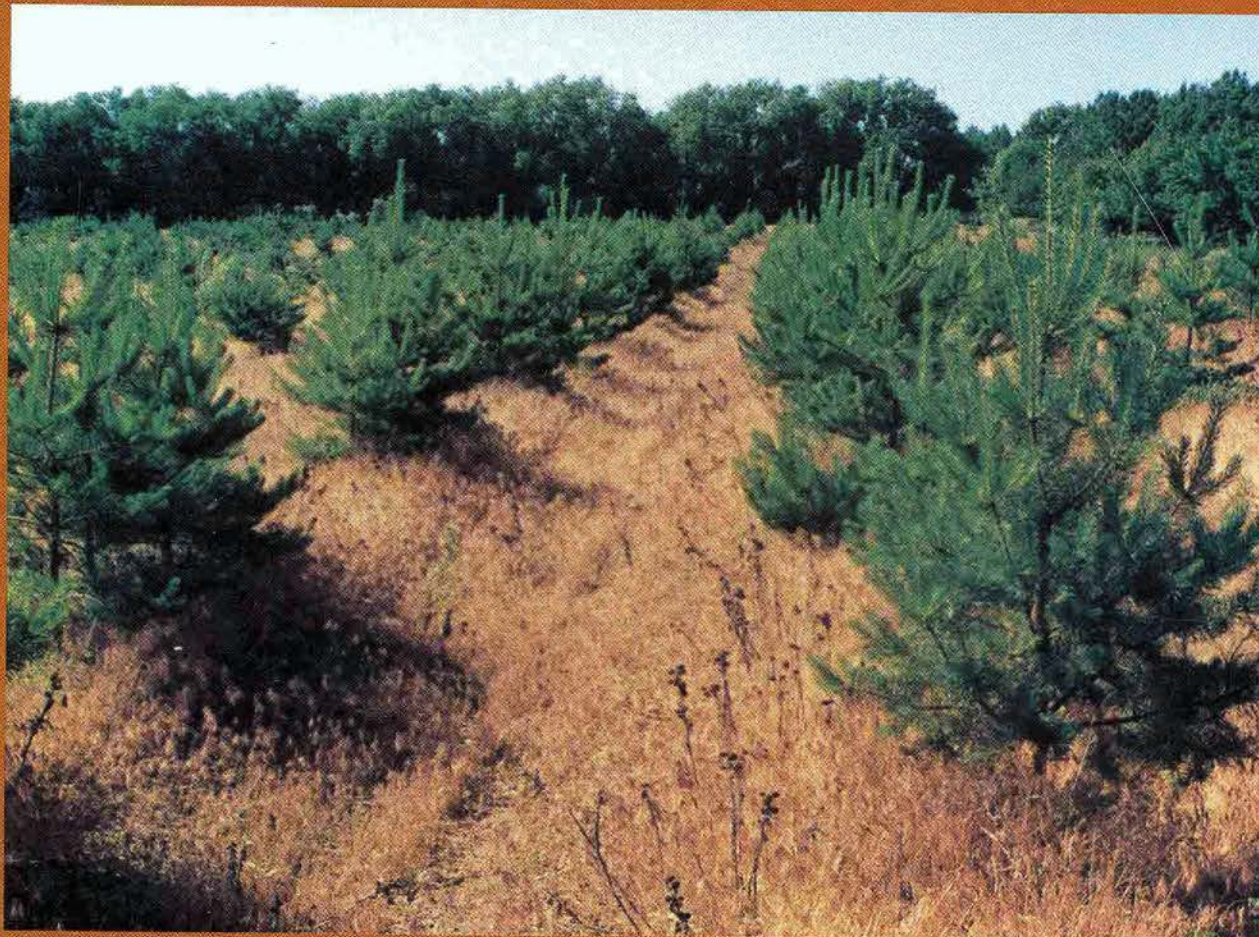


Desertification Control Bulletin

A Bulletin of World Events in the
Control of Desertification, Restoration
of Degraded Lands and Reforestation

