

## **Dryland Management and Combating Desertification Through Development**

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**Abstract.** Although desertification process is not new or site specific, the environmental awareness in a world board scale has enlarged and generated a wider public interest, extensive to the scientific circles and governments. Desertification takes place in all continents except Antarctic and affects the livelihoods of millions of people, including a large proportion of the poor in drylands which occupies about 41% of the Earth's land and are home to more than 2 billion people. The persistence of unresolved stabilization of these fragile lands and the substantial reduction in the provision of ecosystem services as a result of intensive use of resources, incapacity of wide spread adequate technologies for providing increased supply of food, forage and fuel, water scarcity, and climate change puts desertification in among the greatest environmental challenges today and a major impediment to meeting human needs and attainment of the Millennium Development Goals. Scenarios for Climate change add up to environmental degradation associated with desertification bringing new threats of intensification of trends in the expansion of these degraded areas. In Portugal, the predictive scenarios on Climate Change points out the risk line of desertification overtaking already the Tagus River. Although Portugal is far better positioned than other desertification prone dry countries in the tropics and whose intervention examples are revised, the author believes that coping with desertification and its economic conditions, just as it is proposed for the tropics, will likely fare better when proactive management approaches and forest research projects are used and when increased integration of land and water management are implemented by effective policies. These integrated approaches may initially have high costs due to technological development and may also have a slow expression in environment improvement but its long term multiplicative effect may make the difference in conserving or enhance biodiversity and being able to provide acceptable livelihood for people in these risk prone areas.

**Key words:** ecological effects; human impacts; dryland management; natural resources; management strategies

### **Gestão de Terras Áridas Combatendo a Desertificação com o Desenvolvimento**

**Sumário.** Embora o processo de desertificação não seja novo, ou específico de uma estação determinada, a percepção do ambiente numa escala mundial ampliou-se e gerou um interesse público alargado que se expandiu aos círculos científicos e governamentais. A desertificação

ocorre em todos os continentes excepto no Antártico e afecta os modos de vida de milhões de pessoas, incluindo uma larga proporção de pobres nas zonas áridas que ocupam 41% da superfície terrestre e alberga mais de 2 biliões de pessoas. A persistência da não estabilização destas terras frágeis e a substancial redução na provisão de serviços ambientais em resultado do uso intensivo dos recursos, da incapacidade de uma generalização de tecnologias apropriadas para proporcionar um aumento da oferta de alimentos, forragem e fuel, da escassez de água, e da mudança climática coloca a desertificação entre o maior desafio ambiental de hoje e num dos maiores obstáculos na satisfação das necessidades humanas e na finalização dos Objectivos do Desenvolvimento do Milénio. Os cenários das mudanças climáticas adicionam-se à degradação ambiental associada com a desertificação e trazem novas ameaças quanto à intensificação das tendências de expansão destas áreas degradadas. Em Portugal, os cenários preditivos das mudanças climáticas colocam a fronteira de risco de desertificação a norte do Rio Tejo. Se bem que Portugal esteja muito melhor equipado do que outros susceptíveis à desertificação nos trópicos, o autor acredita que lidar com a desertificação e as suas consequências económicas, tal como proposto para os trópicos, e cujos exemplos de intervenção revisitámos, é mais susceptível de produzir resultados quando são implementadas abordagens pró-activas de gestão e implementados projectos de investigação florestal em conjugação com um aumento de gestão integrada do solo e da água e de políticas efectivas. Estas abordagens integradas podem ser inicialmente caras devidas ao desenvolvimento tecnológico e podem também ter uma lenta expressão na melhoria ambiental mas o seu efeito multiplicativo a longo prazo pode ser decisivo na conservação e aumento da biodiversidade e de serem capazes de proporcionar um modo de vida aceitável para as populações destas áreas de risco.

**Palavras-chave:** efeitos ecológicos; impactos humanos; gestão de terras áridas; estratégias de gestão de recursos naturais

#### **Gestion des Terres Arides en Combattant la Désertification par le Développement**

**Résumé.** Bien que le processus de la désertification ne soit pas nouveau ou spécifique au site, la croissance de conscience environnementale à l'échelle mondiale étendue a généré un intérêt public extensif, et aussi de la part de la communauté scientifique et des gouvernements. La Désertification a lieu sur tous les continents à l'exception de l'Antarctique et elle affecte la qualité de vie de millions de personnes, y compris une large proportion de pauvres qui occupent presque 41% de la surface de la Terre et est la maison de plus de 2 billions de personnes. Le manque de stabilisation de ces sols fragiles, la réduction de la provision des services environnementaux résultant de l'usage intensif des ressources, de l'incapacité de l'expansion extensive des technologies adaptables pour accroître une offre ajoutée de nourriture, pâturage et de bois d'énergie, et le manque d'eau et les effets du changement climatique, fait de la désertisation un des premiers défis pour l'environnement. Ce sont aussi des obstacles majeurs à la finalisation des objectifs du Développement du Millenium. Les prévisions de changements climatiques accroissent les risques de dégradations associées à la désertification, ce qui fait accroître les tendances d'extension de ces terres dégradées. Au Portugal, les prévisions de changement climatique placent la ligne de risque déjà au nord du fleuve Tejo. Si bien que le Portugal est mieux placé, comparativement à d'autres pays tropicaux secs en risque. L'auteur croit que pour faire face à la désertification et à ses conséquences économiques, comme il est proposé pour certains pays tropicaux, et dont les projets de récupération revus, les abordages de gestion proactive et la recherche forestière utilisés, en conjugaison avec la gestion intégré du sols et de l'eau, supporté par des politiques effectives sont des instruments essentiels à l'obtention de résultats. Ces abordages intégrés peuvent être très coûteux dans la phase initiale et peuvent ne pas produire de résultats environnementaux visibles, mais ces effets multiplicatifs à long terme feraient la différence entre la conservation et

l'amélioration de la biodiversité et pourraient fournir, à moyen terme, des moyens de vie acceptable pour les personnes dans ces espaces.

