causes problems in the availability of nutrients. The topographic and climatic characteristics of this highland region are such that rates of erosion are naturally high. The region as a whole is semi-arid to arid and is subject to recurrent droughts, which hinder the decomposition of organic residues, while the organic matter content of the soils is already low. The increase in silt content leads to unfavourable soil properties (structure and crusting) and eventually to unfavourable plant growth conditions, and hampers the growth of the vegetative cover. The water-holding capacity of the soils is thus reduced, and this further reduces the vegetative cover which, in turn, further weakens the overall structure of the soil. As a result, the soils are highly susceptible to wind and water erosion and thus to land degradation.

Current cultivation practices and the increased grazing pressures on the rangeland vegetation are adding to the risk of land degradation by accelerating the rate of soil loss. As a result, the already degraded soil and the limited water resources are being further degraded and/or depleted. Overgrazing is leading to the displacement of the native vegetation and its replacement with less palatable plants and sometimes poisonous ones. The heavy burden placed by livestock on the fragile soils is leaving the soil surface bare and compacted during much of the fallow period, which makes it more susceptible to wind and water erosion. This is one of the main causes of land degradation in the area. Between four and six tillage

[71] Ibid.

[72] This was also observed by S.A. Khresat, Z. Rawajfih, and M. Mohammad, *Land Degradation in North-Western Jordan: Causes and Processes*, in Journal of Arid Environments (1998) 39: 623-629.

operations are usually done during a fallow period of 16 to 18 months, and these tillage operations are performed using heavy disks and mouldboard ploughs which, combined with an up and down plough of the slopes, intensify the incidence of soil erosion.[73] Another impact of the use of the mouldboard ploughs is that they do not leave crop residues, which are needed to protect the soil against wind and water erosion, as compared with other machinery such as the chisel plough.

Additional causes of land degradation in the Yarmouk River basin area include improper farming practices such as the overexploitation of the land, the conversion of rangelands to croplands in marginal areas where rainfall is not enough to support long-term cropping, and an uncontrolled expansion of urban and rural settlements at the cost of agricultural land as a result of the high population growth and increased urbanization. This contributes to further degradation and desertification of the land, notably through the loss of arable land, and through contamination due to inadequate sewerage systems. The ecosystem is fragile and prone to rapid degradation, which leads to less vegetative cover and eventually to the loss of the fertile topsoil, thereby making the land incapable of supporting plant growth, as the soil becomes even more susceptible to further degradation.[74]

(c) *Programmes, activities and results*

(i) *Predictability*

The programme/project has gone to great length to become credible and reliable through trust, technical expertise, and stability and through the provision of various benefits to its stakeholders. In order to support poor farmers and landless people, particularly women the programme/project has provided technical and financial support including loans for on and off-farm activities, has improved agricultural production, and has promoted soil and water conservation. Support was provided to enable stakeholders to adopt or construct soil and water conservation measures. By helping to arrest land degradation and erosion and to restore soil fertility, the programme/project had a positive impact on the environment. Soil and water conservation efforts and better farm management practices have helped to reduce the degradation of the fragile ecosystem, restore the natural vegetative cover, reduce run-off and soil loss, and improve soil fertility and resistance to erosion.[75]

The programme/project has introduced various land conservation measures such as contour ploughing, terracing and stonewalls and their use on farmers' fields has helped to curb the accelerating erosion and to protect agricultural lands. All these measures have reduced surface water run-off by trapping it in order to increase the infiltration rate, which also favoured the development of the vegetative cover. About 80,000 dunams have been protected using contour stonewalls, earth banks, contour guidelines, stone tree basins and micro catchments, and through the building of cisterns or water wells to allow for the storage of rainwater for complementary irrigation, all of which reduced surface water run-off. On-farm water harvesting using underground cisterns has proved to be one of the most successful activities as it reduces surface water run-off while at the same time collecting and storing water, thereby enabling supplementary irrigation all year-round. Contour stonewalls have also proved effective in alleviating land degradation caused by water erosion.[76]

Off-farm work has included the construction of wadi-bank protection measures using gabion, and of mini-earth dams for water harvesting of seasonal rainfall run-off, as well as the protection and rehabilitation of springs to allow for complementary irrigation. So far about 3,000 dunams of arable land have been

[73] S.A. Khresat, Z. Rawajfih, and M. Mohammad, *Land degradation in North-Western Jordan: Causes and Processes*. In *Journal of Arid Environments* (1998) 39: 623-629.

[74] Ibid. and General Corporation for the Environment Protection, *The Hashemite Kingdom of Jordan National Report on the UNCCD Implementation*, 2002.

[75] IFAD, *Report on the International Fund for Agricultural Development Intervention Programmes to Combat Desertification and Rural Poverty in Affected Non-African Countries*, 2006.

[76] Ibid., *Harvesting Rainwater in Jordan*, in *Rural Poverty Portal*, 5 July 2006, Rome.

protected from floods through the construction of wadi-banks, and 10 cubic metres of dams have been built to store run-off rainfall and to protect against flooding and excess irrigation. These, in addition to the rehabilitation of springs and the building of water wells, have allowed the irrigation of about 3,500 dunams of farmland. The mini earth dams, small-scale water-harvesting structures and the rehabilitation and protection of springs are all being carried out in such a way to have minimal negative environmental side effects while improving water-use efficiency.

The programme/project relies as much as possible on practices and innovations that have no or little risks associated with them. Most technologies that are being advocated have been widely tested or are already used under field conditions in Jordan and elsewhere, and do not include sophisticated techniques or require advanced management skills that would be beyond the capacity of farmers to adopt.

In promoting the sustainable use of land and water resources over years, the programme/project has continuously improved the food security situation and the income level of its stakeholders.

(ii) *Collective action and participatory approach*

A key to success for the programme/project is the participation of all stakeholders, particularly women and resource-poor farmers, and their empowerment so they can fully take part in all soil and water conservation practices, and in spring protection and rehabilitation initiatives in order to enhance their productivity. To achieve this goal, the programme/project uses a participatory approach, whereby the beneficiaries are involved in all activities from planning to implementation. This participatory approach, in combination with well-targeted extension and support services including the provision of small loans, should lead to the long-term sustainability of efforts. Soil and water conservation initiatives have to follow a predetermined path, which should be based on a longer-term land-use planning effort prepared in collaboration with concerned communities. In the Yarmouk Project, user groups play an important role in setting the overall objectives and priorities. In order to support this effort, the programme/project only funds and/or implements those initiatives proposed by the community. The beneficiaries are thus encouraged to form user groups, to contribute to the cost, mostly in-kind, and to commit to carrying out future maintenance works. The programme/project puts special emphasis on women, as they play a major role as family caretakers and major economic agents in their communities. As such, a special unit was put in place in order to provide them with loans to finance small-scale income-generating activities such as livestock, poultry, bee or mushroom production as well as home garden development, and the establishment of small-scale food and milk-processing units.[77]

The programme/project has strengthened the capacity of local institutions and has enhanced the policy and regulatory frameworks, particularly those that govern the use of natural resources, with a view to promoting integrated land use planning and to mainstreaming the issue of sustainable land management into national planning. As such, the programme/project has strengthened the capacity of various agricultural and rural institutions, including the Ministry of Agriculture, and this has allowed these institutions to provide better technical support and extension services to their stakeholders. All these efforts have provided an incremental added value by enhancing the application of sustainable land management, irrigation and water resource management techniques; and by the development of an environmental monitoring system at national and local levels. The improvement of the dialogue among all concerned stakeholders so as to harmonize and prioritize policies and legislations, and the use of awareness-raising programmes to enhance sustainable land management, could also be part of the incremental added value.

(iii) *Replicability and transferability*

As in the previous case study, this programme/project is also fully and easily replicable and/or transferable to other geographic areas, as it relies on a common structural style and mostly makes use of locally generated techniques, expertise and experience.

[77] IDRC, *Jordan-Yarmouk Agricultural Resource Development Project* (n.d.), Karianet. Available at: http://www.idrc.ca/en/ev-97640-201-1-DO_TOPIC.htm (last accessed March 2007).

C. CASE STUDY: SYRIAN ARAB REPUBLIC[78]

The Syrian Arab Republic is divided into five climatic zones. The first zone is the coastal area, which covers about 15 per cent of the country and receives about 600 mm of annual rainfall. The second zone covers 13 per cent of the land and receives between 250 and 350 mm of rain annually, enough to sustain the growing of wheat, barley and summer crops. The third and fourth zones occupy 17 per cent of the territory, mostly in the south-east and north-east, and receive up to 250 mm of rain. These include marginal lands in which some grains, legumes and barley are grown. The fifth and last zone is the steppe, or Badia, which covers up to 55 per cent of the country, and which receives less than 200 mm of annual rainfall; it sustains some rainfed and irrigated farming. The land cover varies with the climate, soil type and human exploitation. As such, the country can be divided into five eco-vegetative zones: the high humid forests; the low humid or semi-humid forests; the arid or semi-arid steppe with trees; the arid steppe with bushes; and the very arid desert. The major part of the Syrian Arab Republic is covered by rangelands, while forests are in the coastal mountains and irrigated agriculture is practised along the Euphrates, Khabour and Orontes Rivers, thereby leaving rainfed agriculture in the northern and western parts of the country.[79]

1. *General setting and stakeholders*

The Badia area is characterized by dry and harsh climatic conditions and by limited natural resources, including water, soil and the vegetative cover. Water resources are scarce, and the rainfall is low and irregular. The region experiences frequent droughts. The degradation of the soil, of the vegetative cover (rangelands and forests) and of biodiversity, together with the harsh climatic conditions, human interference and sand encroachment, are leading to land degradation and to desertification and are decreasing agricultural productivity.[80] Desertification is a problem in the Syrian Arab Republic, and several programmes to overcome it are being implemented. The major causes of land degradation are, in addition to the climate: improper agro-practices such as improper irrigation methods, salinization, water and wind erosion, wood-cutting and overgrazing; inappropriate land use and urbanization. Land degradation is a serious threat affecting large areas and a high percentage of the population. Land degradation in the Syrian Arab Republic, as in many other countries of the region, is linked to agricultural activities and to the severity of the climate and the unsustainable exploitation of natural resources. Climate is the main natural cause of land degradation, and the main factors are droughts, wind erosion (especially in dry arid areas), and water erosion caused by torrential rains. Soil salinization is gaining in importance and is quite serious in several areas. In fact, salinization is the main cause of land degradation in several irrigated areas as a result of inappropriate practices.

TABLE 1. EXTENT OF HUMAN-INDUCED SOIL DEGRADATION IN THE SYRIAN ARAB REPUBLIC (*Thousands of hectares*)*

Type	Degree		
	Slight	Moderate	Severe
Water erosion	902	127	29
Wind erosion	1 210	380	30
Over blowing[a/]	11	267	130
Salinization	15	20	90
Total	2 138	794	297

Source: ACSAD, *State of desertification in the Arab world* (*updated study*) (Damascus, 2004, ACSAD, CAMRE, UNEP) (Arabic).

* Human excessive and faulty agro-practices lead to weakening of soil cover, structure and tenacity, making it prone to these types of land degradation.

a/ Over blowing-blowing in air, completely lost.

[78] The case study on the Syrian Arab Republic was extracted from an ESCWA Report entitled "*Land Degradation Assessment and Prevention in Jabal Bishri Area-Syria*", which was prepared by a consultant.

[79] Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD), *State of desertification in the Arab world (updated study)* (Damascus, 2004, ACSAD, CAMRE, UNEP) (Arabic).

[80] Ibid.

The area of interest for the present case study is the Jabal Bishri area, which is located in the north central area of the Syrian Arab Republic in a Badia region. It covers up to 5,000 km^2 and has elevations ranging from 350 m to 850 m above sea level, and an average annual rainfall of just 160 mm. It is a rural and poor area with low population density, more than 60 per cent of whom are nomads, the rest being barley farmers. The Bishri Mountains and their surroundings are a large part of the Syrian Steppe and are mostly a grazing area for the livestock of the nomadic population. The distribution of socio-economic activities depends on whether the land is used for rainfed agriculture, for grazing or is left barren. The activities determine the impact on the vegetation cycle, and hence the stability of the community. The population density and their demands and activities determine the pressures on the land. Of significance are the nomads, who are spread all over the area as assessed through their campsites.[81] Campsites and grazing follow nature-defined features such as wadis and other depressions that contain sufficient water for some vegetation to grow. In 1985, barley cultivation was encouraged, and this has greatly affected the land structure and has led to sand encroachment.