Number 31, 1997

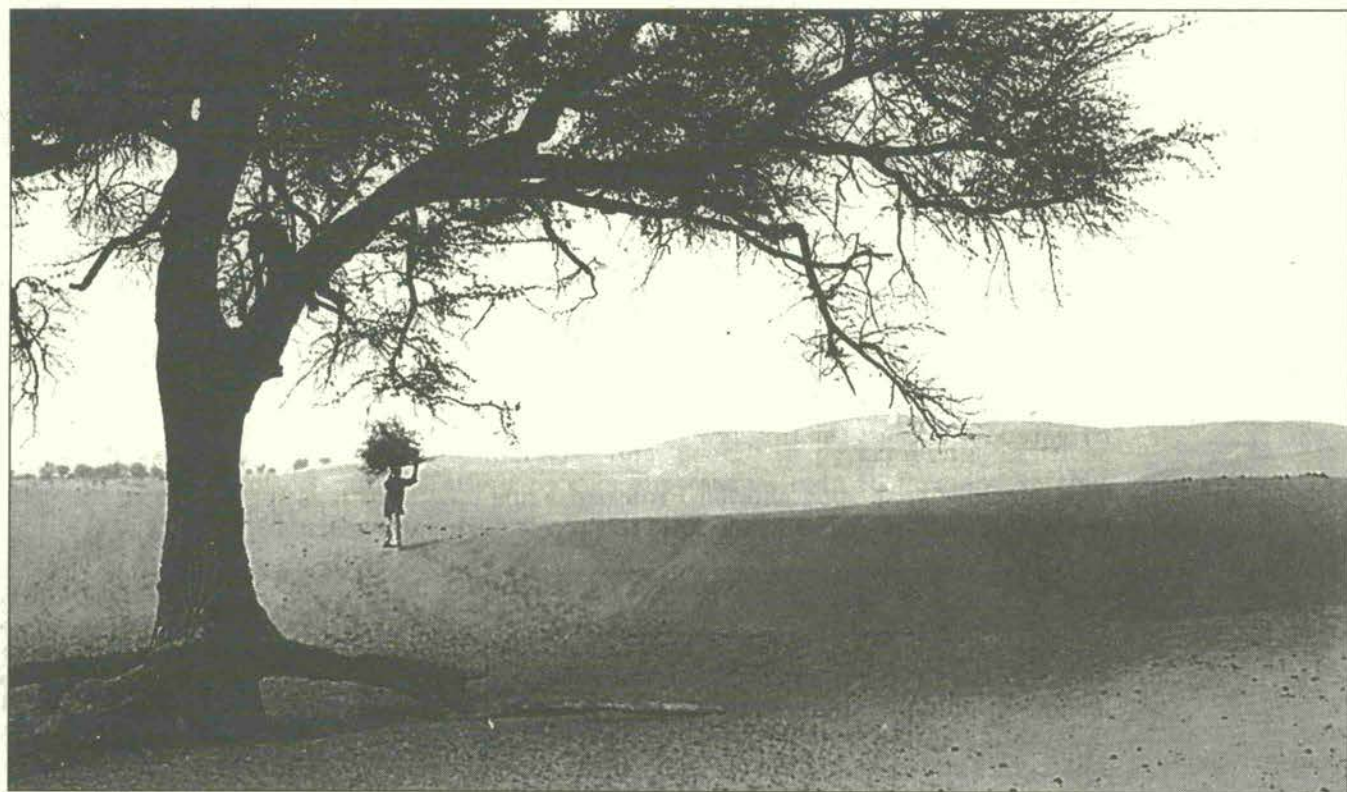


Desertification Control Bulletin

United Nations Environment Programme

Number 31, 1997

Photo: Joran Fries, Sweden



In the Sudano-Sahel protective vegetation has often disappeared and there is a risk of sand dune formation and encroachment

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Cover: Integrated land reclamation technology for desertified areas developed by YNIALMI, Volgograd region. Photo: Leonid Kroumkatchev, UNEP

The United Nations Convention to Combat Desertification (CCD) which came into force on 26 December 1996, lays out new measures to be undertaken by governments of affected countries and by those in a position to help. It is a comprehensive treaty, with an innovative participatory approach aimed at involving all stakeholders.

The core of the Convention is the development of national, sub-regional and regional action programmes to combat desertification. National action programmes are to be developed by governments in close cooperation with donors, local populations and non-governmental organizations (NGOs). In contrast to many past efforts, these action programmes must be fully integrated with other national policies for sustainable development. They should be flexible, able to be modified as circumstances change.

For this approach to work it is essential that people at all levels are aware of the strengths of the drylands, as well as the causes and mechanisms of desertification and of possible solutions to the problems. Accordingly the UN-CCD emphasizes the increasing need to raise awareness and knowledge of dryland issues globally, particularly among government decision makers, affected and non-affected community groups, donors, international partners and the general public.

The UNEP Governing Council (GC. 19/17) requested that the function of UNEP/DEDC-PAC be maintained as a global centre of excellence on desertification control, promoting cooperation and the coordination of worldwide efforts to combat desertification, and advised UNEP to concentrate its efforts on the following:

- (a) The development, jointly with partners, of appropriate indicators on land use and quality as part of an updated assessment methodology for drylands and desertification control;
- (b) Increasing awareness of desertification and drought issues, and disseminating targeted information materials to a broad range of media and the public;
- (c) Continuing to contribute to the implementation of the Convention and intensifying support for activities in Africa, Asia, Latin America and the Caribbean, at all levels, particularly in the preparation of national, sub-regional and regional action programmes.

One of the main aims of the bi-annual Desertification Control Bulletin is to disseminate information on, knowledge of, desertification problems and to present news about the programmes, activities and achievements in the implementation of the CCD around the world. Articles published in the *Desertification Control Bulletin* do not imply the expression of any opinion on the part of UNEP concerning the legal status of any country, territory, city or area, or its authorities, or concerning the delimitation of its frontiers or boundaries.