**Mots clés:** désertification; effets écologiques; impacts humains; gestion des terres arides; stratégies de gestion pour les ressources naturelles

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## Foreword

Interest by environmental issues has increasingly broadening at all levels of the society, and held the attention of the general public, plus a wide spectrum of academic, government and public interest groups. Most of the issues were not entirely new and most of them were addressed by the UN Conference on the Human Environment in Stockholm (1972) and the UN Conference on Environment and Development in Rio de Janeiro (1992) and by various regional submits. Diverse as these issues were, they had a number of features in common. They were global or at least hemispheric, large-scale environment problems. All involved human interference in the earth/atmosphere system and reflects society's increasing ability to disrupt environmental systems on a large scale. Several initiatives taken afterwards including those in the Framework Convention on Climate Change and in Tokyo Convention have faced with several obstructions to progress notwithstanding the warnings scientific community has being issuing. To express the dimension of the environment degradation, and considering only sub-Saharan Africa, it is sufficient to say that an estimated two thirds of available land will have been lost by 2025 due to land degradation leading to the loss of an average of more than 3% of agriculture GDP (CLEAVER and SCHREIBER, 2004). World wide desertification affects two billion people leaving in drylands hitting hardest poor

people especially those who depend on agriculture. That is why the UN, recognising the severity of the problem, has declared 2006 as the International Year of Deserts and Desertification. Global environment predictions impacts in Portugal and geographic mapping of enlargement of drought prone areas and desertification pressures south of Tagus river made us look to available experiences, mostly in Africa as an alert to needed research, including plants adaptability and development work on desertification problems that likely will increasingly affect Portugal in the near future.

So, this overview has been prepared to provide insights on available experience in the two last decades in the area of antidesertification. Since antidesertification is not a distinct program category at donor and financial agencies it is difficult to comprehensively present all activities in this area. Instead, this overview gives some illustrative examples of problems and the types of actions in dryland management.

The international community has shown a special concern with land resources management and several actions had been devised to focus on priority areas, including maintaining and restoring the renewable natural resources base in ways that increase agricultural productivity and natural resources base in the semiarid zones of sub-Saharan Africa. This report tries to report progress in natural resources management during the last decades, factors of success and failure of

antidesertification programs in the area of natural resources management.

## **Introduction**

### *Background*

Main findings in the area of antidesertification over the last few years were based in a large range of projects being developed in dryland areas of Africa. They were selected among those that have broad development applications, and an extensive number of elements to combating desertification - that is, managing dryland natural resources such as soils, forests, range and water resources.

Many of the findings result from evaluation of projects interventions mostly designed following the lessons learned from the major drought that struck the West African Sahel in 1968 and 1983-84 droughts in Africa, and carried out in dry lands of the world with a particular emphasis in Africa and completed in the late 1980s. Although, certainly, not all of the projects had been analyzed, it is believed that there exist a comprehensive framework of information and data on which main recommendations for interventions were drawn.

### *National frameworks*

Over the past years, several international and national organizations have joined with the World Bank and other donors in the design and implementation of National Environmental Action Plans (NEAPs). It should be noted that NEAPs in their initial formulation are meant to be long-term processes, not single "one-off"

reports. They were designed to provide a political and strategic overview to permit the more rational allocation of donor, non-governmental organization (NGO)/private voluntary organization (PVO), and host-country resources. Local control and participation are meant to be central attributes of NEAPs and perhaps could make up for the deficiencies in bilateral project design. Thus, if the participatory approach is lacking in any project in a given portfolio, a strengthened NEAP could compensate by encouraging a change in the course of project design and implementation.

Of course, the success of any NEAP in Africa, or elsewhere, depends directly on the thoroughness with which all the factors of resource utilization are considered. Especially pertinent are those informal sector activities that end up playing such a vital role in determining how, when, and by whom "common" natural resources are actually utilized. This focus necessitates that NEAPs be long term in both design and orientation. NEAPs are therefore important in the initiation of a process whereby the country takes control of its environmental/natural resource problems and coordinates the use of all available resources, from a wide variety of donors, in-country agencies, and NGOs/PVOs.

### **Statement of understanding definition**

This review uses the definition of desertification based on that of the United Nations Environment Program (UNEP) and the United Nations Conference on the Environment and Development (UNCED), as it was developed in Agenda 21. Desertification is understood as "Land degradation in arid, semiarid, and dry sub-humid areas

resulting mainly from adverse human impact." It is a complex phenomenon adversely affecting 2 billion people leaving in drylands. The UN Convention to Combat Desertification (1996) has a slight modified definition to include recognition of negative climate effects ("Land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities"). So, independent of refinements in the definition one major impact remains: where desertification occurs, poor people especially those who depend on agriculture are hit hardest.

#### *Causes of desertification*

There is no widely accepted definition of desertification. Desertification typically occurs at the fringes of deserts (which themselves have been created over long periods of time by natural phenomena), and was referred to originally as "desertization" (LE HOUEROU, 1977), though their presence is not a prerequisite for desertification. These fringes or transition zones represent delicately balanced ecosystems where a variety of microclimates can be found. Degradation<sup>1</sup> of the land can occur as humans stress these transition zones with their activities. This human-induced degradation interacts with natural phenomena in complex ways that can alter the ecosystem and intensify the degradation. Although diverse views exist on the relationship between climatic and human effects on desertification the introduction of human activity, acting

synergistically with adverse climatic conditions is now widely accepted (VERSTRAETE, 1986), and UNEP has tended to emphasize the importance of the human impact over drought. Nevertheless the relative importance of each of these elements remains still very controversial (KEMP, 1994; MA, 2005). Whether it can be stopped or reversed is a question of much debate. To understand the process of desertification, one must develop an awareness of the interactions between variables such as climate, population growth, and human land use under conditions of change. The problems with, and controversy surrounding, the term "desertification" stem from a real lack of ecological knowledge about arid and semiarid lands, and their resilience under different kinds of land use pressures. The assessment portrayed by the Committee on Science and Technology (2005) of the UNCCD challenges the international community to focus on the need action.

Research on desertification processes at arid and semiarid sites has indicated that desertification result from the following series of steps:

1. initial vegetation reduction as a result of overgrazing or harvest;
2. redistribution of sediments, nutrients, and soil moisture from non-vegetated zones to vegetated zones;
3. soil desiccation and nutrient impoverishment in non-vegetated zones, which stress vegetation in fringe areas, leading to floristic recession;
4. soil desiccation, which also contributes to the development of a calcified or lateritic layers that inhibits deep water penetration and storage;
5. positive feedback between vegetation reduction and soil desiccation and

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<sup>1</sup> Land degradation must be understood as the reduction or lost of the biologic productivity of drylands.

nutrient impoverishment, which accelerates vegetation stress and decline.

Desertification of arid and semiarid lands could then be said to result from a combination of natural fluctuations in drought, coupled with delayed reductions in land uses by humans during unpredictable periods of drought.

#### *The cyclic nature of desertification*

Regional climates tend to fluctuate in weak 3 to 4 year cycles (some suggest 10 to 20 year cycles<sup>2</sup>) with a high amplitude of wet or dry conditions. Human activity can contribute to either the accentuation or the dampening of these amplitudes by their intensity of plant and/or soil disturbances during periods of drought. Vegetation removal exposes soil surfaces to direct solar radiation and increases soil reflection (albedo). In addition, global circulation models demonstrate that increased albedo results in a feedback mechanism to the local climate that increases the probability of continued drought. This means that land use practices, to be effective, must be modified early in the drought cycle to alleviate this feedback and to retain the structural and functional properties of soils such as water infiltration or nutrient cycling (MULLER, 1993).