2. *Challenges*

There are major natural factors that make the Bishri Mountain area prone to land degradation and desertification. It is a semi-arid and arid region, also known as Badia, with only, as noted above, 160 mm average annual precipitation, which does not exceed 200 mm in most cases. The increase in drought frequency has meant more aridity, though it is also likely that the effects of global warming are playing a role in this increasing aridity,[82] as similar observations have been noted in neighbouring Jordan[83] and Lebanon[84] and in Egypt.[85]

The management of a nomadic steppe area characterized by the rapidly growing demands of an increasing population and more settlements is not easy. Soil properties and rainfall determine the potential of the land according to its type and the intensity of land use. Pressures on the land can be differentiated between immediate ones, such as cultivation, and more gradual ones, such as overgrazing and fuel-wood cutting. However, all of these social aspects contributed to a reduction of the vegetative cover and the destruction of soil properties. Dry farming is practised to a larger extent than previously anticipated, and most of the cultivation is taking place in the central Bishri area.

The area has witnessed a rapid growth in population since the 1940s, and this has meant increasing pressure on the fragile natural resources, water, green cover and soils which, in turn, has greatly contributed to the degradation of the land. Another stress was added when the government encouraged the cultivation of barley. The early successes of barley cultivation were helped by the exceptional rainfall that prevailed towards the end of the 1980s. However, the tillage of the fragile soil, which is mainly sandy and silty, using heavy machinery, destroyed the weak structure thereby making it more susceptible to wind and water erosion. The natural equilibrium was further weakened by the increased mobility of people as they became faster to react to droughts and water shortages. This has enabled them to stay longer than the capacity of

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[81] R. Geerken, *Combating Desertification in the Near East; Identification of Rehabilitation Measures and Impact Monitoring*, ACSAD Report (Damascus, 2001).

[82] ACSAD, *State of desertification in the Arab world (updated study*, 2004 (Arabic); H. Eswaran and P. Reich, *Impacts of land degradation in the Mediterranean region,* Bulgarian Journal of Agricultural Science, 5:14-23 (1999); and C. Giupponi and M. Shechter, *Climate Change in the Mediterranean: Socio-economic Perspectives of Impacts, Vulnerability and Adaptation* (United Kingdom, 2003, Edward Edgar Pub.).

[83] A. El-Hadid, and W. Sartawi, *Country Report: Jordan* (2005), in *Regional Workshop on Promoting LADA Programme in Western Asia and the Near East*, ACSAD, FAO, SESRTCIC, Damascus, 25-28 July 2004.

[84] M. Khawlie and others, *Status of Desertification Assessment and Contribution of Geomatics in Lebanon, National Report,* in *Workshop on Desertification Assessment & Monitoring System (Arab Countries),* ACSAD-GTZ, Damascus, April 2005; and M. Khawlie and others, *Monitoring land degradation, biodiversity and sustainable management in Lebanon*, in *Workshop on Status of Arabian Deserts and Their Prospects*, ACSAD, GTZ, UNEP/ROWA, FAO, Damascus, 14-16 May 2006 (Arabic).

[85] S.A. Mahmoud, *Country Report: Egypt* (2005) in *Regional Workshop on Promoting LADA Programme in Western Asia and the Near East*, ACSAD, FAO, SESRTCIC, Damascus, 25-28 July 2004.

these marginal zones would allow, thereby shortening the period for the rehabilitation of the vegetative cover and, as a result, further increasing the degradation process. The increasing number of animals and the expansion of barley cultivation into drylands led to heightened pressure on the fragile steppe lands, and this has led to serious environmental damage.[86]

The major types of land degradation are wind and water erosion. Human-induced degradation processes are overgrazing, improper agro-practices including tillage using heavy machinery,[87] and fuel-wood cutting. The scarce natural resources are being affected by the concentration of socio-economic activities, which are concentrated around wadis and depressions, which tend to be better watered. Land degradation severity is variable and ranges from slight to severe, though this variability would change from one year to another depending on the climate. In addition, the impact of land degradation varies, both in terms of how fast the deterioration takes place and how difficult and expensive it is to alleviate it. The mismanagement of natural resources caused by the various socio-economic pressures has led to increased degradation as well as to the loss of a high percentage of the plant cover, increased erosion and the salinization of cultivable soils. The extent of the degradation process is such that intervention has become a necessity.

The different types of land degradation relate to different phenomena and characteristics of the land, and/or interference by humans. The process of wind erosion leads to a scrapping of the soil surface, the deterioration of the vegetative cover, the depletion of its nutritive capacity and the destruction of its plant-holding ability. Deep or mechanized ploughing is a critical problem in the area, which, together with green-cover removal, leads to the stripping and exposure of more unprotected soil surfaces. The areas mostly affected are the elevated tops, exposed slopes, as well as those strips of plains or valleys improperly exploited. Wind speed in the area ranges between 16 m/s and 27 m/s all year long, which implies that the process of wind erosion is continuous throughout the year as only 5 m/s is needed to move sand particles. The area is witnessing increasing aridity with minimal precipitation and frequent droughts. The soil has a weak disaggregated structure with a coarse texture and is poor in organic content and subject to aridity. All this favours wind erosion and, in fact, the area is one of the major sources of sands that are blown away into the surrounding regions of the Syrian Arab Republic. Wind erosion increased tremendously after the introduction of cultivated agriculture, and the increase in human settlements.

Water erosion results from both torrential rain and unsustainable human practices. It is more apparent in dry periods when the land surface is cracked, and then a powerful flow of water comes scouring on the land surface, widening cracks into gullies and eroding the soil in a down-flow direction. Sloping surfaces and valleys are the most affected by this process, which is becoming increasingly serious as people exploit more those lands for agriculture and housing purposes, thereby making them even more susceptible to degradation. The process may contribute further to the accumulation of sediments downstream, which may increase silt build-up in artificial reservoirs and, in a worst case scenario, under arid conditions form salt plains, also known as *sabkha*. As it is an arid climate, rain is intermittent, erratic and often torrential. When torrential rain falls in large amounts during a very short time period and following a long dry interval, torrential flows or even floods tend to occur with a powerful erosive force. The already dissected slopes and valley floors are more susceptible to further erosion and gullying as their surface cover is very dry and easily removable. If nothing is blocking the path of the torrential flow, more land dissection and gully branching with soil erosion are observed and this turns the land into a barren scratched surface. Unfortunately, the geology of the area, which consists of Neogene and Paleogene calcareous deposits and gypsum, under the present climatic regime does not allow the formation of a good soil cover. This, in turn, together with the scarcity of water or soil moisture, does not favour the development of a good green cover. This means poor density, a loss in variety and an increase of deleterious desert types and species, which are indicative of the severity of the degradation process.

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[86] M. Aleiwi, *Monitoring and combating desertification in the Syrian and Jordanian Badiya* in *Workshop on Choosing Pilot Areas Affected by Desertification through Remote Sensing*, ACSAD, Amman, 22-27 May 2001 (Arabic); and R. Geerken, *Combating Desertification in the Near East, Identification of Rehabilitation Measures and Impact Monitoring*, ACSAD Report, Damascus, 2001.

[87] G. Abdelgawad and A.R. Loulou, *Combating desertification in rangeland, case study, Syrian steppe-Bishri area* (2006), ACSAD Report, Damascus; and ACSAD, *State of desertification in the Arab world (updated study)* (Arabic).

The area is rich in gypsum, which is a problem, as gypsum easily dissolves in water, thereby producing not only salty water, but also salt deposits and *sabkha* and thus chemical deterioration. Furthermore, the improper irrigation practices due to mismanagement and lack of awareness also contribute to chemical salt build-ups, adding to the deterioration process. The chaotic human expansion and resource exploitation has led to an increase in wood-cutting and clearing and an over-extraction of groundwater beyond renewal rate, and in grazing excessive amounts of cattle. All these have had a drastic effect on land degradation in the Bishri area. Irrigation, with its poor or inadequate drainage and improper use of water or cultivation practices, has led to high levels of soil salinization. Add to this the disorderly and excessive grazing and fuel-wood cutting, and the frequent droughts, all of which have meant serious resource degradation and/or depletion in soil, water and green cover.

3. *Programmes, activities and results*

Because of the significance of the Bishri Mountains and the impact of degradation on the rangelands, a programme/project to combat desertification was jointly implemented by various Syrian institutions, the German Agency for Technical Cooperation (Gesellschaft für Technische Zusammenarbeit or GTZ) and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). The programme/project, which was initiated in 1995 for a 10-year period, was aimed at analysing the prevailing desertification processes in this steppe area by monitoring, evaluating and implementing various measures to combat desertification. The Bishri Mountains were selected as representatives of degraded steppe areas, where measures to monitor and combat desertification could be tested and applied.

(a) *Predictability*

The programme/project's predictability was assessed through its technical expertise and stability. As part of the programme/project, several thematic maps were produced with a view to supporting environmental assessment. These maps have provided information on the area's climate, geology, geomorphology, soils, drainage, green cover and land use, with the goal of showing the negative impact of land degradation. A "change detection" map showing the overall evolution of the area was also produced, and it revealed that between 1985 and 1993 there was an expansion of about 90,000 ha in new area that was covered by sand deposits, while between 1993 and 1997, there was a reduction of about 75,000 ha in the area affected, as confirmed by the field surveys conducted as a follow-up to these image analyses. Another map characterized the intensity of grazing by comparing 1993 and 1994 images with those of earlier periods. During the analysis, efforts were made to try to take into account the reduction of the green cover caused by climate and human activities. The end analysis showed that the trend of greenness decreased significantly starting from 1989, but it was found that this reduction was a result of both the impact of overgrazing and of a significant reduction of the November/December rainfall, which has never since reached the rainfall levels of 1988; that year seems to have been the apex of the green cover.

Degraded species are mostly found where sands have accumulated. The accumulation of sands in fertile grazing areas has led to a deterioration of the soil, and grazing plant species are gradually replaced by more drought-resistant and degraded ones. Where the sand is deposited on gypsiferous, barren areas, the conditions will slightly improve and the vegetation will grow to support the spreading of some good species. The improvement of soil conditions will also depend on an increase of the organic matter and the availability of water. Despite the low nutrient value of the degraded species, there is a positive effect when they spread into barren lands, as it translates into an expansion of the vegetative cover and a stabilization of the soils.[88] There is no doubt that the agro-operations that were practised in the 1980s, barley cultivation of arid steppe areas, excessive grazing, fuel-wood cutting, disruption of the soil stability, improper settlements, ploughing and irrigation, led to an increased rate of degradation. Hence, the control imposed by the Government to stop the steppe cultivation in 1995 came as a highly needed and effective remedial measure. When comparing the satellite imagery covers of 1993 and 1997, it was found that the sands had receded from an area of 75,000 ha.[89] There was also an increase in the natural green cover, which has contributed to holding the upper layers of the soil in place.

[88] R. Geerken, C*ombating Desertification in the Near East, Identification of Rehabilitation Measures and Impact Monitoring*.

[89] M. Aleiwi, *Monitoring and combating desertification in the Syrian and Jordanian Badiya* (Arabic).

Restrictions had to be imposed on grazing, as the green cover density, especially fodder, and the density of cattle had to be balanced. This also required restricting the herds' movements and the time they could stay on the thinly covered watering points, as well as opening new roads to reduce the pressure of surrounding settlements and nomads on existing roads. The area was subdivided into different environmental zones, calcareous hills, gypsiferous hills, slopes, valleys, depressions, plains and others, to determine the major type of degradation and its extent in each zone. Attempts to arrest wind erosion took the form of plant wind barriers (mostly small trees), ribbon plantations of rangeland meadows grown perpendicularly to the wind direction or a chess-type plantation to fix the sands. The plants used in this rangeland area included Rubinia, Calligonum, Retama and Atriplex. As for water erosion, attempts to arrest it took the form of contour plantations in the hilly areas with channels to collect run-off water; plantations in crescent-shaped terraces on sloping lands; and growing various rangeland plants in drainage paths to reduce the speed of run-off water and hence its erosive power.