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The Editor of *Desertification Control Bulletin* is seeking photographs for consideration as bulletin covers. All submissions should be addressed to the editor at the above address.

Technical requirements

Photographs must be colour transparencies of subjects related directly to desertification, land, animals, human beings, structures affected by desertification, control of desertification, reclamation of desertified lands, etc. Submissions must be of high quality to be enlarged to accommodate a square 18 cm x 18 cm (8 in x 8 in).

Captions

A brief caption must accompany each photograph giving a description of the subject, place and country, date of photograph and name and address of photographer.

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Articles

Desertification Control Bulletin invites articles from the world's scientists and specialists interested in the problems arising from or associated with the spread of desertification.

Audience

The bulletin addresses a large audience which includes decision makers, planners, administrators, specialists and technicians of countries facing desertification problems, as well as all others interested in arresting the spread of desertification.

Language

The bulletin is published in English and Spanish. All manuscripts for publication must be in English.

Manuscript preparation

Manuscripts should be clearly typewritten with double spacing and wide margins, on one side of the page only. The title of the manuscript, with the author's name and address, should be given in the upper half of the first page and the number of words in the main text should appear in the upper right corner. Subsequent pages should have only the author's name in the upper right hand corner. Users of word-processors are welcome to submit their articles on diskette in MS-DOS format, indicating the programme used.

Metric system

All measurements should be in the metric system.

Tables

Each table should be typed on a separate page, should have a title and should be numbered to correspond to its point in the text. Only essential tables should be included and all should be identified as to source.

Illustrations and photographs

Line drawings of any kind should each be on a separate page drawn in black china ink and double or larger than the size to appear in the bulletin. They should never be pasted in the text. They should be as clear and as simple as possible.

Photographs in the bulletin are printed black and white. For satisfactory results, high quality black and white prints 18 cm x 24 cm (8 in x 10 in) on glossy paper are essential. Diapositive slides of high quality may be accepted; however, their quality when printed black and white in the bulletin cannot be guaranteed.

All line drawings and photographs should be numbered in one sequence to correspond to their point of reference in the text, and their descriptions should be listed on a separate page.

Footnotes and references

Footnotes and references should be listed on separate pages at the end of the manuscript. Footnotes should be kept to an absolute minimum. References should be strictly relevant to the article and should also be kept to a minimum. The style of references should follow the format common for scientific and technical publications; the last name(s) of the author(s) (each), followed by his/her initials, year of publication, title, publisher (or journal), serial number and number of pages.

Other requirements

Desertification Control Bulletin publishes original articles which have not appeared in other publications. However, reprints providing the possibility of exchange of views and developments of basic importance in desertification control among the developing regions of the world, or translations from languages of limited audiences, are not ruled out. Short reviews introducing recently published books in the subjects relevant to desertification and of interest to the readers of the bulletin are also accepted. Medium-length articles of about 3,000 words are preferred.

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Summary of the first Conference of the Parties to the Convention to Combat Desertification¹

29 September–10 October 1997

The first Conference of the Parties (COP-1) to the Convention to Combat Desertification (CCD) met in Rome, Italy, from 29 September to 10 October 1997. Monday, 29 September, was used for regional consultations, so the COP opened officially on 30 September. The Committee on Science and Technology (CST) held its first session simultaneously on 2 to 3 October. Additional parallel events included a non-governmental organizations (NGOs) Forum, an international forum for mayors, a seminar for the media and an exhibit of comic strips. One hundred and two States submitted their instruments of ratification by the requisite date and participated as Parties to the Convention. As of 30 September 1997, 113 countries had submitted instruments of ratification.

The COP-1 and CST-1 agendas contained primarily organizational matters. Delegates selected Bonn, Germany, as the location for the Permanent Secretariat and the

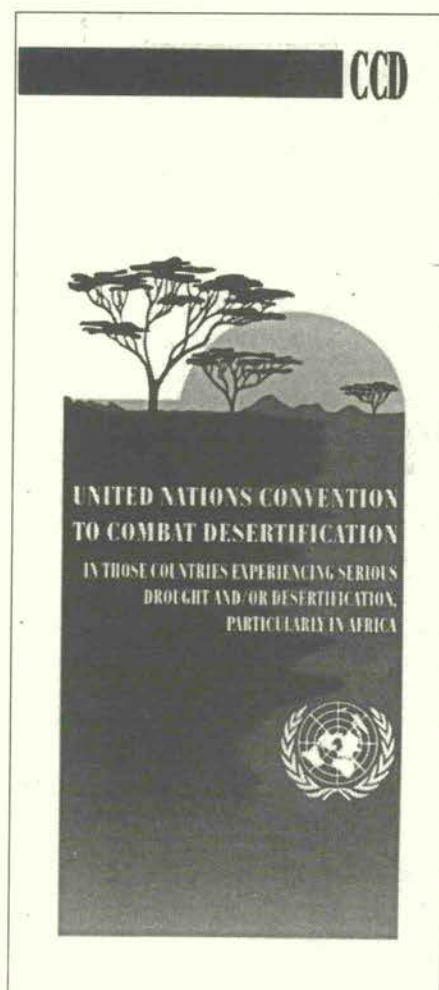
International Fund for Agricultural Development (IFAD) as the organization to administer the Global Mechanism. At the CST's recommendation, the COP established an ad hoc panel to oversee the continuation of the process of surveying