In numerous cases in Africa and elsewhere, farmers have used investments in simple management practices to restore land productivity. These are primarily financial decisions and thus out of the critical link between land degradation and local vested interest.

#### *The effect of vegetation*

Given the fact that indigenous plants and animals have evolved mechanisms to tolerate variations in local climates, it is not surprising that dryland plants have adaptations to cope with variable precipitation. But these same plants are often less capable of surviving extended droughts when continuously cropped (e.g., grazed or gathered). In addition, ephemeral plants rely on the seed phase of the life cycle to survive drought periods. Grazing of ephemeral plants during early growth can often be tolerated, but grazing during flower and seed production will result in a decline of these species within the ecosystem. Herbaceous perennials are most at risk, since they produce foliage when moisture is available. This same foliage senesces and whole plants become dormant during drought periods. Renewal buds for these plants are located at or below the soil surface, thus they tend to be most vulnerable to use later in the growing season when these buds are elevated (MULLER, 1993).

#### *Land use*

Available experience allow to state that the use of arid lands can be sustainable, provided that timing, duration, and intensity of use are sufficiently flexible during early signs of drought. When precipitation is adequate for plant growth, then land uses must be compatible with the maintenance of physical and biological components of the ecosystem.

Adverse human impacts in areas vulnerable to desertification are often due to poor practices of soil conservation, agricultural cultivation

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<sup>2</sup> Environmental Change in the West African Sahel, National Academy Press, Washington, DC.

practices, livestock overgrazing, and urban settlement patterns. Sustained high levels of stress on these already fragile environments by human populations eking out their existence on these ecosystems during short-term periods of drought can be long-lasting or irreparable, sometimes even resulting in increased desertification. Reference must be made that UNEP's insistence on explaining most desertification as the result of human activities and failure to appreciate the extent of annual fluctuations in vegetation boundaries – differences of as much as 200 km were reported on the Sudan/Chad border between 1984 and 1985 – combined with inadequate ground control (NELSON, 1990) may have contributed to the misrepresentation of the extent of the problem. Natural causes such as short-term drought and longer-term climatic change were very often ignored or given less attention than they deserve, and yet both can produce desert-like conditions without human interference. It is believed that failure to appreciate the various potential causes of desertification would undoubtedly limit the response to the problem.

#### *Rosegardens and reality*

In conclusion, there is no single element of strategy, or single management technique, that alone will halt or reverse the process of desertification. Sound dryland management is an ongoing process, responding to the many variables coming into play and the dynamics between them. The complexity of the issue of desertification demands an exploration of past experience before a sound strategy can be put forward.

In fact, single technically based

prescriptions have limited impact and may be self-defeating.

Farmers sometimes choose the land management option that is different from the "prescription" of the technical expert. Their decisions are driven by such concerns as: i) secure tenure; ii) access to credits and markets; iii) lack of first-hand experience with the "prescribed" technology; and iv) social and economic pressures.

#### **Experience to date**

##### *Has anything worked?*

The simple answer is yes. Data already available on 70 promising natural resource management initiatives in four countries: Niger, Mali, Senegal, and the Gambia (SHAIKH *et al.*, 1988). Many of these sites have occasionally been revisited, and several have formed the basis for larger interventions.

This section examines what has worked and some lessons that have been learned in Africa. Interventions in natural resources management at the ground level, revised and amended farming techniques, and disaster mitigation illustrate main scope and work going on in dryland management in Africa.

#### **Some significant case studies on dryland management. Facts to be learned**

##### *Operation Haute Vallee*

Analysis of more than 10 years of activity of the Operation Haute Vallee (OHV) program has contributed to significant increases in agricultural productivity and sustainable develop-

ment in an area that now incorporates 106 villages. The collection and use of animal manure has increased the efficiency of chemical fertilizer, thus enhancing the fertility of the soil while lessening the potential for environmental danger (USAID/NRMS, 1991).

General figures show that the soil fertility of the project participants has been enhanced and productivity figures suggest that the increase has been significant. Yields per hectare have increased, and the range of crops under cultivation has expanded to include rice, "gorum-gorum," and "dolique," all of which were not previously grown in the area. Increase in yield in the Koulikoro region reached values of 400 kg/ha of millet, 600 kg/ha of sorghum, and 800 kg/ha of peanuts that reached 800 kg/ha of millet, 1200 kg/ha of sorghum, and 1600 kg/ha of peanuts after implementation of new integrated "package" without farmers clearing substantial areas of new farmland (USAID/NRMS, 1991).

The success of OHV is in large part attributable to the facility with which knowledge and access to implementation has spread through the Niger valley. What started off as a pilot program in a single village has now reached out to over 100 villages via a network of extension-agent-training programs, farmer-to-farmer visits, agricultural field days, and media broadcasts. The tangible success of some farmers is the single most convincing argument of the potential of spreading innovative techniques. No longer are the benefits merely theoretical promises made by extension agents.

OHV has engaged in decentralizing rural development through the creation of local credit funds. The project was

designed to function, without government subsidies or donor funds. Work in conserving soil fertility reduced the need for frequently expensive and often unnecessary chemical fertilizers. This was a welcome relief to village credit funds. More money was now available for the funds to finance other activities, such as contour dikes, windbreaks, and agroforestry projects.

#### *The CARE Majjia Valley windbreak project*

NGO CARE has managed a windbreak project in the Majjia Valley in Niger. This Sahelian valley has deep alluvial soils and a shallow water table, but wind erosion is severe and has carried away much valuable topsoil. Crops are often sown several times because seeds or seedlings become buried or blown away. Fallow periods have become rare, with most fields coming under permanent cultivation. In this case, the specific constraints addressed by windbreaks have included loss of topsoil and soil moisture, mechanical damage to crop seedlings, and declining crop yields. Windbreaks were first planted in 1975, mostly consisting of neem trees (*Azadirachta indica*) with the later addition of some acacia (*Acacia nilotica*) along windward lines. By the end of 1988, 463 km of windbreaks had been established protecting an area of 4600 ha (ERDMANN, 1992).

Wind speed was reduced by an average of 42 percent (and up to 80 percent), leading to decrease wind erosion and evaporation and increased soil moisture (ERDMANN, 1992). Possible increases in millet yields have been observed, though studies have been inconclusive due to high variability of



yields in different plots.

Economic benefits to local people have included the sale of harvested windbreak wood (pollarding 1 km of 10-year-old trees yields 900 poles and 12 cubic meters of firewood worth \$1,307 (ERDMANN, 1992), project employment as nursery workers and guards, and increased vegetative growth of the millet stalks, which translates to increased fodder for livestock.