To rehabilitate the vegetative cover, thousands of rangeland seedlings, mostly of indigenous plants already well adapted to the area, were planted per year over 1,800 ha. The Ruta plant was used in 80 per cent of the cases while the remaining consisted of different types of Atriplex; this proved to be a good approach as the success rate was well over 90 per cent for the whole area. Concerning water harvesting, which is a crucial issue in the Bishri area because of the prevailing water scarcity and hydrogeological difficulties, a number of approaches were followed. One consisted in the construction of collection ponds or reservoirs. The small reservoirs (300 m^3 or less) were devoted to domestic uses, the medium ones (up to 5,000 m^3) were for livestock watering while the larger ones (10,000 m^3 or more) were used for irrigation. All reservoirs had flood control mechanisms that allowed the excess water to drain in the distribution system. As a result of the combination of the above measures, combating land degradation in the Bishri area has proved successful. The green cover improved from 13 per cent for bushes, 9 per cent for grass and 78 per cent for bare soil in 1995 to 30 per cent, 40 per cent and 30 per cent respectively in 2005. Similarly, diversity and productivity have increased as shown in the table below.

TABLE 2. INCREASE IN GREEN COVER IN THE BISHRI AREA, 1995-2005

	Types	Species	Genus	Vegetable productivity kg/ha	Rangeland productivity kg/ha	Rangeland capacity head/ha
1995	8	27	35	95	45	0.17
2005	17	90	121	929	464	1.7

Source: G. Kattash, "Impact of biodiversity in sustainable development of arid environments" submitted to the Workshop on Status of Arabian Deserts and Their Prospects, held in Damascus from 14 to 16 May 2006 (ACSAD, GTZ, UNEP/ROWA, FAO) (Arabic).

The improvement of rangelands is important as it contributes to the stabilization and improvement of the soil properties, a greater retention of water, and a habitat for wildlife and birds, as well as the protection of the biodiversity and the ecosystem. Satellite images from the area before and after the rehabilitation show a positive change in the green cover, which implies a better soil cover, more protection and better ground moisture. The enhanced cover promoted a healthier biodiversity and rangeland productivity. As a result of these rehabilitation measures, the plant density increased to a great extent. At the beginning of the programme/project in 1995, the plant density was 1.02 plant/m^2; by 2005 the plant density had increased to 101.5 plant/m^2. At the same time, the range shrubs density increased from 0.057 to 5.8 shrubs/trees/m^2 and the plant productivity increased eight times. In 1995 the dry material production was 90 kg/ha while in 2005 it had increased to about 748 kg/ha. This had a positive impact on grazing productivity, as it increased from 45 kg/ha in 1995 to 367 kg/ha in 2005, which in turn increased the grazing capacity from 0.35 head/ha in 1995 to 2.83 head/ha in 2005.

(b) *Collective action and participatory approach*

The success of land degradation control depends on the presence of a favourable framework including organizational, institutional, legal and political structures and processes that promote programme planning

and implementation.[90] Among the steps to achieve success in controlling land degradation was the analysis of the factors influencing institutional response capacity, and from there the derivation of recommendations for capacity-building and participatory modalities.[91] Several socio-economic studies and surveys were conducted in order to have a deeper understanding of the people's attitudes, concerns, capacities and knowledge base. Stakeholders were exposed to the effective results of the protective approaches that were implemented so as to showcase the value of land degradation control practices within norms that secure public welfare. There are numerous strategies that could be employed depending on the circumstances, area, stakeholders, and time; some require aggressive immediate actions, such as stopping barley cultivation, while others would require progressive action.

The Bishri programme/project gave due importance to social aspects and the attitude of the community in contributing to preventive approaches. Thus several surveys were carried out in order to assess the economic status, the knowledge base and the willingness of people to get involved. The main purpose of the participatory programme/project was to highlight the issue of land degradation as a potentially irreversible process that should be stopped. The participatory programme/project further encouraged local initiatives, promoted indigenous knowledge, and led to local contribution of future plans and activities to combat degradation. The surveys were conducted through interviews with local stakeholders, filling up information, and conducting training and object-oriented discussion meetings. The beneficiaries were satisfied with regard to the work that was done.[92] The characterization of pilot sites, in terms of agro-ecological and socio-economic aspects, was shared with other stakeholders who contributed to the spread of the technology. Awareness-raising with regard to the importance and means of combating land degradation through field visits, media programmes and incentives proved quite effective. The local community proved also valuable by helping in the analysis of appropriate policies and strategies to enhance the adoption of relevant methodologies and interventions. Issues such as property rights, land ownership, community behaviour and responses proved to be crucial in this regard. Any measure that would enhance the quality of living, as well as improve land productivity and family income, is always acceptable and viable.

Therefore, understanding the perceptions and strategies of households is a requirement. Studies were conducted to identify the prevailing problems faced by the community with regard to natural resources. They evaluated households' strategies for resource management, assessed the impact of technical assistance on those strategies, analysed households' economy, taking into account the gender dimension and ensured natural resource sustainability.[93] The Government is now paying more attention to the gender issue as women in rural areas play a major role both at the family and agricultural production levels. All institutes involved in income-generating activities should join their efforts to promote technology transfer in order to increase income through the introduction of new approaches.[94] In fact, all the procedures mentioned as remedial measures (on soil, plant cover and water) were meant to rehabilitate the rangeland, improve productivity and management, thus ultimately improving the income generation capacity of the community. It is obvious that promoting communication and the exchange of experiences to fight degradation will help the community improve its living conditions.[95] Hence, certain conditions for a participatory approach

[90] UNEP/PAP, *Guidelines for erosion and desertification control management, with particular reference to Mediterranean coastal area*, PAP/RAC, Split, Croatia, 2000.

[91] Coastal Land Degradation Monitoring (CoLD), *Improving coastal land degradation monitoring in Lebanon and Syria*, 2004, LIFE TCY/00/INT/00069/MED, CNRS, UNEP/PAP/ERS-RAC.

[92] A.R. Loulou, *Participatory approach in ACSAD's desertification combating projects,* in *Workshop proceedings, Determining an income-product generating approach for soil conservation management* (MEDCOASTLAND project), ed. P. Zdruli and G.T. Liuzzi , Morocco, 12-16 February 2004.

[93] A.R. Rafea and M.A. Martini, *Resource management: Perceptions and strategies of households in Bershaya village, El-Bab district, Syria*, in Proceedings of the Workshop on *Desert and Dryland Development: Challenges and Potential in the New Millennium* (Cairo, 2002, UNEP, ICARDA).

[94] I. Waad, *Summary of the Syrian efforts in enhancing productivity and profitability of the agricultural sector*, in *Workshop proceedings*, *Determining an income-product generating approach for soil conservation management* (MEDCOASTLAND project), ed. P. Zdruli and G.T. Liuzzi, Morocco, 12-16 February 2004.

[95] A.R. Loulou, *Participatory approach in ACSAD's desertification combating projects.*

become clear: they relate to the necessity of good communication, a clear prioritization of problematic areas, upgrading of relevant policies and legislation together, and capacity-building and transfer of technical know-how.

(c) *Replicability and transferability*

The Bishri Mountains programme/project was not a typical development programme/project usually seen in rural areas. It was more of a programme/project aimed at assessing how well land and other environmental degradation could be evaluated and what type of responses could be proposed in order to control and reverse the degradation process. As such, it lacked a few characteristics that make development programmes successful over the years. These characteristics included the lack of formal entitlements that could ensure the continued availability and participation of stakeholders in programme design, implementation and follow-up. The results of the programme/project make it worthwhile to conduct more studies, but some of them could readily be utilized in the design of programmes/projects to combat land degradation in the region.

D. CASE STUDY: UNITED ARAB EMIRATES

The United Arab Emirates covers an area of about 83,000 km² and has a hot and dry climate throughout much of the year, which ranges from hyper arid to arid, with the largest part of the country being classified as hyperacid or desert. The climate is semi-tropical, with long hot summers and temperatures that can reach 45° C, and a relative humidity of more than 90 per cent. The evaporation rate is more than 3,000 mm per annum, while rainfall is only 100-120 mm per annum, making water availability a major concern in the country. A large part of the Emirate of Ras Al-Khaimah is made up of sandy soils, with little organic matter content but with high levels of calcium carbonate (about 40 per cent). Agriculture in the Emirate of Ras Al-Khaimah, as in most other parts of the United Arab Emirates, is highly dependent on the availability of groundwater resources, which are pumped from wells or withdrawn through the *Aflaj* system, a network of subterranean channels that allow the water to flow to its intended place of utilization. Other sources of water include desalinated water and treated effluent, which are mainly available and used for domestic purposes and for the various cities' greening programmes.

Land suitable for agriculture in the United Arab Emirates represents about 2.4 per cent of the total area. The country has devoted a lot of resources to the development of the agricultural sector, and about a third of these resources were specifically aimed at improvements to make water more readily available and to establish modern irrigation networks. Following these investments, the cultivated area has increased by more than 100 per cent since the early 1990s.[96]

1. *General setting and stakeholders*

The Emirate of Ras Al-Khaimah is located in the north-east of the country and is bordered by a mountain ridge composed of limestone and a sandy desert consisting of sand dunes and sandy plains rich in minerals such as quartz, lime and limestone, particularly in the coastal areas. The land in Ras Al-Khaimah has no distinct layer of soil and is classified as sandy loam to loamy. The top layer contains gravel with a substantial amount of calcium carbonate and a pH of 8 or above. The soils are low in organic matter, nitrogen, phosphorus and most other micronutrients. For this reason, only a small portion of the land can be economically exploited for agricultural purposes and most of it is planted with permanent crops such as date palms. Owing to the high evapotranspiration rate, and the fall of the water table as a result of the high demand on the limited groundwater resources, salinity has become a major concern. The issues of land degradation and desertification are pervasive throughout the area and are major limiting factors for agricultural development.[97]

[96] Library of Congress, *Country Profile: United Arab Emirates, March 2006* (Washington, D.C., 2006, Federal Research Division).

[97] M.H. Al-Shamsi, *United Arab Emirates' Experience in Combating Desertification,* in *Desert and Dryland Development: Challenges and Potential in the New Millennium* (Aleppo, Syrian Arab Republic, 2000, ICARDA).

The Emirate of Ras El-Khaimah is subject to recurrent sand and dust storms, which add to the degradation process. The vegetation is limited owing to the harsh climate and is under continuous stress because of overgrazing and other human activities. Most of the vegetative cover is in the rangelands, which are mainly used for livestock grazing. Rangelands are an integral part of the heritage of the people of the Ras Al-Khaimah Emirate, and provide forage, green cover, livestock products, water and recreation.

If properly managed, the rangelands could provide a good protection against wind erosion and help to halt sand encroachment; they could be part of a strategy to arrest and reverse land degradation and the desertification process. The extreme environmental conditions of the area have exerted stringent selection pressures on local plants and other organisms and, as a result, they are uniquely adapted to withstand high temperatures, extreme drought and elevated levels of soil salinity.

2. *Challenges*

Land degradation is a major threat and is leading to the loss of the vegetative cover and biodiversity as well as causing soil erosion. Overgrazing and over-cultivation are cited as the main causes of land degradation in the Emirate of Ras Al-Khaimah while the harsh climate acts as an enhancer.[98]

The area is greatly affected by various physical processes of land degradation, the major ones being soil erosion by wind and the deposition of dust following this erosion. Other physical processes include a weak soil structure and a weak water-holding capacity, both of which are not conducive to the sustained and intensive exploitation of these lands. Salinity, alkalinity and depleted soil nutrients and/or fertility are the major chemical processes of land degradation in the area. Biological processes include the loss of land cover and biomass, the loss of organic matter and the loss of biological diversity, which are intense and affect the whole area. Among the driving forces and pressures of land degradation are the climate variability, as seen through the high average air temperature changes, the frequency of high velocity winds and high aridity. The adverse landscapes are exemplified through the weak soil structure and its lack of depth; the high depth of the water table; the limited plant diversity; the decline in primary production of the ecosystem; the recession of the land cover, causing an increased exposure to erosive forces; and the depletion of the soil organic matter and carbon.

Overgrazing, which sometimes attains extremely high proportions, is perceived as the main cause of vegetative degradation on rangelands. However, industrial activities, human settlements and recreation activities are in some instances taking over as leading causes, particularly near major urban centres. Drought, even when it occurs several years in a row, is not a major concern, as the vegetation of the area is well adapted to the prevailing harsh conditions. It has been shown that natural arid land ecosystems can withstand prolonged drought with virtually no damage, provided that human interference is light. The degradation of the vegetation is seldom triggered by drought alone and in most cases it can occur rapidly even under favourable climatic conditions.[99]

The rapid deterioration of the arid land ecosystem of Ras Al-Khaimah, as in most other parts of the United Arab Emirates and, at subregional level, in most other parts of the GCC countries, can be directly attributed to human induced factors. Land degradation in this dryland area translates into desertification or the development of desert-like landscapes, the generation of shifting sand dunes, and the crusting of bare soils. These are accompanied by increased sandstorms, flooding and sedimentation. The destruction of the vegetative cover is the main form of land degradation, while its regeneration proves difficult to achieve with the prevailing harsh conditions in Ras Al-Khaimah.