benchmarks and indicators, and decided that CST-2 would consider linkages between traditional knowledge and modern technology. Five Plenary meetings were devoted to a High-Level Segment and one to a dialogue between NGOs and delegates on building partnerships for the CCD. Argentina's proposal that Plenary meetings at future COPs be devoted to similar NGO dialogues was also adopted. While most delegates were pleased with the two-week session, they looked forward to COP-2, which will take place in Dakar, Senegal, to delve into more substantive issues related to combatting desertification.

A brief history of the Convention

The Convention to Combat Desertification was adopted on 17 June 1994 and was opened for signature in October 1994 in Paris. Three months following the receipt of its fiftieth ratification, the Convention entered into force on 26 December 1996.

The Convention recognizes: the physical, biological and socio-economic



¹ This report was compiled from the special issue of *Earth Negotiations Bulletin* published by the International Institute for Sustainable Development (IISD). This report is printed without prejudice and in the understanding that any views expressed herein are not necessarily those of UNEP.

aspects of desertification; the importance of redirecting technology transfer so that it is demand driven; and the involvement of local populations. The core of the CCD is the development of national and subregional/regional action programmes by national governments in cooperation with donors, local populations and NGOs. The purpose of using an innovative "bottom-up" approach, by involving people who are affected by desertification in decision-making, is to facilitate effective implementation of the Convention.

Negotiation of the Convention

In 1992, the United Nations General Assembly, as requested by the United Nations Conference on Environment and Development (UNCED), adopted resolution 47/188 calling for the establishment of the Intergovernmental Negotiating Committee for the elaboration of an International Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (INCD). At the organizational session of the INCD in January 1993, delegates elected Bo Kjellén (Sweden) as Chair of the Committee. The INCD met five times between May 1993 and June 1994, during which delegates drafted the Convention and four regional Annexes for Africa, Asia, Latin America and the Caribbean, and the Northern Mediterranean. The Convention was adopted on 17 June 1994, along with resolutions recommending urgent action for Africa and interim arrangements for the period between the adoption of the CCD and its entry into force.

The interim period

Pending the entry into force of the CCD, the INCD met six times between January 1995 and August 1997 to hear progress reports on urgent action taking place in Africa and interim measures in other regions, and to prepare for COP-1. The preparations included discussion of issues

such as the Secretariat's programme and budget, the functions of and administrative arrangements for the Global Mechanism, the physical location of the permanent Secretariat and the establishment of the CST. Although considerable progress was made, especially on scientific and technological cooperation, some important issues remained unresolved at the end of the last session of the INCD. The size and membership of the COP Bureau were left for COP-1 to decide, as were questions about the host institutions and some functions of the Global Mechanism.

Report of COP-1

CCD Executive Secretary Hama Arba Diallo opened the first Conference of the Parties to the Convention to Combat Desertification on 30 September 1997, and thanked the Italian Government for hosting the meeting. Delegates elected Lamberto Dini, Italy's Minister for Foreign Affairs, as COP-1 President by acclamation. In his opening remarks, Dini said the Convention presents the best effort to effectively re-design North-South relationships and international cooperation.

The United Nations Under-Secretary-General Nitin Desai spoke on behalf of the United Nations Secretary-General Kofi Annan. He said COP-1 must ensure that the Secretariat has the necessary resources to meet countries' requirements and aspirations and stressed the importance of the decision on administrative arrangements for the Global Mechanism. Desai noted that the CCD has brought together all parts of the United Nations system and has been a worthy development of the 'spirit' of Rio. INCD Chair Bo Kjellén noted the important basis that the first meeting of the CST will establish for the exchange of experiences and networking. He stressed the need for a decision on the Global Mechanism so that it is operational by COP-2.

During the rest of the meeting, delegates proceeded through the agenda. The Plenary heard statements from representatives of intergovernmental organizations, ministers and other

government officials regarding efforts to implement the CCD. The Plenary also focused on the issue of building partnerships with NGOs during a half-day meeting organized by the NGOs. Negotiations on the decisions taken by the COP were conducted in a Committee of the Whole (COW), the CST and informal groups.

A brief analysis of COP-1

Participants arrived at COP-1 with fairly realistic expectations and, despite evident, recurring tensions between the regions, were generally pleased with its results. Since the agenda focused on the organizational aspects of the Convention, the substance will only catch up with the rhetoric at COP-2. Nevertheless, some key discussions and decisions, including the Bureau election, the meeting of the CST and the Global Mechanism debate highlighted key expectations of delegates and will serve as the framework for matters to be considered at future COPs.