In hindsight, the biggest problem with the Majjia Valley project was that not enough was done to involve the local community in the establishment and maintenance of the windbreaks. A sociological study conducted in 1984-85 showed that while 90 percent of the respondents thought they benefited from the windbreaks, only 2 percent thought they owned the trees (ERDMANN, 1992). Sustainability has also been an issue, and doubts have been raised as to whether windbreak establishment and management can survive after external funding ceases. A serious question therefore still remains on whether cash receipts from the sale of windbreak products will be enough to sustain this infrastructure in the long run.

#### *Forest and land use planning project*

Guesselbodi National Forest in Niger has been the site of a promising natural forest management initiative included in the Forest and Land Use Planning Project (FLUP)<sup>3</sup>. In 1981 this forest was considered as one of its model sites. The forest was severely degraded at the start of the project: 40 to 60 percent of the total vegetative cover had disappeared between 1950 and 1980 (ERDMANN,

1992). The recuperation initiative was based on local participation in forest management from the start and on the use of forest resources to generate income to pay for the management. Wood was harvested from live woody perennials, and livestock was excluded from a newly cut plot for three years. Plots were also improved by constructing physical contour barriers on slopes. Villagers harvested grass from the protected plots and sold it as hay. A wood-cutters cooperative was later formed, and proceeds generated by wood-cutting and grazing permits were deposited into a forestry fund and paid for recurrent management costs. The Government of Niger agreed to reduce permit fees for wood coming off managed land. Cut wood was sold to the cooperative, which then sold the wood to traders. The profits (ERDMANN, 1992) were divided between the forestry fund (75 percent) and the cooperative (25 percent).

Some of the techniques used in the project - mulching, physical contour barriers, and microcatchments - achieved positive results. Fifty percent survival of seedlings was reported in 1984 with only 233 mm of rainfall. Managed tree cutting proved effective (3 meter coppice shoots were recorded from *Combretum nigricans* stumps cut a year earlier), and rapid regeneration of grass occurred in protected plots. The latter convinced villagers that controlled management of the forest was beneficial, and by 1985 the number of livestock caught in protected plots had significantly decreased (ERDMANN, 1992).

Despite its achievements, Guesselbodi faces potential problems. The harvesting of wood on a relatively short rotation, and the annual harvesting of grass, could

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<sup>3</sup> Funded by the USAID

have negative long-term effects. Also, sustainability is again uncertain: some doubt exists as to whether revenues generated from fuelwood sales can sustain the cost of fully rehabilitating a given plot. Financial management of the cooperative still requires outside assistance, revenues from the forestry fund have yet to be disbursed, a grazing plan amenable to all concerned has not been devised, and women have largely been excluded from project activities (ERDMANN, 1992). But, at this time, one fact stands out: the Guesselbodi National Forest is more densely forested than it was 10 years ago, the composition mix is richer, and revenues from the management are substantially greater.

Before the FLUP project in the Guesselbodi forest in Niger began, forest resource policy decisions were tightly controlled by the Nigerian Government Forest Service. Commercial exploitation of a national forest such as Guesselbodi was prohibited, and cultivation was permitted only by contract, while livestock enjoyed unrestricted use of the land. This was at odds with local people, who, due to a lack of resources and incentives, could not curtail their overexploitation of the forest resources. The results of the FLUP project induced the Forest Service to alter its policy at Guesselbodi. This realization later led the Nigerian Government to alter its Rural Code (McGAHUEY, 1993).

#### *Rural and forestry code reforms*

Both European and North American based institutions, namely USAID, have promoted the reform of rural and forestry codes in Niger, Guinea-Conakry and Senegal so that they may reflect sounder natural resources management

principles and may encourage conservation through sustainable use at the local level (McGAHUEY, 1993; Sardinha, 1998). The Land Tenure Center at the University of Wisconsin, has advised the Nigerian Government in its overhaul of the rural code, passed into law in 1992.

Major issues in the reforms included: **i)** decentralizing policy making and management; **ii)** allowing private initiative; and **iii)** permitting some sustainable use instead of human-exclusive conservation. The FLUP project in Guesselbodi had broken strict land use policies being carried out by the Nigerian Government. The successes at Guesselbodi then encouraged the reforms in these policy areas of the rural code.

#### *The Senegal reforestation project*

The Senegal Reforestation Project was initiated in 1988 with the support of the University of Wisconsin (Land Tenure Centre). The project contained a matching grant component designed to mobilize rural communities, farmers, and economic operators to invest in reforestation. This component established agreements to provide reimbursement funds to individuals or groups who had undertaken a forestry activity with some degree of success. Individuals and groups were reimbursed as a means of defraying costs incurred during the reforestation activity. The amount depended on the level of success of their efforts: the number of living trees after the first year of the activity. The program was implemented through forestry extension agents, who worked directly with local groups and individuals, with support of the project.

Although the project is still in progress the results of the monitoring survey completed in 1991 (TIMBERLAKE, 1992) showed that the matching grant program appears to be having a positive impact on changing forestry-related perceptions, knowledge, and practices. Village respondents to the survey indicated that they participated in the program for the later economic benefits of the sale of forest products (60% of those surveyed) rather than home consumption (40%). Men participants found the greatest use of the money as a financing source (43%), while 50 percent of the women stated that they spent the money for family living expenses (TIMBERLAKE, 1992).

Main constraints found were related with water limitations to guarantee nursery work or seedling survival which demanded modifications in the project implementation. Thus, related activities in addition to matching grants were considered. For instance, funding for wells was partially provided if it could be demonstrated that a significant reforestation activity, such as a nursery or plantation, would be undertaken. The forestry agents have a very influential role in advising the project's participants, yet they are hampered by problematic transportation to project sites. They play a large part in decision making regarding the reforestation and matching grant activities. As the key to the program's success, the agents need further training and more mobility to better help participants achieve their forestry goals (McGAHUEY, 1993).

## **Strategies for natural resources management in Africa**

### *Agenda 21*

Most forest development interventions in the arid and semi-arid zones, namely in the Sahel, have been based primarily on two inter-related concerns: a concern about desertification or environment degradation on the one hand and a concern about meeting the energy needs of populations on the other hand. Given the fuelwood is the energy source used by overwhelming majority of that population and that forestry has been viewed as having a special role to play in the battle against drought and desertification, trees have stood at the centre of both these concerns.

So far as formal sector strategies and planning are concerned, a distinction needs to be made between the national and regional levels. At the national level, a careful formulation of strategy or delineation of a sector plan has, until very recently, been the exception than the rule. Even now, and in spite of FTAP, reliable data upon which sound planning must be based has been unavailable and plans, to the extent that they existed, have consisted primarily of a listing of projects for which external funding has been sought. There has been, and in some cases continue to be, an uneasy balance between what National Forestry Services thought ought to be done and what particular donor organizations were willing to fund.