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[98] Ibid. G. Brown and others, *Coastal and Terrestrial Ecosystem Management Requirements in the GCC States: A Background Report*, Environmental Research and Wildlife Development Agency (ERWDA) Internal Report (Abu Dhabi, United Arab Emirates, 2003, ERWDA, Terrestrial Environmental Research Centre [TERC]); and United Nations Convention to Combat Desertification (UNCCD), *Summary of the Second United Arab Emirates National Report to the UNCCD*, 2002.

[99] G. Brown and others, *Coastal and Terrestrial Ecosystem Management Requirements in the GCC States: A Background Report*, 2003.

The rate of population growth in the United Arab Emirates is about 2 per cent per annum and the available agricultural land per capita is about 0.1 ha/person, meaning that the limited arable land is subject to intense pressure. The human pressure on land is especially noticeable near major urban centres and in areas where the land is relatively favourable for agricultural production in the Emirate of Ras Al-Khaimah. In these areas, part of the land is exploited nearly all year round, using increasing amount of salty water, fertilizers and pesticides, or overused as grazing rangeland. The other part is taken out of production in order to meet urban, transport and other economic developmental needs. The water available for irrigation is mostly saline while soil salinity is already hovering at high levels. The above pressures, combined with an increase in salinity levels resulting from the depletion of groundwater resources and the intrusion of seawater, are leading to the abandonment of farms, and the Emirate of Ras Al-Khaimah is particularly affected.[100]

The increased population and agricultural activity have also raised water demand. This has led to an overexploitation of groundwater resources, which has aggravated the salinization process and the increased destruction of plant and animal habitats. The proximate causes of land degradation and loss of biodiversity are overgrazing; the expansion of agriculture into marginal areas and rangelands to meet the increasing demand for food and fodder; and salinization due to the heavy abstraction of groundwater resources and poor irrigation practices. Of these, overgrazing is the most important factor.[101]

3. *Programmes, activities and results*

(a) *Programme predictability*

Below is a brief overview of a programme/project implemented by two research institutions (the International Center for Biosaline Agriculture and the Al-Hraniya Agricultural Research Station), a succinct review of the United Arab Emirates afforestation programme, and a brief description of an experiment to introduce a new technology to retain more water in the soil. Most of these are not linked to special development programmes and it is therefore difficult to identify essential elements, such as predictability or replicability. In its effort to combat land degradation, the United Arab Emirates has embarked on several programmes to improve agricultural productivity and resource management systems in line with the prevailing environmental conditions. These have included a programme/project that was developed in collaboration with the International Center for Biosaline Agriculture (ICBA) and the Al-Hraniya Agricultural Research Station (HARS) in Ras Al-Khaimah. The programme/project, which was implemented in the early 2000s, was aimed at demonstrating and disseminating the most appropriate crop and management techniques that could be used in salt-affected areas such as those prevailing in the Emirate of Ras Al Khaimah. In these areas, the groundwater is generally of poor quality and in most cases is also a source of salinity. Thus conventional crops cannot be grown, as good water quality is in short supply. The adoption of biosaline agriculture was the best alternative, as it is a farming system specially adapted to salt-affected areas, which advocates the use of the latest practices and technologies in crop production, including irrigation technologies such as drip irrigation, the use of raised beds, and the use of specially selected plant and crop species. The combination of raised beds and the drip irrigation system has been shown to favour the leaching of salts from the root-zone, and this allowed the plants to grow in a healthier environment.

The programme/project disseminated plant species that could thrive in saline environments, introduced appropriate practices that would allow the use of low quality (saline) water, monitored soil salinity and identified the most appropriate accompanying practices for soil management. Several crop species that are adapted and productive in saline environments were proposed to farmers. These have included new date palm cultivars and other plants species that improve soil properties. The programme/project has also installed accompanying irrigation and drainage systems. A number of new crop genotypes, especially of barley, were introduced and planted alongside local species and other foreign plants such as buffel grass (*Cenchrus*

[100] UNEP, *Global Environment Outlook-1 (*1997). Available at: http://www.grida.no/geo1/.

[101] Gulf Research Center (GRC) and The Energy Resources Institute (TERI), *Green Gulf Report: Executive Summary* (Dubai, United Arab Emirates, 2006, GRC and TERI); Ibid., *Green Gulf Preliminary Report*, chap. 2, "Land and terrestrial biodiversity" (Dubai, United Arab Emirates, 2006).

ciliaris). The overall results have been improvements, not just in terms of productivity but also in combating and reversing land degradation, and farmers have appreciated the growth of these plants and learned new management techniques for irrigating cereals using saline water.[102]

The United Arab Emirates is doing its utmost to conserve its resource base.[103] The country has made this objective one of its development pillars, and so far has made great strides in that direction. Among the measures that have been implemented to address land degradation, desertification and the problem of biodiversity loss are the formulation of national action plans and strategies to combat desertification, the establishment of protected areas and the reintroduction of local and already well adapted species, which were on the brink of extinction. Over the last few decades, an intensive programme of afforestation has led to the plantation of over 120 million trees and 25 million date palms. Many are in urban centres, but the great majority are out in the desert where recreation activities and biodiversity are being favoured, just to cite a few benefits.[104]

One of the largest newly planted forests covers an area of about 20,000 hectares and, overall, over 92,000 hectares have been planted with forest trees. Several kinds of arid region plants, both local and imported, have been successfully tested and then planted. As they grow to maturity, their roots are reaching underground water supplies, thus allowing them to survive without as much care and attention as they used to require at the beginning. These newly established green areas are now helping to reverse the process of desertification in areas at risk, to stabilize sand dunes, and to provide a habitat for the wildlife.

In addition, a new technology that could help in the alleviation of land degradation and desertification is being tested in the Emirate of Ras al-Khaimah in collaboration with partners from Japan. The technology consists of laying below ground a special textile called Moisture Absorbent Textile (MAT), which is coated with water-absorbent resins that allow the textile to absorb a great quantity of water and to release it gradually, thereby becoming a permanent source of moisture for the surrounding area and reducing the quantity of water needed to keep the moisture at the same level. In areas where the MAT technology is being used, the vegetation is thicker and healthier than in areas where that technology was not used. Much larger areas could then be planted using a limited quantity of water. These MATs could become a major technological breakthrough as tests being conducted on growing crops using them are showing highly promising results.[105]

(b) *Collective action and participatory approach*

The government encourages farmers to sustain their farming through the provision of incentives such as well-drilling equipment, loans, fertilizers, seeds, and other farming equipment at below market rates or through assistance in carrying out the initial work such as levelling and cultivating the land. The above, in addition to the establishment of large farms on desert soils, is seen as a way to further the programme to "green the desert". The development of integrated land-use planning, the adoption of improved range management and irrigation practices, and the strengthening of flora and fauna conservation with the active participation of local communities have all been beneficial to the environment and concerned stakeholders, and have allowed the country to greatly improve the overall living conditions of concerned communities.[106]

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[102] International Center for Biosaline Agriculture (ICBA), *Biosalinity News*, Newsletter of the International Center for Biosaline Agriculture. vol. 5, No. 1 (2004). Dubai, United Arab Emirates; and M.H. Al-Shamsi, *United Arab Emirates' Experience in Combating Desertification* in *Desert and Dryland Development: Challenges and Potential in the New Millennium,* 2000.

[103] M.H. Al-Shamsi, *United Arab Emirates' Experience in Combating Desertification*.

[104] Environment Agency, *Greening the Desert*, in *UAE Interact*, UAE Environment News, Abu Dhabi, 2006.

[105] Kippo News, *Kansai in Focus: Fukui Prefecture Shows 'Green Thumb' in UAE Desert Project* (1996), vol. 3, No. 92, Fukui, Japan.

[106] Gulf Research Center (GRC) and The Energy Resources Institute (TERI), *Green Gulf Report: Executive Summary* and *Green Gulf Preliminary Report*, chap. 2, "Land and terrestrial biodiversity", 2006.

(c) *Programme replicability and transferability*

As noted above, the programmes/projects described (the joint project by ICBA and HARS, the United Arab Emirates afforestation programme and the experiment to introduce a new technology to retain more water in the soil) were small-scale and research-type projects. However, they have produced good results, which could be applied to other similar environments. Moreover, the programmes/projects could be built upon in efforts to identify innovative techniques and technologies that could be used in programmes/projects to combat and reverse land degradation and the desertification process.

IV. LESSONS LEARNED AND RECOMMENDATIONS

The sustainable exploitation of land resources is possible in the region and it can also be economically viable, environmentally sound and socially acceptable. However, it would need to be well planned and well coordinated and encouraged at local, national and regional levels. Without appropriate policy support, successful programmes and activities will remain at best localized in extent and at worst lost. Thus governments could and should take the lead in better managing the land and related resources of the region. However, issues pertaining to the conservation of resources and defining successful programmes are always debatable. Stakeholders tend to have different perspectives and perceptions on the type of problems to deal with and on what constitutes a successful programme. It is important to focus on sharing these perspectives and insights. What has been examined in this report should not, therefore, be seen as a set of practices or conditions fixed in time and space. Rather, the practices reviewed imply a need or capacity to adapt and change as external and internal conditions change.

A. PROCESS OF IDENTIFYING SUCCESSFUL PROGRAMMES

In order to better understand how to design and implement successful programmes, particularly those aimed at combating and preventing land degradation, one needs to analyse critically those programmes that were successful and the context in which they have evolved. One also needs to go beyond a mere scrutiny of successful programmes and to analyse unsuccessful programmes too. Lessons learned from the shortcomings of unsuccessful programmes and the factors that led to their failure, or that transformed them into failed initiatives, will enable planners to design and implement more successful programmes.

Many programmes are being implemented around the world. Some are well documented and have been closely studied and monitored, while others have not been given the attention they deserve, especially the less formal programmes and practices. These include all the traditional practices that have helped stakeholders at grassroots level make sustainable use of the same piece of land over several generations and/or centuries. The continued successful exploitation of olive groves since the Roman era in various parts of Jordan and the continued utilization of ancient terraces in Lebanon are good examples. More attention should be devoted to analysing the factors leading to such success. The leading factors determining the success of these programmes and practices need to be documented so that they can be used as guides in the design of wider national and regional initiatives.

B. REPLICATION AND TRANSFER OF PROGRAMMES

The proper implementation and management of a programme is very important. In designing programmes, there is a need to encourage good management and to allow flexibility within preset limits. This goes hand in hand with the conducting of frequent monitoring and assessments in order to identify impending problems ahead of time. Such monitoring can provide a way to improve the programmes effectively. There is a need to promote a more collaborative relationship between programme managers and programme monitors and evaluators. Successful programmes tend to emphasize the importance of comprehensiveness and integration and an intervention may therefore have to encourage a variety of relationships among its various stakeholders in order to be effective.

An excellent programme does not stand alone and, as such, cannot be implemented successfully in its original form in a new location and/or under new circumstances. Changing location and circumstances will affect the implementation and the programme, if only because of the new management and differing interlinkages and expectations. A less-than-successful programme can be changed into an effective one with a dedicated management or enthusiastic stakeholders, but the reverse is also true: a highly successful programme can lose its effectiveness because of poor management, unsustainable funding or uninterested stakeholders.

C. STAKEHOLDERS AND COMMUNITY PARTICIPATION

Success requires the active participation of the beneficiaries in all aspects of programme planning and implementation. This implies the adoption of a participatory approach whereby technical staff are

encouraged and trained to work closely with farmers and to build mutual trust and confidence. The community-based participatory approach, which was adopted by most of the programmes/projects reviewed above, used the principle that communities should participate in the elaboration and implementation of the various activities of the programme. Communities should be called upon both in the planning and implementation stages, including selecting beneficiaries or new locations or identifying new areas of work. All programme interventions at local level would have to be planned and implemented on the basis of community demand. This could be accomplished through existing community institutions such as cooperatives or other associations, provided that these are dynamic; if no community institution is available, then an ad hoc village development committee could take on the work. With this system, it would be possible to give prominence to the most disadvantaged groups, such as women, by involving them in the decision-making process at community level and by prioritizing their development concerns and aspirations starting from the planning stage. In addition to their involvement in decision-making, programme beneficiaries should also be requested to contribute, preferably in kind, for instance with labour, so as to instil a greater sense of ownership.