Accomplishments

FROM POLITICS TO PRACTICE: Many participants described the COP-1 as a milestone. Finally, some delegates sighed, the process of combatting desertification has reached its most important phase: implementation. Despite useful interim activities such as the urgent action for Africa, governments have focused on the negotiations and their national ratification processes. Now that the CCD has entered into force and an "infrastructure" for the implementation phase has been established at COP-1, no obstacles remain to prevent countries from carrying out real action in the field.

CST OFF TO A GOOD START: Delegates to the CST were frustrated by the postponement of their meeting for two days due to the problems with the election of the Bureau and the manner in which the CST Chair was chosen. Some said the election process for the CST Chair was anything but transparent. For instance, delegates were not provided with

the candidate's CV when requested. Some also hinted that there was no adequate consultation with other regional groups on the decision. Tension eased when the first two-day meeting of the CST finally started. Delegates were, in fact, pleasantly surprised by the outcome and were content with how speedily the CST had been guided through its agenda.

Despite this generally positive impression, some felt that the Committee had failed to make itself a unique institution and to determine the kind of work it should carry out based on that uniqueness. They expressed a fear that the CST may in the future be dominated by politically oriented members and never get down to "scientific business," as has been the case with the Convention on Biological Diversity's Subsidiary Body on Scientific, Technical and Technological Advice, whose meetings initially turned into mini-COPs where political considerations were prioritized over substantive scientific issues. Some questioned the wisdom of running the CST and COP meetings concurrently and the approach to government-endorsed nomination of experts. Since CST meetings will only take place once a year, it could take several years before the real impacts of these INCD provisions are determined.

NGO PARTICIPATION: Delegates and NGOs alike hailed the COP-1 breakthrough that found, for the first time ever, a Plenary meeting dedicated to NGO dialogue. The afternoon Plenary of Thursday, 9 October, was organized by the NGO community and was co-chaired by COW Chair Mahmoud Ould El-Ghaouth (Mauritania) and NGO Edit Tuboly (The Netherlands) of BothEnds.

Many of the delegates and observers who participated said it was a useful forum and that it sets a precedent for incorporating practitioners into intergovernmental processes. It enabled governments and NGOs to define concepts such as partnerships and to jointly define what they would like to achieve. This forum could mark the beginning of a process that actively embraces the ideas of other interest groups as an integral part of intergovernmental negotiations. While COP-1 decided that the arrangement should continue in the

future, some noted the need for caution as the precedent whereby government initiatives to realize justice on behalf of the international community could be undermined by interest and lobby groups with conflicting goals.

Procedural aspects

"Bonn! C'est bon!" delegates exclaimed as the result of the vote on the location of the permanent Secretariat was announced on Friday 3 October. Reasons for Bonn's victory were believed to be its financially generous offer, long-standing cooperation between Germany and some African countries, and proximity to the Climate Change Convention Secretariat.

The election of Bonn demonstrated broad support for the German city and many delegates complemented those responsible for the smooth selection process. Participants also believed that the negotiation process on other difficult issues, such as the informal consultations on the programme and budget and some aspects of the Global Mechanism, enabled tough issues to be dealt with in a manner that did not dampen the 'spirit' of Rio.

By contrast, the selection process for the host of the Global Mechanism frustrated and even infuriated delegates. There was no clear consensus within or between regional groups. A minority thought this impasse should be resolved through a vote, but this was ruled out because the Global Mechanism is linked to the financial rules, for which the decision-making process is still not agreed and, by default, must be made through consensus. Some thought the decision of the African Group should guide the selection, but that Group also did not agree on one institution, despite having voted by secret ballot. Ironically, delegates had labored to develop a criteria for selecting the institution, but in the end it was completely disregarded. Although some delegates suggested that UNDP met the criteria, there seemed to be no consensus in any of the regional groups. Furthermore, some delegates were upset by the lobbying of the bidding institutions, which have been established to service the governments. In the face of no consensus after drawn out regional

consultations that had caused the suspension of several formal sessions of the COW, in the final Plenary COW Chair El-Ghaouth proposed that he indicates one institution, and if 53 States Parties spoke against it, the proposal would not stand. This suggestion amounted to voting by another name. The Chair's proposal of IFAD to host the Mechanism and UNDP to select the Mechanism's head came as a surprise to the majority in the closing Plenary, including the institutions themselves. While some delegates seemed content with IFAD as the host, others noted that, although the negotiated criteria to determine the host institution were thorough, the blatant disregard for these criteria does not augur well for the host institution, in particular its ability to garner the support needed to enable it to become the lead Mechanism to mobilize resources for the Convention. At the end of COP-1, two delegates tellingly commented: "what goes around, comes around" and "it is not over yet!"