At the regional level, CILSS have been active in the development of formal sector strategies since its creation in the

mid-1970's. A series of regional meetings, involving Forest Services representatives along with expatriate advisors and donor organizations, has wrestled with questions of what should be done and how. Notable among these:

- CILSS/UNSO/FAO consultation in 1976 on the Role of Forestry Rehabilitation Programme for the Sahel (CILSS, 1976);

- the CILSS preparation of a Programme Régional Pour la Satisfac-tion des Besoins en Produits Forestiers et de la Lutte Contre la Désertification au Sahel (CILSS, 1977);

- the CILSS Forestry/Ecology Working group Meeting in Niamey (CILSS, 1979);

- the CILSS /UNSO/Clube du Sahel meeting in Dakar which prepared a desertification Control Programme for CILSS Member countries integrating elements of previous proposals and adding elements of the UNEP Action Plan (CILSS/UNSO, 1979).

Many others took place around the subject and strategies proposed had been diverse and equally disparate. Common themes have revolved around four principal themes: increasing production of wood and wood products with primary attention to fuelwood, reducing consumption, improving utilization, and developing alternative energy sources with an emphasis on renewable resources.

A common feature of failures shows that most of the strategies failed to recognize cross sectorial characteristic of the forest sector, antagonism of target populations with the Forest Services coupled with a failure to adequately review and reform forest policy and legislation prior to launching rural forestry programmes. There was at the

same time a lack of perception to understand that environment degradation and reduction of natural resources base is very much tied up to poverty and lack of integrated development strategies.

The first priority in combating desertification according to Agenda 21 of the United Nations Conference on Environment and Development (UNCED) should be "the implementation of preventive measures for lands that are not yet degraded, or which are only slightly degraded. This is recognised in the United Nations Plan of Action to Combat Desertification. In combating desertification and drought, the participation of local communities, rural organisations, national governments, NGOs and international and regional organisations is essential" (UNEP, 1992a).

Any strategy for combating desertification should include an approach for monitoring, capturing, processing, analysing, archiving, and disseminating data and information believed relevant to the process. Support for research that helps to identify the relevant data should also be included in that strategy. Most important, the strategy should be grounded on the fact that ultimate success or failure depends on the natural resources management decisions made by hundreds of thousands of farmers, herders and woodcutters, as they pursue more secure and prosperous livelihoods. For this reason, antidesertification programs need to be based on an ever-improving understanding of how these individuals make management decisions.

Prescriptive approaches based solely on technical considerations should be avoided. It is believed that appropriate technical knowledge may reside more

with those who have experience managing the land and less with experts from the outside. Nomadic herdsman of Sahel region may be better managers of the land than the farmers in water areas to the South and may also know more about dealing with pastoral land-use problems than they are given credit for by scientists from developed countries.

*Desertification as addressed under donor agencies*

### Strategy

In the area of desertification, a sufficient range of technically proven and economically attractive natural resource interventions is available to halt the decline of rural production systems in arid and semiarid lands in Africa. Better technological packages can and should be developed, but there is wider consensus that technology is not now the limiting factor.

A much larger development challenge is to bring about widespread adoption of the appropriate technologies. Much of this experience already available should be applicable in Africa once institutional and the socio-economic factors of local communities are taken into account and the recipients' participation is included all the way from project design to evaluation.

There is a large consensus that donors and the public sector have an important role to play in training and outreach to: **i)** make viable approaches available to smallholders; **ii)** provide technical assistance during initial phases; and **iii)** ensure cost-sharing where direct benefits are insufficient to bring about participation but where high environmental benefits warrant priority allocation of limited public budgets.

Experience available indicates that two broad strategies are essential. That is:

**1. Spread existing technologies.** The highest priority at all funding levels should be the deployment of existing technologies that have positive and financially attractive impacts at the farm and/or village levels and that help to meet criteria necessary for a sustainable system. Deployment of existing technologies and strategies by local supportive NRI's (National Research Institutes) and prepared man-power have been observed to have substantial and enduring impacts on the capacity of farmers to produce food, forage, wood, and other products. Farmer acceptance appears to be as dependent on risk reduction as on the potential for yield increases. Opportunities to earn cash income that reduces economic risk can be a powerful motivating factor. This is a very important element when discussing internal research priorities.

**2. Increase the productive potential.** At the medium and higher funding level, research should be supported that reduces risks and increases efficiencies of higher yielding technologies and germplasm. Field evidence strongly suggests that the efficiency of higher yielding technologies and germplasm will be increased when existing methods of soil and water conservation and fertility improvement have already been applied.

### **Essential elements for success**

#### *Focus and definition*

"Desertification" as a topic has been a major discouragement to multilateral and bilateral donors--mostly because the

term was earlier seen as a general catch-all, including virtually anything related to drylands, drought, famine, environmental, refugees, and so forth.

As referred in a recent report by the ODA<sup>4</sup>, "In the last five years, the terms of the debate have changed from 'combating desertification' to 'improving natural resource management in dryland regions.' This is more than just a change in terminology, and helps shift attention to the institutions responsible at local and national levels for managing how natural resources are actually used" (TOULMIN, 1992). The focus must be on the prevention of desertification rather than on providing technical fixes to areas already desertified. The cost of restoration is many-fold greater than the cost of proper land management (Figure 1).

A fresh start is clearly needed. To begin with interminable discussions of what is meant by "desertification" should be avoided. It is assumed that the definition used will be that developed and used at UNCED. The next step would be to ensure that everyone involved (host countries, NGOs/PVOs, international organisations and donors) would be willing to look again at the goals and objectives within country programs and that they would do so in a much more realistic way than in the past.

Plans to combat desertification must be based on sound science that recognises that natural resources although renewable are finite (not inexhaustible), have intricate interrelationships, and are integrally linked with the well-being of the rural producers. Also, plans must be strategic and they should be developed with a

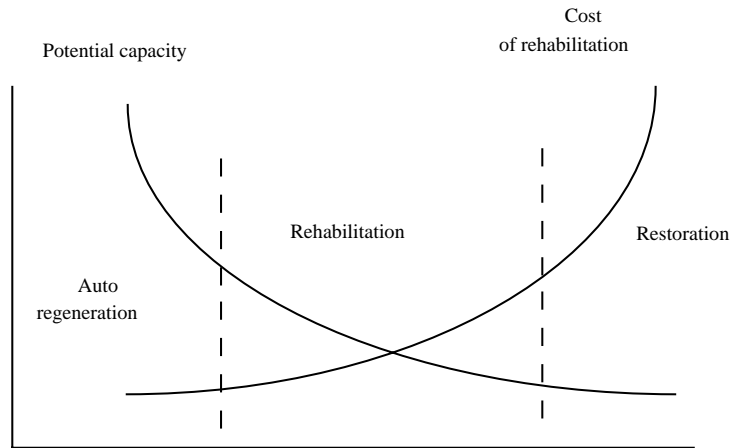
vision and a clear definition of the limiting constraints. An honest assessment must be made of financial and physical capabilities and the limits of the natural resources affected. Plans must focus on real problems and issues which should be evaluated holistically. Proposed uses must match the ecosystem within which they are located, avoiding not proven and tested technologies (technical and economical feasibility as well socially acceptability).