One needs to recognize the existing and potential capacity of those whom the programmes are seeking to help. Understanding the concerns of beneficiaries and building on their strengths should be the only way to ensure the effectiveness of programmes. Thus, care should be taken to involve closely the target population, preferably from the beginning. Support for and effectiveness of programmes are largely based on the quality of the relationship that would be developed with and among all those holding a stake in the programme: users/beneficiaries, staff, administrators, local leadership, donors and policy makers. A successful programme should lead to strong involvement and participation of stakeholders, and utilize management practices and operating procedures that are not only highly productive and efficient but also well adapted to local conditions and circumstances.

Most of the time policy makers and programme managers are not convinced that a participatory approach is either cost-effective or the most appropriate route. However, various successful programmes point to the fact that more could be achieved by encouraging the adoption of a participatory approach. A strategic approach to encourage community participation needs to be adopted. An institutional strengthening and enhancement would be required and would have to be incorporated from the programme planning stage. It should include technical training for both the beneficiaries and administrative and technical staff so as to facilitate the introduction and adoption of the participatory approach.

D. PROMOTION OF MENTORING PROGRAMMES AND LINKING SUPPORT TO ADOPTION OF RESOURCE-CONSERVING PRACTICES

Beneficiaries learn most from each other and so beneficiary-to-beneficiary extension, visits, mentoring and training should be encouraged. The programme could be set up in several ways but, in general, it should bring together interested parties so as to facilitate the exchange and dissemination of information and experiences. This could be in the form of visit training, in which interested beneficiaries would be brought to the site of a successful or innovative practice to observe and discuss relevant issues with them. The discussions and observations would stimulate the beneficiaries to try the new practice. The role of the programme staff would be to facilitate these visits and provide overall guidance during the various discussions and observations while the mentor beneficiary would deal with the details of what has been accomplished and how, when and where.

Efforts need to be made to avoid imposing the new practices on interested beneficiaries. Rather, those willing to adopt new practices would receive the required help and additional support on other initiatives, such as agricultural, livestock and small-business development. One option would be to link all support to the beneficiary's adoption of the new techniques, practices or technologies.

E. AVOIDING OVERLY AMBITIOUS PROGRAMMES

The implementation of ambitious programmes is difficult in terms of management, coordination and costing. The achievements are too scattered to have an impact in areas that were not reached by the programme. Efforts should therefore be devoted to concentrate activities in well-delineated areas so as to

improve the visibility of their impact. Successful programmes would slowly cross into surrounding areas, and this would be an indicator of achievement. Such a diffusive strategy would be facilitated by an informal and spontaneous spread of ideas, approaches and methods to other stakeholders who, in turn, would further spread them substantially, thereby improving the overall impact of the programme. The programme would start working in the most affected areas, the "hot spots", and these would have to be identified jointly with the concerned communities.

V. CONCLUSION

The aim of this report was to recognize some processes of identifying successful programmes for resource conservation. In the ESCWA region, where fertile soil and water resources are scarce and the pressure of the population is increasing rapidly, halting the degradation of the limited resources is paramount. It is therefore crucial that the experiences gained from the implementation of appropriate and successful programmes in assessing and reversing land degradation should be analysed, documented and disseminated regularly to those who use them as a template for the design of future programmes with prospects for success.

This work points to the need to select and study successful programmes. Using case studies, the report highlights some points that should be taken into account in identifying and transferring successful programmes. The selection of successful programmes can be considered an evaluation process. Therefore, clear guidelines, criteria and indicators, such as credibility, stability, formal entitlement, participatory approach and replicability, would have to be set up and/or chosen and followed in order to ensure objectivity during the policy-making process while assessing the different objectives to be pursued by the programme. The importance of the judgements by the beneficiaries should carry great weight, and it would be necessary to conduct a more in-depth analysis of their values and attitudes.

There are resource-conserving technologies, appropriate institutional structures and enabling programmes that are known to work. However, appropriate ways to evaluate and document them need to be institutionalized so that they can be used or adapted in an effective manner in similar settings. There is a need to conduct these assessments with a view to exploring the possibility of transferring and implementing those programmes that have proved successful in other areas and that could support the transition to greater sustainability and self-reliance, particularly in rural areas.

So far, very few of the well-known successful programmes have been adopted in a way that their full benefits or potential could readily be made apparent. The major challenges lie in the development of new approaches to design and implement programmes that are predictable and replicable and that encourage community participation. For a more sustainable development of rural areas to succeed, policy formulation should become more enabling and support the appropriate use of local resources, skills and knowledge and innovative experiences. The greatest challenge will be the adoption of policies that will encourage the use of a participatory approach, whereby stakeholders would be treated as full partners at all stages of the process of programme design and implementation.

In the context of the above, it is relevant to mention that ESCWA has developed a methodological framework to assess land degradation, which has so far been applied in two ESCWA member countries, namely Jordan and Lebanon. The framework is simple and straightforward and could assist member countries in regularly identifying areas affected by land degradation, “hot spots”, and areas responding well to measures of combating land degradation, “bright spots”, It thus could provide relevant inputs in the design of policies to control and reverse the land degradation process. The ESCWA framework is complementary to the Land Degradation Assessment in Drylands (LADA), an approach developed by FAO which combines Remote Sensing Satellite image analysis, GIS, GPS and field surveys, as well as observations to identify and verify the land degradation processes and trends. The results of the framework are reliable, and they are amenable to replication. The framework also caters to the needs of the stakeholders and will facilitate the successful implementation, monitoring and assessment of any intervention programme or project on land degradation assessment and prevention.

In what follows, a brief overview of the ESCWA framework is provided.

The Driving Force-Pressure-State-Impact-Result (DPSIR) approach underpins the ESCWA assessment framework. The DPSIR approach allows for the understanding of the direct and indirect causes of the current states of land degradation, their impact and the responses that people have generated to counter the adversity caused by land degradation and the decrease in ecosystem services. The DPSIR approach allows for the identification of causative factors and for the mapping of the linkages to the states (intensity) and types of degradation, all of which should be reflected in a mapping legend for spatial display purposes.

Moreover, the DPSIR approach is the mechanism used for the integration of the biophysical factors with the social, economic, cultural and policy factors related to land degradation, and it is applied in the context of the interplay and trade-offs between the five capitals (natural, social, financial, physical and human).[107]

Driving force	Broad social, economic, institutional and ecological factors underlying the pressures on an ecological system leading to land degradation. Indirect causality related to the state of degradation.
Pressure	Factors that directly influence the state of an ecological system typically manifest as change, increase or decrease, degree of intensity, or extent of influence.
State	Physical, chemical and biological assemblages of conditions resulting from the pressures exerted on an ecological system.
Impact	Direct social, economic, ecological and cultural effects on the livelihood of people experiencing the state of an ecological system.
Response	Societal actions moving towards reversing negative impact or relieving or ameliorating the pressures on an ecological system and their driving forces.

The ESCWA framework's component tasks for the assessment also consist of 12 core sets of activities:

1. Define area and scale: Identify and delimit areas for the assessment and define the working and reporting scales.

2. Select indicators: Identify (from the LADA list or LADA indicators DSS (Decision Support Systems) the set of indicator variables relevant to the selected assessment scale. Include other local indicators and complement the indicators list as appropriate.

3. Select methods, procedures and tools: Select from the "toolbox" the applicable thematic module(s) containing the methods, procedures and tools needed for the assessment at the selected scale, according to the indicators identified.

4. Collect existing data and identify data gaps: Gather and compile existent relevant data (spatial and attributes) and databases, (including satellite imagery, if applicable), identify data gaps and compare with LADA recommended minimum datasets.

5. Stratify or partition variability: Stratify variability (bio-physical, socio-economic) in the area into relevant units (zones, terrain/landscape units, and land use) to be assessed. These will be the objects of assessment.

6. Design a data collection strategy for missing data: Design a data collection strategy consistent with data needed and in agreement with technology, local capacities and desired accuracy by:

(a) Designing a statistically reliable sampling scheme on the basis of the strata or units and locate sampling sites based on the stratification;

(b) Collecting data in the field (if applicable) from designed sampling sites and surveys, for the relevant indicators and scale of the assessment.

7. Analyse data: Analyse data by applying the method and tools selected from the DPSIR framework "toolbox".

[107] ESCWA, *Assessing Land Degradation in the ESCWA Region: A Methodological Framework*, submitted to the Expert Group Meeting on Reversing Land Degradation: Issues and Options, held in Beirut from 25 to 27 July 2005.

8. Integrate results: Integrate results using the decision support tool (whether the paper forms or digital decision-support system designed for this purpose) and establish causes, impact and responses; integrate findings and seek to establish causality and impact on livelihoods, including the economic costs of degradation.

9. Identify "hot spots" and "bright spots": From the integration of causes and responses to land degradation identify areas where degradation is being arrested and even reduced ("bright spots") and areas where degradation and degradation risk are high ("hot spots").

10. Validate results and assess accuracy: Undertake the implementation of ground validation and verification of results, including finding and reporting uncertainties and assessment of accuracy.

11. Map out and report results: Map the spatial distribution of land degradation by designing an ESCWA-explicit legend (or by adopting the LADA legend suggested in the framework), and report findings.

12. Monitor changes over time: Design a monitoring strategy consistent with data availability and in agreement with the technology, local capacities and desired accuracy.

For the application of the ESCWA framework in assessing land degradation, a comprehensive list of indicators is compiled and organized in terms of five capitals:

(a) Natural;
(b) Human;
(c) Social;
(d) Financial;
(e) Physical.

These indicators are also organized in terms of the DPSIR approach:

(a) Driving forces;
(b) Pressures;
(c) States;
(d) Impacts;
(e) Responses.

The DPSIR approach aids in the conceptualization of the complex myriad of interrelationships of issues relating to land degradation. It provides a sound organizational framework for the indicators, particularly for the selection process, and for eventual analysis.

The framework is not simple, but neither are the problems of land degradation, particularly when they are examined in terms of their causes and their impact in order to formulate policy and remedial action. Nevertheless, the framework is complete, fully comprehensive and, above all, flexible. It can be adapted to a wide range of circumstances encompassing data, technical knowledge, technology, scale and competencies of personnel. From that standpoint, its usefulness can be increased as its development and implementation take incremental steps and refinement. Many tasks, particularly those related to the development of the automated decision support systems for the completion of the 12 core component tasks of the framework, demand immediate attention, with the possibility of great rewards in terms of progress in completing and testing the methodological part of the proposed framework.

An initial overview of the application of the ESCWA framework in the Hermel area of Lebanon is presented in the annex to this report.

References

Abdel-Azim, R., and M.N. Allam. 2006. *Agricultural drainage water reuse in Egypt: Strategic issues and mitigation measures*. Options Méditerranéennes. Série B: Studies and Research, Number 53: 105-117. Proceedings of the 3rd WASAMED (Non-Conventional Water Use) Workshop, Cairo, 7-11 December 2004. International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM).

Abdelgawad, G., and A.R. Loulou. 2006. *Combating desertification in rangeland, case study, Syrian steppe – Bishri area*. ACSAD Report, Damascus. ACSAD, 2004. *State of desertification in the Arab World (updated study)*. ACSAD, CAMRE, UNEP, Damascus (Arabic).

Abdel-Kader, F.H. 2003. *Land Degradation and Conservation Measures in Egypt*. MEDCOASTLAND PROJECT, Workshop 1: *Ecosystem-based assessment of soil degradation to facilitate land users' and land owners' prompt action*. Adana, Turkey, 2-7 June 2003.

Abdel-Kader, F.H., M.H. Bahnassy, and A. El-Menshawy. 1998. *GIS Analysis of Wadi El-Kasaba Watershed, Northwest Coast, Egypt*. Alex. J. Agric. Res Alex. (43): 303-321.

Abdel-Kader, F.H., H. Schreier, A. Moustafa, M. Bahnassy, and A. Heneidy. 1998b. *Evaluation of soil and forage biomass: Wadi Naghamish-east Matrouh*. Rainfed Agriculture Conference in Arab Countries, Academy of Scientific Research and Technology, Cairo, 7-9 March 1998.

Abdel Rahman S.I., and Sh. A. Sadek. 1995. *The Application of Multispectral Remote Sensing to the Assessment and Evaluation of Soil Productivity in North Nile Delta, Egypt*. Egypt. J. Soil Sci. (35): 147-162.

Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). 2004. *State of desertification in the Arab world (updated study)*. ACSAD, CAMRE, UNEP, Damascus.