Tensions and challenges

PARTICULARITY VERSUS UNIVERSALITY: The tensions that kept surfacing at critical stages of the INCD negotiations between and within regional groups, continued to appear at COP-1. At issue is the CCD's emphasis of the particularity of Africa, which the region has used to get exceptional treatment. The crises in selecting the Bureau and representatives to the ad hoc panel of the CST, determining the number of presentations at the COP-2 CST meetings, and electing the organization to host the Global Mechanism all manifested this tension. Africa wanted three seats on the Bureau and the ad hoc panel to the other region's two seats and two presentations at the CST-2's consideration of traditional knowledge to the other region's one presentation. The other regions chose to go by the G-77 and China's preference for the Global Mechanism host, which they expected would be determined by Africa's choice. Each of these debates created crises that manifested this tension. These difficulties were foreseen by INCD Chair Bo Kjellén, who repeatedly, but unsuccessfully, pushed for the selection

of the Bureau members at the resumed session of INCD-10.

Solutions were found at COP-1 regarding the Bureau and composition of the ad hoc panels thanks to the fact that only one Eastern European State had ratified the CCD and no names from the region had been submitted to the roster of experts. This resulted in a "vacant" Eastern European seat, which many regional groups were eager to fill. However, the matter promises to recur at COP-2 and possibly assume greater proportions if a second ratification is forthcoming from Eastern Europe. While certain delegates stated that the composition did not establish a precedent for the future, they went on to announce that the number of seats they had obtained should be the same next year. Some even began jockeying for the position of CST-2 Chair. Before a solution was found at COP-1, some delegates had suggested creating an ex officio position of the COW Chair on the Bureau to provide Africa with the third seat. However, this option was ruled out for COP-2 because it is against standard procedures for a region to hold both the Presidency and COW Chair. Some delegates warned that providing exceptions creates precedents for others to argue for exceptional status on other issues.

Equality between the sister conventions

Since the CCD negotiations began, developing countries have stressed that the Convention must be equal to its sister Conventions on Climate Change (FCCC) and Biological Diversity (CBD). A every obstacle, precedents from FCCC negotiations, in particular, have been invoked. Despite these professions of equality, divergent views were expressed about the relationship between the three Conventions.

Some considered the CCD the superior of the three. The CCD is very innovative, more participatory and deals with the two fundamental concerns of humankind: survival and freedom. It is a grassroots Convention. Implemented as negotiated, it can amass great political momentum to

address the long-standing problem of land that pervades every form of human conflict. Its importance is manifested in the number of ratifications by COP-1, twice as many as the other two Conventions. The Convention is as much about democratization and good governance as it is about development and combatting poverty.

Other delegates, however, commented that although the Convention is headed in the right direction, it is not yet on par with the FCCC, with which it now has similar institutional arrangements. First, the Global Mechanism must have moral and financial authority to mobilize the required resources to implement the CCD. Second, Africa must relinquish the desire to have a global yet African Convention. Pressing for particularity undermines the CCD's ability to enjoy the same status as the FCCC and CBD. But here again, the FCCC is invoked: pressing for particularity is no different from the exceptional status enjoyed by the Alliance of Small Island States (AOSIS) within the FCCC. Still, the biggest concern is that three important powers, Japan, Russia and the United States, have yet to ratify the Convention, thus making it truly global.

WOMEN AND DESERTIFICATION: The role of women in preventing dryland degradation has been stressed over and over again by ministers and delegates during the negotiation process. That the women farmers should be the greatest beneficiaries of the CCD has been stressed at countless workshops, throughout the INCD process and even at COP-1. However, the fact that only two women were selected to serve in official capacities, as Vice President in the Bureau and Vice-Chair of the Committee on Science and Technology, and only two of the 10 members of the CST ad hoc panel on indicators are women, suggests that it is only politically correct rhetoric. In fact, during the negotiations on the establishment of the roster of experts, two delegates implied that if more women were to be included in order to observe the recommended gender balance, the quality of expertise in the roster would decline. To translate the intentions into action, regional and women's groups, in particular from developing countries,

must take deliberate steps to identify and include qualified women, especially in the work of the CST.

COORDINATION AND COOPERATION: Participation and coordination are the two issues most cited by field practitioners and Convention negotiators as critical elements to effect change on the ground. But several delegates began expressing apprehension that the problem of coordination is far from resolved. The Secretariat's proposed budget perplexed many. Some felt the proposed sum for implementation would make the Secretariat yet another implementing agency, amidst the myriad of specialized intergovernmental agencies already involved in dryland issues, and result in the inefficient use of resources. Unlike the FCCC and CBD, the Secretariat will be involved in some field implementation. The decision that specified the amount of funds that the Secretariat would allocate to the Mechanism was a relief as a lack of specification was considered to be a potential area of conflict between the two institutions. The host institution would have had to negotiate with the Secretariat the contribution it would receive from the programme budget. The Secretariat had proposed close to US\$500,000 but the Plenary increased the amount to US\$1 million. Many delegates stressed the need to discuss the types of activities the Secretariat should undertake and not leave the Secretariat to negotiate with other intergovernmental agencies also working on dryland issues.

Conclusion

There was broad agreement by those at COP-1 that although process issues are crucial, the shelf life of the Convention is of greater importance. The credibility of the Convention hinges on the process used to develop the national action programmes. The ability to develop credible national action programmes and mobilize resources in both developed and developing countries depends on the political will and support accorded the national action programme process and desertification as an issue. These are policy issues that must be addressed at the

country level, and for which affected developing countries, in particular those in Africa, must lead the way.