It is extremely important that implementation be kept in focus from the beginning of the effort. Management prescriptions and mitigation measures proposed must be placed within the cultural background and values of the population and groups who have a vested interest in the plan to assure that proposed actions are realistic and implementable. It is considered critical for any intervention success the holistic treatment of the problem and the understanding of the interrelationships with the social system (Figure 2).

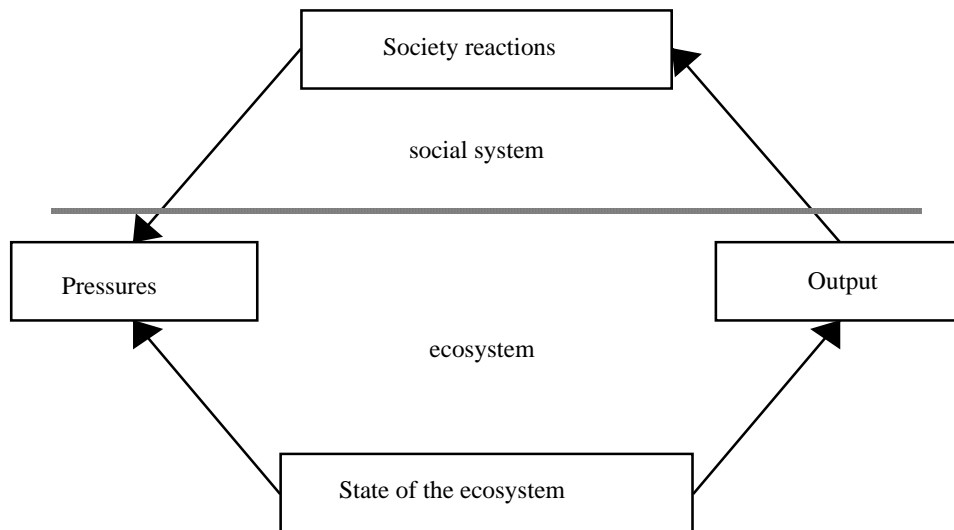
To understand those factors which cause landscape changes in both physical and biological ecosystems, controls must be duly understood (i.e., temperature and precipitation regimes, migrations and competition). In certain ecosystems, disturbances such as fires may have been a part of the original system. It is also important not to underestimate the ability of systems to restore themselves, just as it must be realised that natural systems have buffering capabilities for disturbances. But if the natural resources are overused, the buffering capabilities suffer and the system is eventually lost.

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<sup>4</sup> Overseas Development Administration, U.K.



**Figure 1** - Conceptual representation between the intensity of exploitation and the cost to recover (adp. from MAINI, 1992)



**Figure 2** - Diagram illustrating the interrelationship of forest management and the social system

### *Empowerment*

Previous approaches towards desertification have traditionally involved a set of top-down directives, plans, and interventions. The early effort at establishing a Plan of Action to Combat Desertification (PACD) was often viewed as a plan expeditiously designed by a "chosen few." By UNEP's own admission, the early PACD process in Africa did not work. Why? An external evaluation of the PACDs designed over the period 1978 to 1989 concluded that **their failure was due in part to shortcomings of the PACDs themselves -- notably their lack of focus and their omission of socioeconomic factors** (UNEP, 1992b).

In reply, UNEP pointed out that the shortcomings of the PACD process were also due to the fact that almost all agencies involved (donor governments, intergovernmental organisations, aid agencies, and NGOs) "failed to accord high priority to restoring degraded land" and "tended to favour agricultural projects, as a means of reversing desertification." This is done in spite of strong conviction that aside from family planning, few activities can contribute more to the evolution of a sustainable society than planting trees. UNEP felt that, even when the land resource base was fast being depleted by degradation, these same agencies were reluctant to fund programs in pastoral areas where nomadic or semi-nomadic peoples were rapidly degrading rangeland by overgrazing (UNEP, 1992b).

At this point, it is believed that a more productive approach is needed. To begin with, to help empower regional and village-level groups, a more participatory, more transparent method should be used in the country planning

stage. Due to funding processes and elections, government programs usually are necessarily of short duration. If implementation is to be completed, it is extremely important to obtain local commitment and support of the vision and long-term objectives involved. It is believed that any reasonable plan to create conditions for ecosystem rehabilitation and research capability in Africa needs a 20- to 25-year planning horizon for investments (CHRISTENSEN, 1994).

*Coordination and cooperation to avoid duplication of effort* (e.g., National Environmental Action Plans)

Basically, the NEAP is an in-country demand-driven process, based on considerable local participation and is intended to provide a framework for integrating environmental considerations into a nation's economic and social development. It aims to define a time-bound plan that outlines environmental policy needs, institutional and legal reforms, corrective measures to ongoing development programs, and new investment programs needed in the environment sector.

USAID, working with the World Bank and other multilateral and bilateral donors, has provided the initial impetus and stimulation to the development of many of the NEAPs in African countries.

In regard to desertification, the coordination of the national effort towards dryland management has already been recognised by the United Nations Environment Program (UNEP, 1992b) and Agenda 21 (UNEP, 1992a). In both cases, it is cited as an important step in focusing the limited resources available to help in resolving problems in the



desertification sector. This co-ordination could be achieved by incorporation of the national PACD into the NEAP process. The NEAP, in turn, would especially be useful in providing a framework within which NGO/PVO and regional/village level participation would be encouraged. The NEAP process would also encourage the kind of local ownership that is needed and called for in Agenda 21. **Decision makers and land users need to bond and work together, but this can only be done if there is co-ordination and co-operation from the beginning of the planning process through implementation. Scientists and donors also need to be involved from the beginning.**

Given the nature of desertification process and the fact it cuts across all sectors of the economy, successful interventions demands improved sharing of resources between existing national and international organisations interested in the issues. This sharing of resources could include exchange of personnel and data, joint conduct of research and development projects, and other co-operation. For instance, there are already existing facilities/institutions, with multilateral financial arrangements such as the AGRHYMET Regional Centre in the Sahel, which are already an integral part of weather and climate services.

#### *Policy reform and structural adjustment*

Experience demonstrates that it will take 20 years or more before impacts from successful programs become visible on a large scale. Thus, a long-term commitment is needed. New approaches and the flexibility to adapt goals to new opportunities, as these arise, are important contributors to success.