Aleiwi, M. 2001. *Monitoring and combating desertification in the Syrian and Jordanian Badiya.* Workshop on Choosing Pilot Areas Affected by Desertification through Remote Sensing. ACSAD. Amman, 22-27 May 2001. (Arabic).

Alexandria University. 2000. *Land Resource Assessment of West Nubaria-Bustan Using RS/GIS technique*. Department of Soil and Water Science, Faculty of Agriculture, Alexandria University. Bustan Agricultural Development Project (BADP). -EC. 1998-2000.

Al-Jaloudy, Settah, M.A. 2001. *Country Pasture/Forage Resource Profiles: Jordan*. In *Grassland and Pasture Crops.* Edited by J.M. Suttie and S.G. Reynolds. FAO, Rome.

Alkire, C. 2004. *Emphasis on Conservation and Ecological Restoration*. Bureau of Land Management Budget, The Wilderness Society, Washington, D.C.

Allam M.N. 2004. *Participatory Irrigation Water Management In Egypt: Review And Analysis*. Options Méditerranéennes, Série B n. 48: 123-131. Proceedings of the 1st WASAMED (Water Saving in Mediterranean Agriculture) Workshop, Şanliurfa, Turkey, 15-19 December 2003. CIHEAM.

Al-Shamsi, M.H. 2000. *United Arab Emirates' Experience in Combating Desertification*. In *Desert and Dryland Development: Challenges and Potential in the New Millennium*. ICARDA, Aleppo, Syrian Arab Republic.

Al-Zabet, T.G. 2002. *Integrated Agricultural and Water Management in the Jordan Valley*. In *Modern and Traditional Irrigation Technologies in the Eastern Mediterranean.* Edited by O. Mehmet and H.A. Biçak, IDRC, Canada.

Bloom, G., W. Chilowa, E. Chirwa, H. Lucas, P. Mvula, A. Schou, and M. Tsoka. 2004. *Poverty Reduction during Democratic Transition: The Malawi Social Action Fund 1996-2001*. Centre for Social Research, Malawi, Institute of Development Studies, United Kingdom, and Norwegian Institute for Urban and Local Government Research, Norway.

Brown, G., J. Peacock, R. Loughland, and G.A. Aldrami. 2003. *Coastal and Terrestrial Ecosystem Management Requirements in the GCC States: A Background Report*. Environmental Research and Wildlife Development Agency (ERWDA) Internal Report, Terrestrial Environmental Research Centre (TERC), Abu Dhabi, United Arab Emirates.

CAMP-PAP/RAC. 1998. *Coastal Area Management Programme, Fuka-Matrouh-Egypt*. Priority Actions Programme (PAP), Regional Activity Center (RAC). Egyptian Environmental Affairs Agency (EEAA). Final Integrated Report. Ministry of Cabinet Affairs, Egypt.

CAPMAS, 2001. Egyptian Central Agency for Pubic Mobilization and Statistics. *Statistical Year Book, Arab Republic of Egypt, Cairo*.

Christiansen, S., F. Delaroque, S.N. Ismael, G. Gintzburger, H. Jochen, H. Regner, H.N. Le Houerou, S. El-Naggar, N. Haddad, and N. El-Mowelhi. 1999. *Private rangeland intensification in Egypt's Northwest Coast. Sixth International Conference on the Development of Dry Lands*. 22-27 August 1999. Desert and dry land development: challenges and potential in the new millennium. UNEP, ICARDA, Cairo, 275-280.

Coastal Land Degradation Monitoring (CoLD). 2004. *Improving coastal land degradation monitoring in Lebanon and Syria*. LIFE TCY/00/INT/00069/MED. CNRS, UNEP/PAP/ERS-RAC.

Dregne, H. E., and N.T. Chou. 1992. *Global desertification dimensions and costs*. In *Degradation and restoration of arid lands*. Lubbock, Texas Tech. University.

Economic and Social Research Council (ESRC). 1997. *Environmental Entitlements: The Institutional Dynamics of Environmental Change*. Paper presented at the International Policy and Research Workshop, Institute of Development Studies, University of Sussex, United Kingdom.

El-Bably, A.Z. 2002. *Advanced and Integrated approaches for crop tolerance to poor quality irrigation water in Egypt*: 7th International Meeting on Soils with Mediterranean Type of Climate. Bari, Italy, CIHEAM 363-378.

El-Hadid, A., and W. Sartawi. 2005. *Country Report: Jordan* in *Regional Workshop on Promoting LADA Programme in Western Asia and the Near East*. ACSAD, FAO, SESRTCIC (Statistical, Economic and Social Research and Training Centre for Islamic Countries), Damascus, 25-28 July 2004.

Environment Agency. 2006. *Greening the Desert* in *UAE Interact*, the UAE Environment News, Abu Dhabi.

ESCWA. 2005. *Assessing Land Degradation in the ESCWA Region: A Methodological Framework*. Report presented at the Expert Group Meeting on Reversing Land Degradation: Issues and Options, Beirut, 25-27 July 2005.

Eswaran, H., and P. Reich. 1999. *Impacts of land degradation in the Mediterranean region*. Bulgarian Journal of Agricultural Science, 5:14-23.

Fabra, A., 2002. *The Intersection of Human Rights and Environmental Issues: A Review of Institutional Developments at the International Level*. Paper presented at the Joint UNEP-OHCHR Expert Seminar on Human Rights and the Environment, 14-16 January 2002, Geneva.

FAO. 2004. *Rehabilitation of degraded lands in Sub-Saharan Africa: Lessons from case studies*. Paper presented at the Workshop on Strengthening Regional Action – Implementation of the IPF/IFF Proposals for Action in Africa. Accra, Ghana, 16-18 February 2004.

Gad, A., A.G. Abdel-Samei, and M.A. Yehia. 2000. *Monitoring, Assessment and Combating Desertification Processes of Irrigated Lands in Egypt: Case Reviews*. Second International Conference on Earth Observation and Environmental Information. 11-14 November 2000, Cairo, Egypt.

Gaiha, R., and K. Imai. 2005. *A Review of the Employment Guarantee Scheme in India*. Inter-Regional Inequality Facility, Overseas Development Institute (ODI), Manchester, United Kingdom.

Geerken, R. 2001. *Combating Desertification in the Near East, Identification of Rehabilitation Measures and Impact Monitoring*. ACSAD Report, Damascus.

General Corporation for the Environment Protection. 2002. *The Hashemite Kingdom of Jordan National Report on the UNCCD Implementation*.

Giupponi, C., and M. Shechter. 2003. *Climate change in the Mediterranean: Socio-economic Perspectives of Impacts, Vulnerability and Adaptation*. United Kingdom, Edward Elgar.

GRC and TERI. 2006a. *Green Gulf Report: Executive Summary*. Gulf Research Center (GRC) and The Energy Resources Institute (TERI), Dubai, United Arab Emirates.

———. 2006b. *Green Gulf Preliminary Report,* chap. 2, "Land and terrestrial biodiversity". Gulf Research Center (GRC) and The Energy Resources Institute (TERI), Dubai, UAE.

Grun, R.E. 2006. *Monitoring and Evaluating Projects: A Step-by-Step Primer on Monitoring, Benchmarking and Impact Evaluation*. Health, Nutrition and Population (HNP) Discussion Paper, The World Bank, Washington, D.C.

Hattar, B. 2003. *Improvement of Agricultural Productivity in Arid and Semi-Arid Zones of Jordan (JAZPP Project)*. In *Workshop Proceedings, Ecosystem-based Assessment of Soil Degradation to Facilitate Land Users' and Land Owners' Prompt Actions, Adana, Turkey, 2-7 June 2003.* Edited by P. Zdruli, P. Steduto, S. Kapur and E. Akça, Medcoastland Project, Bari, Italy.

Hegazi, M., I.H. El Bagouri, and M.A. Kassas. 2002. *Arab Republic of Egypt, National Action Plan for Combating Desertification*. www.unccd.int.

Hughes, D., W. Butcher, A. Jarradat, and A. Penaranda. 1995. *Economic Analysis of the Long-Term Consequences of Farming Practices in the Barley Cropping Area of Jordan*. In *Agricultural Systems 47*, pp. 439-58. Elsevier Science Ltd, United Kingdom.

ICBA, 2004. *Biosalinity News.* Newsletter of the International Center for Biosaline Agriculture. Vol. 5, No. 1. Dubai, United Arab Emirates.

IDRC. n.d. *Jordan–Yarmouk Agricultural Resource Development Project*. Karianet. http://www.idrc.ca/en/ev-97640-201-1-DO_TOPIC.htm (last accessed March 2007).

International Fund for Agricultural Development (IFAD). 2006a. *Harvesting Rainwater in Jordan*. In *Rural Poverty Portal.* 5 July 2006, IFAD, Rome.

———. 2006b. *Report on the International Fund for Agricultural Development Intervention Programmes to Combat Desertification and Rural Poverty in Affected Non-African Countries*.

———. 2004a. *Report and Recommendation of the President to the Executive Board on a Proposed Financial Assistance to the Hashemite Kingdom of Jordan for the Agricultural Resource Management Project – Phase II.* Executive Board, 83rd session, Rome.

———. 2004b. *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project, Interim Evaluation.* Report No. 1559-JO, Rome.

———. 2001. *The Hashemite Kingdom of Jordan: Agricultural Resources Management Project in the Governorates of Karak and Tafilat.* Rome. http://www.ifad.org/evaluation/public_htm/ekyst/doc/agreement/pn/jo_329.htm.

———. *1999. Report and Recommendation of the President to the Executive Board on a Proposed Loan to the Hashemite Kingdom of Jordan for the Yarmouk Agricultural Resources Development Project*. IFAD Executive Board, 66th session, Rome, 28-29 April 1999.

Kattash, G., 2006. *Impact of biodiversity in sustainable development of arid environments.* In *Workshop on Status of Arabian deserts and their prospects*. ACSAD, GTZ, UNEP/ROWA, FAO, Damascus 14-16 May 2006. (Arabic).

Khalil, B.M., S.T. Abdel-Gawad, and J.A. Millette. 2004. *Impact of controlled drainage on rice production, irrigation water requirement and soil salinity in Egypt*. Proceedings of the 8th International Drainage Symposium-Drainage VIII, 2004: 443-452.

Khawlie, M., T. Darwish, R. Bou Kheir, and T. Masri. 2006. *Monitoring land degradation, biodiversity and sustainable management in Lebanon*. In *Workshop on Status of Arabian deserts and their prospects*. ACSAD, GTZ, UNEP/ROWA, FAO, Damascus 14-16 May 2006. (Arabic).

Khawlie, M., T. Darwish, T. Masri, R. Bou Kheir, and G. Faour. 2005. *Status of Desertification Assessment and Contribution of Geomatics in Lebanon, National Report*. In Workshop on Desertification Assessment & Monitoring System (Arab Countries), ACSAD-GTZ, Damascus, April 2005.

Khresat, S.A., Z. Rawajfih, and M. Mohammad. 1998. *Land degradation in North-Western Jordan: Causes and Processes*. In *Journal of Arid Environments* (1998) 39: 623-629.

Kippo News. 1996. *Kansai in Focus: Fukui Prefecture Shows 'Green Thumb' in UAE Desert Project*. Vol. 3, No. 92, Fukui, Japan.

Kishk, M.A. 1986. *Land degradation in the Nile Valley (Egypt)*. Ambio (15), 4: 226-230.

Kotb, T.H.S., T. Watanabe, Y. Ogino, and K. Tanji. 2000. *Soil salinization in the Nile Delta and related policy issues in Egypt*. Agricultural Water Management 43: 239-261.

Leach, M., R. Mearns, and I. Scoones. 1999. *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management*. In *World Development*, vol. 27, No. 2, pp. 225-247. Elsevier, United Kingdom.

Lenney, M.P., C.E. Woodcock, and J.B. Collins. 1996. *The Status of Agricultural Lands in Egypt: The Use of Multitemporal NDVI Features Derived from Landsat TM. Remote Sensing of Environment*, 56:8-20.

Library of Congress. 2006. *Country Profile: United Arab Emirates, March 2006*. Federal Research Division, Washington, D.C.

Loulou, A.R. 2004. *Participatory approach in ACSAD's desertification combating projects*. In: Proceedings of the Workshop on Determining an Income-product Generating Approach for Soil Conservation Management (MEDCOASTLAND project). Morocco, 12-16 February 2004. Edited by P. Zdruli and G.T. Liuzzi.