Considering the skepticism expressed in Rio at the idea of a global desertification convention, the progress made thus far bodes well for the future. One hundred and thirteen countries have ratified the

Convention and more are expected. A large number of developing countries participated in the INCD process. New ground has been broken in NGO participation in intergovernmental negotiations. All of these achievements demonstrate a political will that was lacking two decades ago following the

adoption of the 1977 Plan of Action to Combat Desertification. The CCD is a major accomplishment for Africa and for the world, but the real success will be determined by whether it changes the lives of those living in the drylands.

Desertification Assessment and Mapping in the Arid and Semi-arid Regions of Patagonia (Argentina)

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Abstract

The objective of the present study was to evaluate, classify and interpret the spectral signatures for mapping the status of desertification in the arid and semi-arid regions of Patagonia (Argentina). From the total surface of the studied region (78,549,400 ha) 93.6 per cent (73,544,000 ha) is at some risk of desertification. Thirty five per cent of the total surface is moderately to severely desertified and 31.8 per cent is severely desertified. The latter, constitutes very degraded lands of almost no use to man and which is economically in an irreversible state. From an analysis of the results, it is clear that the environmental degradation in the Patagonian extra-Andean region - caused by man and exacerbated by nature - has already had deep impacts on its viability in the long term. The approach adopted in

this study can be viewed as an assessment of landscape ecology, and therefore an assessment of processes involving physical, biological, climatic and human influences that alter landscape patterns. Considering such, the following actions are recommended: (1) to give importance to landscape diversity when managing natural resources; (2) to suggest alternative livestock grazing schemes and management of the environmental variations; (3) to re-vegetate or restore degraded areas; (4) to declare some areas Provincial Reserves; and (5) to exclude livestock and the collection of firewood either temporarily or permanently.

Introduction

Over the last few years in Patagonia, digital analysis through different remote sensors has directly or indirectly taken ecological aspects into consideration as they relate to the desertification process: Aguiar *et. al.* (1988), Batista (1988), Paruelo *et. al.* (1991), Soriano and Paruelo (1992), Paruelo *et. al.* (1993), Alvarez *et. al.* (1993), LUDEPA (1995) and del Valle (1996).

Owing to the fact that Patagonia is a vast region (over 700,000 km²), remote sensing becomes a proper means for studying and planning the use of the region at different levels. However, the

evaluation, classification and interpretation of spectral signatures, on a global scale, requires the acquisition of a satellite mosaic which operates as a base for the analysis of the damage to the whole region. There is a need for such a mosaic as it is almost impossible to get one image of the whole region free of clouds and snow. Several authors have remarked on the utility of spectral data supplied by satellites of the NOAA/AVHRR series (Justice *et. al.* 1985, Kogan 1992). The resolution - both temporal (daily) and spatial (1.21 km² = 121 ha) of LAC data ("Large Area Coverage") of said satellites make them particularly appropriate for the detection of general patterns on a global scale. On the other hand, not only is the purpose of any mapping about regional desertification analysis to diagnose the actual environmental scene but it is also to plan preventive or control measures regarding biophysical damage (Kust 1992).

The present study, therefore, was to evaluate, classify and interpret spectral signatures of the desertification status similar to what was established by LUDEPA (1995). The LUDEPA project, derived from the spanish title "Lucha contra la Desertificación en la Patagonia", means "Fight against desertification in Patagonia".

Materials and methods

Study region

Patagonia (Figure 1) occupies the southern extremity of Argentina south of the Colorado River (39.5° S). This region presents a wide variety of climate and vegetation types, and most of the land has been subjected to intense grazing by sheep since the end of the last century. The Patagonian steppe (arid and semi-arid)

from a broad ecological viewpoint, can be considered as a cool semi-desert ecosystem (Soriano 1983). Precipitation, concentrated in the winter months, declines from west to east (Barros *et al.* 1979). Along this gradient of decreasing precipitation, starting from the Subantarctic forest border, grass steppes give way to shrub-grass steppes and then to deserts in the east. Structural and dynamic characteristics may be found elsewhere (Soriano 1983).

Mapping of desertification: digital classification

Seven NOAA-AVHRR LAC images taken on different dates were used (Ayesa and Jobbagy 1994), namely: 23 September 1986; 9 February 1987 (this one divided into North, Centre and South); 26 September 1990; 25 January and 6 November 1992. The aim was to obtain a mosaic relatively free of clouds and snow; therefore, a combination of different areas of each of the images selected was vital to reach the goal. In every case, bands 1 (visible), 2 (near infrared) and 4 (thermal infrared) were used. The pixel size assigned was 1,000 m x 1,000 m. The mosaic was built by using Lambert's Conformal Conic Projection. The major property of this projection is its conformability. At all coordinates, meridians and parallels cross at right angles. The correct angles produce correct shapes. Small proof mosaics were obtained and it was observed that a relative geometrical record showed better results than one pixel.