The obstacle is more often the time needed to bring about participation, rather than the time needed to realise benefits once a technology has been implemented. **It is the human, and not the technological, dimension that takes time.** Adaptation of technologies, and incentive systems to spread them, has often been a slow process. The minimum time horizon is commonly estimated to be 20 years in the Sahel (THOMAS and GAUDET, 1993).

Policy reforms need to begin with some fundamental understanding of the values that the policy is meant to promote. In the case of desertification, the main values question is "Productivity defined how and for whom?" If "productivity" is defined only from the perspective of current human group users, for example, there is still a question of which human group users are being favoured. The commercial (sometimes export-oriented) livestock sector may be favoured by one kind of policy, and the subsistence, self-sufficient pastoralist sector favoured by another kind of policy (McGAHUEY, 1993). There is also the question of arid land biodiversity. Although species diversity is lower in arid lands than in the rainforests, arid land species are no less unique or with lower potential for human use and benefit. They are also normally more threatened than rainforest species because higher human and animal pressures. To protect biodiversity, a different standard of "productivity" is eventually needed, and this should be reflected in conservation and prescriptive measures in the policy.

In market economies the basic philosophy concerning resources management is that those who use a natural resource should pay for that use.

If in the process of using a resource, there is degradation of a capital asset, the user should pay. Conversely, if there is improvement of a capital asset, the user should receive credit. It is evident that current level of economic development and poverty creates cruel contradiction to arid land's people: to survive to day they must drive their farming systems to "eat" ever-increasing amounts of forest, thereby negating the possibility of those some farming systems contributing to their future survival. Although the principle of payment for those who use makes ecological and economic sense, poverty prevents its wider application as an instrument of policy.

Policy reforms need to recognise that degradation of natural resources on arid and semiarid lands is not linear. There are thresholds that when crossed will never allow for a return to the original condition. Thus, it is important to establish baselines and a threshold that degradation must not pass.

As new policies are being developed, the full cost of the proposed action needs to be taken into consideration. This includes direct and indirect costs. Intrinsic values of soil, water, and other natural resources also need to be considered, along with a recognition that they are finite and have significant interrelationships.

Incentives need to be created to promote teamwork and good stewardship of the land and natural resources. Incentives that cause misuse of natural resources should be eliminated in the ongoing process of development or at least minimised.

More diverse, less intensive farming practices should be encouraged, as should more nomadic herding of less destructive livestock be harmonised with

communal-property systems that are very widespread. The creation of communal-property rights consistent with traditional and neo-traditional practices has a better chance of success than "top down" solutions in addressing "commons" problems. The legal specification of user rights at the community level lowers management costs and helps solve implementation problems. However, there has been little progress in integrating community-level with governmental-level management resources. Access limitation and the allocation of exclusive rights in the commons is a zero-sum game in terms of rights-to-use. As some anthropologists have pointed out, there are not only "tragedies of the commons" but also "tragedies of the commoners", when inequities and losses occur with privatisation of resources (McCAY, 1984). The real issue is no longer the feasibility of communal systems but rather if and how they can be viable in the contemporary world. So, some form of land tenure appropriate to the local socio-economic circumstances must be provided to the users. Incentives must be provided for good stewardship, and those incentives that result in misuse of natural resources should be minimised or eliminated.

#### *Application, extension, and transfer of appropriate technology*

Applicable data must be obtained and used to establish the parameters of the program and to make informed decisions about the existing circumstances and the impacts that will result from implementation. Technology transfer to the users is essential to improve their understanding and make them more able

participants in the planning process and implementation.

One example is in the area of remote sensing. Increased local access could be provided to the U.S. National Oceanic and Atmospheric Administration's (NOAA's) Advanced Very High-Resolution Radiometer (AVHRR) data, as well as data from the appropriate geostationary environmental satellites. The successful utilisation could be accomplished through the development of low-cost ground stations for these data, placed in existing or new governmental or multinational facilities in each country. Such data could be readily shared between potential users within and outside the country. UN agencies or intergovernmental agreements could help provide international compilation and sharing of such data for the benefit of humankind. The NASA<sup>5</sup>, with USAID funding, has used NOAA's AVHRR data to determine the rate of expansion and contraction of the Sahara Desert. This analysis could have major policy implications or help the implementation of preventive resources toward combating desertification. From the satellite data, NASA calculated a normalised difference vegetation index (NDVI) for an area of the central Sahara as well as along the desert's southern boundary and the Sahel. NASA plotted the vegetation variation by year to determine changes in vegetation productivity. For 1980-90 alone, it found great variation in biomass productivity over time and space, indicating that some fluctuation is normal. This variation suggests resilience on the part of the Saharan-Sahelian transition zone,

but the data remain inadequate to answer some larger questions concerning desertification. Decades of study will be required to determine whether long-term expansion or contraction is occurring (TUCKER *et al.*, 1991).

The USAID-funded Famine Early Warning System (FEWS) project is currently compiling NASA data toward a multi-decade record of greenness in the Sahara. FEWS gathers primary data from other sources (such as AGRHYMET) to monitor the incidence of ecological stress and the economic costs of land degradation (OLSSON, 1993). Though the main users of this information at the moment are donor groups, ways need to be explored in which FEWS's work could be made more extensively available for wider application toward better resources management at the local level.

*Technical assistance and guidance at the grassroots level*

The promotion of sustainable and broad-based economic growth is often seen by donor agencies as one of their overall objectives. This kind of growth is essential in reversing the overall decline in the quality of life that has come as a result of economic, political, and social downturns. This deterioration has adversely affected many of the poorest of African countries, which are often those most affected by desertification.

In addition to sustainable growth, another common goal of donor agencies is the support of natural resources management strategies that design, support, and implement programs that will lead to sustainable increases in agricultural productivity and hence personal incomes, especially at the local level.

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<sup>5</sup> United States National Aeronautic and Space Administration

This approach is not at odds with the view that capital development, tree plantations, the set-aside of range areas, etc., are solutions. In essence, proper land management is the key. But, unless the technical assistance to avoid and, where feasible, to reverse the effects of desertification are carried down to the grassroots level - and unless all concerned are willing to take an honest approach to what is needed, what is possible, and what resources are at hand - no approach will succeed.

**Education is the key to success.** This includes education at all levels of government, as well as of the users and donors. There is an evolutionary process to changing traditional uses. Thus, early introduction to the vision is extremely important.

Often, large and expensive technical "fixes" do not work.

Small pilot efforts that show short-term accomplishments have a better chance of gaining local support and therefore improve chances of succeeding in the long-term. Additionally, they provide less costly opportunities to learn from mistakes and to refocus the direction of the effort. Remedial measures must be designed so that they are supportable by local expertise and technology unless outside funds are available in quantity and over a long term.