Mahmoud, S.A. 2005. *Country Report Egypt*. In: *Regional Workshop on Promoting LADA Programme in Western Asia and the Near East*. ACSAD, FAO, SESRTCIC, Damascus, 25-28 July 2004.

Meyer, S. 2000. *Enhancing the Credibility of Voluntary Environmental Initiatives.* Stratos Inc., Canada.

Mulvaney, D. 2003. *Review of Leach, Mearns and Scoones "Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management"*. http://envs.ucsc.edu/pewg/PE%20Environmental%20Entitlements.doc.

Nicholls, R., M.H. Ahmed, and M. Yiehia. 2000. *Monitoring the Nile Delta: A Key Step in Adaptation to Long-Term Coastal Change*. 2nd International Conference on Earth Observation and Environmental Information, 11-14 November 2000, Cairo, Egypt.

Nielsen, T.T., and H.K. Adriansen. 2005. *Government policies and land degradation in the Middle East*. Land Degradation and Development, 16 (2): 151-161.

Pretty, J.N. 1995. *Regenerating Agriculture: Policies and Practice for Sustainability and Self-Reliance*. Washington, D.C., Joseph Henry Press.

Rafea, A.R., and M.A. Martini. 2002. *Resource management: perceptions and strategies of households in Bershaya village, El-Bab district, Syria*. In: Workshop Proceedings on *Desert and Dryland Development: Challenges and Potential in the New Millennium*. UNEP, ICARDA, Cairo.

REC. n.d. *Transferability*. The Regional Environmental Center for Central and Eastern Europe. http://www.rec.org/REC/programs/telematics/enwap/gp/transfer.html (last accessed April 2007).

Ritzer, G. 1993. *The McDonaldization of Society - An Investigation into the Changing Character of Contemporary Social Life*. http://www.mcdonaldization.com/main.shtml (last accessed April 2007).

Robson, L.S., H.S. Shannon, L.M. Goldenhar, and A.R. Hale. 2001. *Guide to Evaluating the Effectiveness of Strategies for Preventing Work Injuries: How to Show Whether a Safety Intervention Really Works.* National Institute for Occupational Safety and Health, Centers for Disease Control (CDC), Cincinnati, OH, United States.

Sadek, SH.A. 1993. *Use of Landsat Imagery for Monitoring Agricultural Expansion of East and West Nile Delta, Egypt*. Egypt. J. Soil. Sci. (33): 23-33.

Salam, A.A., E.H.A. Noufal, and H. Abdel-Azeez. 1999. *Monitoring irrigation canal and drainwater quality in the Egyptian Delta*. Sixth International Conference on the Development of Dry Lands, 22-27 August 1999. *Desert and Dry Land Development: Challenges and Potential in the New Millennium*. UNEP, ICARDA. Cairo, Egypt: 210-214.

Shalby, A.R., F. El Gamal, and H. Ali. 2004. *Participatory Water Management In Egypt: Country Review*. Options Méditerranéennes, Série B, n. 48: 113-122. Proceedings of the 1st WASAMED (Water Saving in Mediterranean Agriculture) Workshop, Şanliurfa, Turkey, 15-19 December 2003. CIHEAM.

Suliman, A.S. 2001. *Change Detection from Satellite Images in Nile Delta Coast, Egypt*. Alex. J. Agric. Res. (46): 177-188.

Taimeh, A.Y. 2000. *Climatic and Agroecological Desertification in Jordan.* In *Desert and Dryland Development: Challenges and Potential in the New Millennium.* ICARDA, Aleppo, Syrian Arab Republic.

Tendler, J. 2003. *Why are Social Funds So Popular*? Paper presented at the Expert Group Meeting on Social Funds and Poverty Reduction: Making Social Funds Work for Poor People, United Nations, Department of Economic and Social Affairs, 15-16 October 2003, New York.

Trochim, W.M.K. 2006. *Reliability*. http://www.socialresearchmethods.net/kb/reliable.php.

United Nations Convention to Combat Desertification (UNCCD). 2002. *Summary of the Second United Arab Emirates National Report to the UNCCD.*

UNEP/PAP. 2000. *Guidelines for erosion and desertification control management, with particular reference to Mediterranean coastal areas*. PAP/RAC, Split, Croatia.

UNEP. 1997. *Global Environment Outlook-1*. http://www.grida.no/geo1/.

United Nations. 2006. *World Population Prospects: The 2006 Revision*. United Nations, New York. http://www.un.org/esa/population/publications/wpp2006/wpp2006.htm.

University of Arizona. 2006. *Jordan Soils and Land Management: Land Regions – Soil Types*. Arid Land Information Center (ALIC), The University of Arizona, United States. http://alic.arid.arizona.edu/jordansoils/land_regions.html (last accessed in April 2007).

Waad, I. 2004. *Summary of the Syrian efforts in enhancing productivity and profitability of the agricultural sector* In: Proceedings of the Workshop on Determining an Income-product Generating Approach for Soil Conservation Management (MEDCOASTLAND project, Morocco, 12-16 February 2004. Edited by P. Zdruli and G.T. Liuzzi.

Wassif, M.M., S.F.T. Sharkawy, M.R. Bayoumi. A.Y. Genead, and S. Kh. Atta. 1999. *Wind erosion as related to some soil conservation practices in the Northwest Coastal Zone, Egypt.* Sixth International Conference on the Development of Dry Lands. 22-27 August 1999. *Desert and Dry Land Development: Challenges and Potential in the New Millennium*. UNEP, ICARDA. Cairo, Egypt: 64-68.

WCCIP. 2002. *Making a Plan for Program Stability*. Wisconsin Child Care Improvement Project, Inc. http://www.wccip.org/tips/business/program_stability.html.

World Bank. 2006. *World Development Indicators 2006*. Washington, D.C. http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20899413~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html (last accessed April 2007).

———. 2005. *Key Development Data and Statistics*. Washington, D.C. http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20535285~menuPK:1192694~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html (last accessed April 2007).

Annex

AN INITIAL APPLICATION OF THE ESCWA FRAMEWORK CASE STUDY OF HERMEL, LEBANON

In what follows, the results of the initial application of the ESCWA methodological framework in the Hermel area of Lebanon[*] are presented in the form of a coded legend. Table A.1 depicts a convenient way of expressing these results. The codes reflect the type of land degradation that is occurring, namely, physical (P), chemical (C) and biological (B), and these are further sub-coded based on the various processes that may have been observed in the surveyed area. For instance, the physical processes can be grouped in terms of on-site and off-site processes and processes causing land deformation (such as rills and gullies).

The degree of intensity of the acting degradation process is given a numeral identity, while the spatial extent of the process is expressed in terms of percentage units of the total area being assessed. The codes are then organized according to the type of degradation as coefficient, followed by one or more fractions. The numerator of the fraction is made up of a numeral indicating the intensity of the process, and it is followed by the code of the type of process. The denominator of the fraction indicates the spatial extent of that type and degree of degradation process. Processes within one type (physical, chemical or biological) are enclosed in brackets. Once all types of degradation and their processes, intensities and extents are included, a rectangular bracket closes the fractions and their coefficients.

The causes of the type, intensity and extent of land degradation (driving forces and pressures) are coded together outside the rectangular brackets. The driving forces are coded with capital letters, and the pressures with numerals. Both driving forces and pressures are identified based on interviews with farmers, policymakers, public agencies and non-governmental organizations (NGOs), as well as documented literature. These are then coded so as to be included in the mapping legend. It is understood that in each area these codes might be slightly or considerably different. However, the same organizing principle can be used to substitute or add to the original list. The final composition of the legend is attained by integrating the coded driving forces and pressures as two fractions, one as exponent or "power" of the rectangular bracket, representing the driving forces and pressures with the greatest importance in determining the state of land degradation. The fraction at the bottom of the rectangular bracket represents the driving forces and pressures with the lesser degree of importance in determining the state of land degradation for a given area being assessed. The degree of importance of the driving forces and pressures increases from bottom to top and from left to right. Admittedly, the codes are arbitrary and not universal. However, they could be changed, as long as tabulated information of the coding system accompanies the legend used to map out land degradation using the proposed legend system. Table A.1 illustrates the coding system that was used in the assessment of land degradation while table A.2 shows a list of the codes that could be used for the driving forces and the pressures identified.

Using the 12 core component tasks of the assessment framework, a stratification of the Caza Hermel area in Lebanon was conducted. The ecological variability of the area was partitioned in terms of land systems and land facets. The boundaries identified for land systems coincided, to a large extent, with those of thematic maps of topography, ecological zones, geology, soils and land cover of the area. The results of the stratification yielded two land systems, namely: land system "Yamouneh Plateau" and land system "Bekaa Valley". In each land system, subunits of simple landforms, uniform in moisture, rock, soils, moisture regime and land cover so that they can be given similar management throughout, were identified and are referred to as land facets. Both the Yamouneh Plateau and the Bekaa Valley land systems contain four land facets each, and an assessment of land degradation was conducted for each of the land facets.

The driving forces and pressures identified in the area were tabulated and coded so that they could be incorporated into the symbology of the coded legend, according to the proposed legend design. The synthesis of data and information based on the methodological framework allowed the identification of the

[*] ESCWA, *Assessing Land Degradation in the ESCWA Region: A Methodological Framework*, submitted to the Expert Group Meeting on Reversing Land Degradation: Issues and Options, held in Beirut from 25 to 27 July 2005.

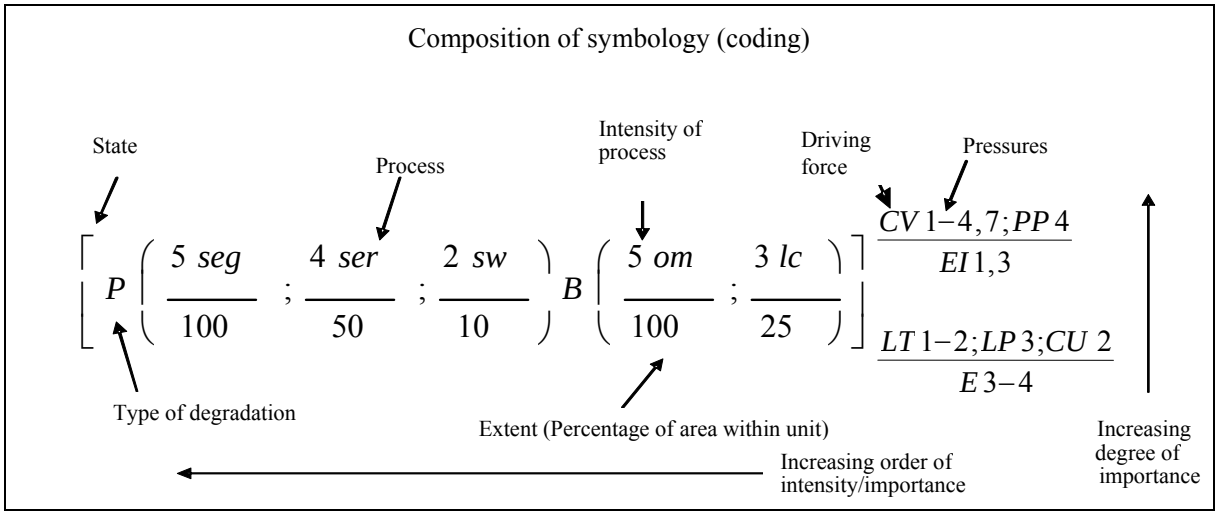
driving forces and pressures at work in each of the land facets of the two land systems comprising the Hermel area. The results of such synthesis of causal chains are compiled in tables A.3 and A.4.

The assessment results indicate that most of the area in the Caza Hermel in Lebanon is affected by intense and severe states of land degradation of all kinds: physical, chemical and biological. The dominant type of land degradation in both spatial extent and intensity is physical degradation (soil erosion by water being the most pervasive agent), followed by biological (organic matter loss and loss of land cover and soil biodiversity) and chemical degradation caused by loss of soil fertility through nutrient "mining". Soil salinity and other element imbalances, (such as soil pollutants). Soil salinity is a localized chemical degradation process associated with irrigation and cropping patterns, and therefore occurring mainly in the flatlands of the valley.

The methodological framework enabled the identification of the driving forces and pressures of land degradation though substantial work and familiarization with the socio-political and economic problems of the area. Data-processing for this aspect of the methodological framework is not an easy task, since the complexity of the linkages requires an in-depth knowledge of the area.