#### **Monitoring, evaluation, and mitigation planning based on indicators**

It is no secret that many bilateral and multilateral aid agencies were reluctant to fund the earlier antidesertification movement, because it seemed at the time like an unending, unrewarding task. However, there are many instances

where people living and farming in arid and semiarid regions have succeeded even during the severe periods of drought in the 1980s. These are well documented (SHAIKH *et al.*, 1988). No matter what strategy is decided on to ensure the flow of donor funds in this sector, those people presently involved in antidesertification measures must receive credit for progress to date, in order to maintain any sort of credibility.

It is also important to note that much of the early information data base in this sector is unreliable or too generalised to be of use. It is gratifying to see that the information used in the recent UNEP report on the PACD (UNEP, 1992b) was taken from the GEM/GRID 1991 data base. This data base may prove to be much more useful in carrying out regular reviews and updates than the earlier, more general data systems. In addition, this approach will go a long way toward informing the general public of progress in the area of desertification. Clear, timely, and relevant information is necessary in securing "broad-based public participation... essential to implementing the PACD." (UNEP, 1992b). Involvement of local people in data collection gives them a sense of ownership and adds local credibility to any assessment results.

A holistic approach to monitoring and management is also necessary. One species surviving within a dryland ecosystem should not be relied on as an indicator of health. On the other hand, if several key species are used at low levels of monitoring, caution must be expressed about the reliability of the results. It should be borne in mind that benchmark soils and sites often reveal trends before they occur on other sites. Therefore, monitoring and management for all

actions must consider the entire ecosystem that may be affected. It should be reiterated that the value of natural resources lost as a result of an action should not be greater than the value received as a basis for that action. Thus, a threshold should be established that determines when the action should take place and when it should not. These principles are valid for both developing countries and Portuguese vulnerable systems.

There should be improved international collaboration in interdisciplinary monitoring and in setting realistic and feasible criteria and indicators. Countries located in arid and semiarid lands vulnerable to desertification should better co-ordinate their analyses of cultural behaviour and environmental conditions with other nations on desert margins. Here, the international agencies could play an increased role. Developing countries should continue to exert pressure on international organisations or nations that have complementary resources in statistical analysis and satellite-based data analysis. In addition, measurements through a network design can be most beneficial, cost effective, and the least controversial in an international resource management program. Local, ground-based, low-cost monitoring of resource trends and conditions can often make remote sensing data more interpretable.

UNEP has set of interventions for the next 20 years in the area of desertification. These will be accompanied by targets for support measures along with practical measures at the field level to achieve these targets (UNEP, 1992b, pp. 48-61). It must be remembered, however, that the problem of desertification is **"a problem that cannot be solved once and**

**for all ... we are dealing with a process that will generate new problems to be tackled once the more urgent ones have been dealt with"** (UNEP, 1992b).

In this regard, two more steps are needed in the desertification sector interventions that were not discussed in any detail in Agenda 21. Specifically:

1. Realistic benchmarks should be assigned to the above targets at country level, along with indicators of progress that are achievable.

2. Provision of a "feedback loop" must be made to ensure that country governments and donors react to the benchmarks and indicators. Thus, if particular project activities are not achieving the targets set, or if the indicators show there is some impact, the project activities should be modified or a course correction in a given program carried out.

Because desertification is a process, it is all the more important that realistic benchmarks and indicators of progress accompany the above targets. Otherwise, there will always be calls for an "increased international effort" to resolve the problem.

Setting realistic benchmarks and designing effective indicators is a difficult task in any field but is especially difficult in the natural resource management sector. For example, Target "e" under the support measures states, "Making land users the main actors in designing and implementing the Plan and ensuring full public participation in antidesertification campaigns" (UNEP, 1992b). This is an intriguing and exciting target. But, unless the national governments and donors involved can demonstrate progress in this direction, and can clearly show that particular

levels of participation have been achieved, there will be little momentum to maintain support.

### **Recommendations by interventoring category**

A host of successful interventions have demonstrated that the following techniques often can easily be incorporated into new or ongoing project interventions (SHAIKH *et al.*, 1988):

- Soil fertility improvement: Focus resources on supporting regeneration of field trees, on manure management, on mineral fertiliser, and on improving *rhizobium* adaptability.

- Soil and water conservation: Extend actions that reduce soil erosion and that increase the soil's capacity to retain available water.

- Maintaining vegetative cover: Support establishment and maintenance of a permanent cover of woody perennials.

- Training and human development: Increase the capacity of personnel to manage soils and vegetation, encourage linkages across sectors, and support advanced training of personnel capable of establishing priorities and plans for management.

- Sectorial collaboration: Use diversified aid portfolios to encourage collaboration.

- Focusing resources on strategic goals: Promote host-country and multi-donor agreement on strategy objectives over a 20- to 30-year time frame, and also promote creation of a more structured co-ordination process for monitoring of progress and allocation of scarce donor and government resources.

- Resource tenure: Work to establish clearer and more secure tenure systems.

- Tax incentives: Support policies to reflect the long-term economic costs of replacing dwindling wood supplies.

- Financing natural resources management: Encourage the creation of "revolving funds" managed at local and village levels to provide credit to small farmers for improved management. Include training in enterprise and credit management.

- Contingent incentives: Provide cash or other incentives-contingent on implementation of a package of natural resources management activities.

- Soil fertility research: Support agroforestry and manure management research, as well as mineral fertiliser research to complement agroforestry and manure management; link it with water-conserving research.

- Soil and water conservation research: Emphasise contour dikes, late season ploughing, and windbreaks.

- Vegetation management research: Findings on the carrying capacity of natural vegetation will be extremely important in establishing principles for local resources management.

From the themes that cuts across the initiatives described above, the following strategy guidelines can be drawn:

- Provide clear, consistent policy signals on resource tenure, local management rights, national political support and mobilisation, prices, and access to credit;

- Focus on incentives for local participation. Offer a range of technical and socio-economic options and allow for flexibility and adaptation;

- Use local trainers and interme-

diaries, who are more efficient and cheaper than outside agents;

- Use "model farmers" and resource managers to provide strong and positive demonstration effects;

- Assure a stable, long-term commitment to the natural resources sector. The rural economy is changing rapidly, and short-cycle projects fail to capitalise on those changes. Abandoned projects have a negative demonstration effect;

- Constantly validate assumptions about the development process;

- Consider how rural producers make management decisions, and take this into account with any prescriptive technical plans;

- Set realistic benchmarks and indicators of progress. Unless the national governments and donors involved can critically demonstrate progress in this direction, and can clearly show that particular levels of participation have been achieved, there will be little interest in the future in plans to combat desertification.

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