Thus, through the methodological framework, it was attempted to bring social and economic factors into the assessment framework and to integrate them with the biophysical and semi-quantitative variables. A parametric semi-quantitative approach to the assessment, as revealed in the case study of Lebanon, allowed flexibility and balance between the biophysical quantitative estimation and modelling of processes, on the one hand, and the intuitive judgment, knowledge and perception of human interactions and social and cultural values, on the other.

TABLE A.1. SYMBOLOGY AND TYPES OF LAND DEGRADATION



Type of land degradation

P = physical C = chemical B = biological

Degree of intensity

1 = very slight
2 = slight
3 = moderate
4 = intense
5 = very intense

Extent

Percentage of area of land unit affected

Processes of physical land degradation (P)

Processes (on site)

se = soil erosion by water (sheet erosion)
sw = soil erosion by wind (sheet erosion)
co = compaction

Processes of land deformation

ser = soil erosion by water (rills)
seg = soil erosion by water (gully)
cr = crusting and sealing

Processes (off-site)

sed = sediment deposition
sefl = flooding
sec = water contaminated by erosion
swd = deposition of dust

Processes of chemical land degradation (C)

sa = salinity
h = acidity
wt = solid wastes (soil surface)
na = alkalinity
f = soil nutrient and fertility depletion
tx = toxic compounds (pollutants in soil matrix)

Processes of biological degradation (B)

lc = loss of land cover and biomass
bio = loss of biological diversity
om = organic matter

TABLE A.2. CODES FOR DRIVING FORCES AND PRESSURES TO USE IN THE MAPPING LEGEND

Code	Driving forces	Pressures	Code
CV	Climatic variability	Increased drought frequency	1
		Average air temperature changes	2
		Increased frequency of erosive rainfall events and surface runoff	3
		Increased frequency of high velocity winds causing dust	4
		Unfavourable rainfall quantity, intensity and distribution	5
		Increased water losses through run-off and evapotranspiration	6
		Increased water demand by plants, animals and humans	7
		Increased aridity and favourable conditions for soil compaction and hardpan formation	8
ND	Natural disasters	Volcanic eruptions and their effects on the landscape	1
		Earthquakes	2
		Tornados	3
		Dust storms and their erosive effect	4
		Landslides	5
		Fire	6
AL	Adverse landscape conditions	Terrain roughness (restrictive rapid topographical changes)	1
		Slope steepness	2
		Position on slope (unfavourable)	3
		Mining, quarrying and extracting activities (clay)	4
		Earthworks modifying the landscape unfavourably	5
		Weak soil structure and texture	6
		Rockiness and stoniness (surface and sub-surface)	7
		Soil depth (restrictive)	8
		Depth to water table	9
AP	Animal populations	Pressures by high animal and/or livestock densities (decreased biomass, soil compaction)	1

Code	Driving forces	Pressures	Code
		Surpassed animal carrying capacity of grasslands/rangelands/forests	2
		Poor livestock and forage (grasses) diversity	3
		Invasion of excessive animal populations	4
		Habitat recession and disappearance	5
PP	Primary productivity	Decline in primary production of ecosystems	1
		Increased demands of forest products	2
		Recess of land cover area/increased exposure to erosive forces	3
		Increased demands of bio-energy	4
		Nutrient exports ("mining")	5
		Soil organic matter and carbon depletion	6
PS	Personal safety	Conflict and violence (presence and frequency)	1
		Volatile political and rural policy system	2
FI	Food insecurity	Crop yield decreases in past three or more years	1
		Frequency of total crop failures	2
		Low value of production/unit area	3
		Increase in deficit of production of staple foodstuffs locally	4
		Low per capita calorie/protein intake	5
		Percentage of malnourished (underweight) rural children under 5	6
WI	Water insecurity	Change in water availability per capita	1
		Increased distance to water supply and collection	2
		Increased time spent in collecting water	3
		Deterioration of water quality (increased turbidity and/or contamination)	4
		Low percentage of rural population with access to water	5
EI	Energy insecurity	Affordability and accessibility to main energy source (unfavourable to biomass)	1
		Changes in main energy source	2
		Main fuel sources	3
LO	Loss of opportunity	Migration (permanent/seasonal)	1
		Poverty gap index/income	2
		Land tenure constraints (type, access)	3
		Access to common cultivable land (hectares/farmer)	4
D.C.	Demographic changes	Population growth rate (higher demands on resources)	1
		Population density (high pressures on the land and resources)	2
		Age/gender distribution and occupation (unfavourable to land stewardship and lack of involvement of women)	3
		Aging farming population and increase in young landless people	4
		Migration of the young and/or poor participation in rural community affairs	5
		Rural infant mortality rate (per 1,000 live births)	6
		Change in non-farm employment	7
		Unemployment rate	8
LI	Level of investment	Percentage of national budget in rural and agricultural development	1
		Lack of personal investment in the land and land activities	2
		Lack of or low government investment in land programmes in rural areas	3
		Low level of Government/institutional staff involvement in agricultural research and extension	4
		Research and investment focus on crops vs. resources	5
AC	Access	Credit availability (lack of)	1
		Presence/use of banking institutions (lack of)	2

Code	Driving forces	Pressures	Code
		Access to markets of input and output supplies (distance, transportation, type)	3
LT	Land tenure	Uncertainty of land tenure	1
		Unregulated, unrestricted use of common lands	2
LP	Land policies	Tax exemptions, such as for large-scale farms	1
		Land tax or incentives for certain land use types of high intensity	2
		Absence or non-enforced by-laws on land use and protection	3
MA	Macroeconomic policies	Legislation for natural resource management (absent or non-enforced)	1
		Globalization, trade agreements and barriers unfavourable to small, self-sustaining (non-export) farmers, or limiting export/import opportunities to them	2
		Manipulated rural investment policies and exchange rates to favour exports	3
		Policies to reduce farm income volatility (produce)	4
		Price guarantees	5
MI	Microeconomic policies	Credit schemes favouring a certain produce	1
		Introduction of untested and unsuitable land use types	2
PR	Privatization	Farmer groups/associations/cooperatives (absent or weak)	1
IS	Institutional support	Lack of knowledge of institutional frameworks and support	1
		Ignorance of regulatory frameworks	2
		Cumbersome requirements of institutions and bureaucracies	3
		Absence of, or weak, natural resource institutions	4
TR	Transport	Density/type of road networks (unfavourable or poor)	1
		Availability/accessibility of public transport (lack of)	2
WA	Water	Lack of stream/storm/run-off control structures	1
		Water distribution system (adequacy or absence)	2
		Sewage/road run-off collection and treatment (adequacy)	3
SW	Solid waste	Access to latrines	1
HO	Housing	Waste disposal type, location, proximity to population (absence or adequacy)	1
ED	Education/skills/ knowledge	Low literacy rate and education	1
		Difficult access to schools	2
		Availability of extension services/agricultural education	3
		Availability of environmental education (lack)	4
CU	Culture	Lack of land stewardship	1
		Lack of livestock management culture	2
HE	Health	Lack of sexual /family planning education	1
		Days/years unable to work on land owing to illness or poor health	2
		Indigenous technical knowledge of land management and resource extraction	3

TABLE A.3. CODED LEGEND DESCRIBING THE TYPE, PROCESS, INTENSITY, EXTENT AND CAUSES (DRIVING FORCES AND PRESSURES) OF LAND DEGRADATION IN EACH LAND FACET OF THE YAMMOUNEH PLATEAU LAND SYSTEM, HERMEL, LEBANON

Land facet	**Status of land degradation (DPSIR legend) in the Yammouneh Plateau land system**
1	$\left[P\left(\frac{5se}{100};\frac{5ser}{50};\frac{3co}{80};\frac{3cr}{80}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{4f}{100};\frac{2tx}{20}\right)\right]\frac{\frac{CV_{1,3,5,8};AL_{7,8};AR_{1,2}}{PS_{1,2};DC_{1,2};LR_{3};MA_{1,2}}\ \frac{EI_{1,3};WA_{1};PR_{3,5,6};WI_{1}}{IS_{2};CU_{1,2}}}$
2	$\left[P\left(\frac{5se}{100};\frac{5seg}{80};\frac{5ser}{80};\frac{3cr}{50}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{4f}{100}\right)\right]\frac{\frac{CV_{1,3,5,8};ND_{2};AL_{1,2,3,7,8};PR_{1,3,5,6}}{PS_{1,2};EI_{1,2};DC_{1,2,3};LI_{1,2,3}}\ \frac{LR_{3};MA_{1,2};MI_{2};IS_{2};WA_{1};ED_{4}}{ED_{4};CU_{1,2}}}$
3	$\left[P\left(\frac{5se}{100};\frac{5seg}{100};\frac{5ser}{100};\frac{3cr}{80}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{4f}{100};\frac{2tx}{100}\right)\right]\frac{\frac{CV_{1,3,5,6,8};ND_{3};AL_{1,2,3,7,8}}{DC_{1,2,3};PR_{1,3};PS_{1,2};EI_{1,2};LI_{1,3}}\ \frac{LT_{2};LR_{3};MA_{1,2};IS_{3};WA_{1}}{ED_{4};CU_{1,2}}}$
4	$\left[P\left(\frac{5se}{100};\frac{5seg}{100};\frac{5ser}{100}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{5f}{100}\right)\right]\frac{\frac{CV_{1,3,5,6,8};ND_{4};AL_{2,3,7,8}}{DC_{1,2,3};PS_{1,2};PR_{1,3};EI_{1,2}}\ \frac{LI_{1};LT_{2};LR_{3};MA_{1,2}}{IS_{2};WA_{1};ED_{4};CU_{1,2}}}$

TABLE A.4. CODED LEGEND DESCRIBING THE TYPE, PROCESS, INTENSITY, EXTENT AND CAUSES (DRIVING FORCES AND PRESSURES) OF LAND DEGRADATION IN EACH LAND FACET OF THE BEKAA VALLEY LAND SYSTEM, HERMEL, LEBANON

Land facet	**Status of land degradation (DPSIR legend) in land system "Bekaa Valley"**
1	$\left[P\left(\frac{5se}{100};\frac{5ser}{100};\frac{3cr}{80};\frac{5sed}{100};\frac{5sefl}{100}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{4f}{100};\frac{2sa}{20}\frac{2tx}{20}\right)\right]\frac{\frac{CV_{1,3,5,6,8};ND_5;AL_{1,5,8};}{DC_{1,2,3};PS_{1,2};AP_{1,2};PP_{1,3,5,6}}\ \frac{FI_{1,2};WI_1;EI_{1,2};LO_3;LI_{1,2,3,5}}{LP_{2,3};MA_{1,2};MI_2;IS_2;WA_1;ED_4;CU_1}}$
2	$\left[P\left(\frac{5se}{100};\frac{4co}{80};\frac{3cr}{80};\frac{5sed}{100};\frac{5sefl}{100}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{5f}{100};\frac{4sa}{30};\frac{3na}{20};\frac{3tx}{20}\right)\right]\frac{\frac{CV_{1,3,5,6,8};ND_5;DC_{1,2,3};AP_{1,2}}{PS_{1,2};PP_{1,3,5,6};FI_{1,2};WI_1;EI_{1,2}}\ \frac{LO_3;LI_{1,2,3,5};LP_{2,3};MA_{1,2};MI_2}{IS_2;WA_1;HQ_1;ED_4;CU_1}}$
3	$\left[P\left(\frac{5se}{100};\frac{5ser}{100};\frac{3cr}{80};\frac{5sed}{100}\right)+B\left(\frac{5lc}{100};\frac{5om}{100};\frac{4bio}{100}\right)+C\left(\frac{5f}{100};\frac{2sa}{30};\frac{3na}{20};\frac{2tx}{20}\right)\right]\frac{\frac{CV_{1,3,5,6,8};ND_5;AL_{1,5,8};DC_{1,2,3}}{PS_{1,2};AP_{1,2};PP_{1,3,5,6};WI_1;EI_{1,2}}\ \frac{LO_3;LI_{1,2,3};LP_3;MA_{1,2}}{IS_2;WA_1;ED_4;CU_1}}$
4	$\left[P\left(\frac{5se}{100};\frac{5ser}{100};\frac{5seg}{100};\frac{5sed}{100};\frac{5sefl}{100}\right)+B\left(\frac{5lc}{100};\frac{5om}{100}\right)+C\left(\frac{3f}{100};\frac{3sa}{30};\frac{4tx}{30}\right)\right]\frac{\frac{CV_{1,3,5};DC_{1,2,3};PS_{1,2}}{PP_3;WI_{1,4};LI_{1,3};LP_3}\ \frac{MA_{1,2};IS_2;WA_1}{HQ_1;ED_4;CU_1}}$