All image enhancement steps were performed on a PC-486 DX2, using an ERDAS image processing software (ERDAS 1991). The methodological procedure intended to receive and evaluate information of different damage status aided by digital processing methods followed the guidelines set forth in LUDEPA (1995). For mapping the damage status, the information on segments and line transects (see Figure 1) established in said research was needed together with the information available from the *Atlas of the Soils of Argentina* (Ferrer and Irisarri 1990, Godagnone and Irisarri 1990, Salazar and Godagnone 1990a and 1990b, and Salazar *et al.* 1990) and Mendia and Irisarri's suggestions (1992).

A combined classification procedure was used: supervised and unsupervised (Chuvieco 1990). The last methodological step consisted in extrapolating and interpolating cartographically the LUDEPA (1995) results. Each one of the classes was chromatically codified according to its desertification status. Unsupervised classes frequently represented more than one status class. In order to minimize

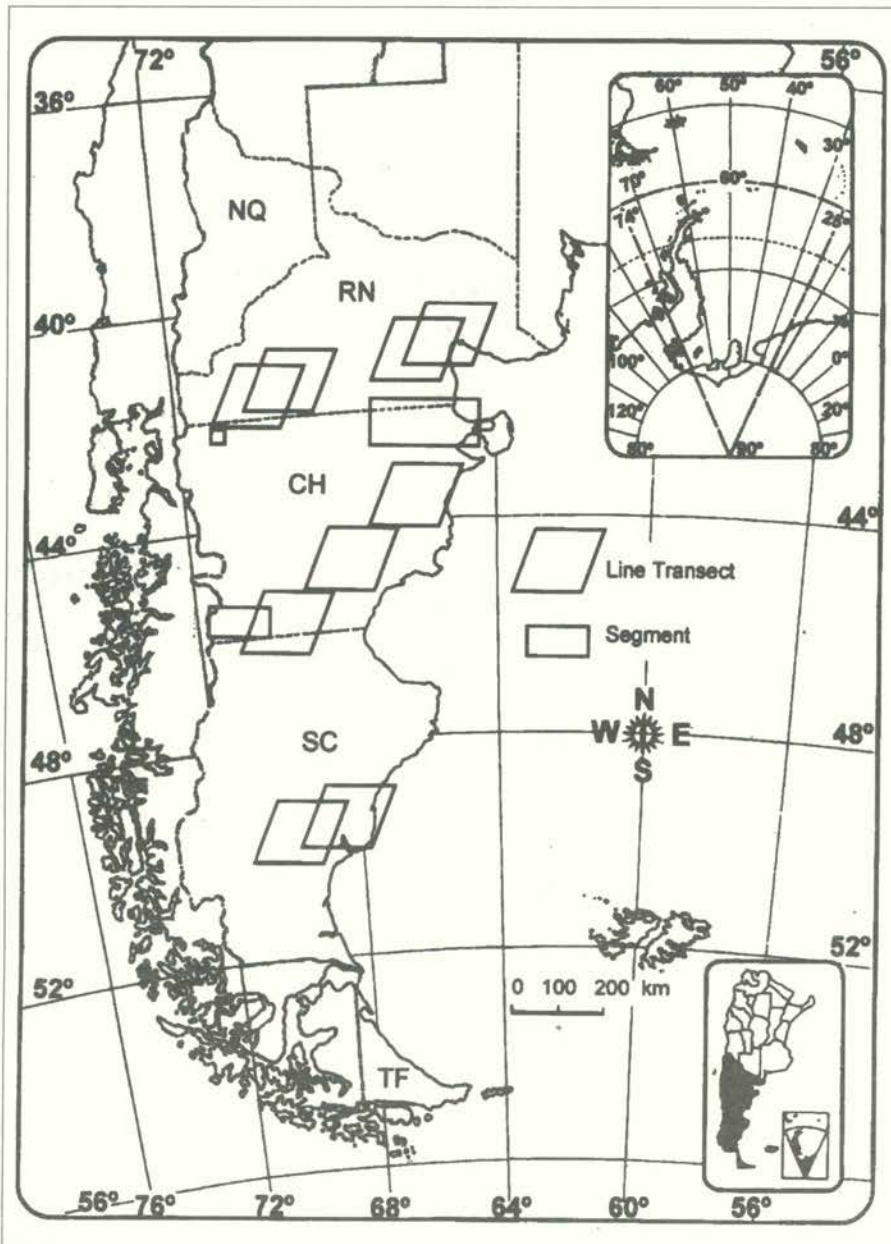


Figure 1. Study region. Segments and line transects performed in LUDEPA (1995) and utilized as "training samples" for the digital classification. Provinces: Neuquén (NQ), Río Negro (RN), Chubut (CH) and Santa Cruz (SC). Archipiélago: Tierra del Fuego (TF).

classification error, a cluster was labelled as the status class that presented the largest overlap with it. This usually implied labelling the clusters with the label of a status category that occupied a large area. The guidelines to determine cartographic classification of the represented areas complied with the FAO-UNEP (1984) criteria. A few modifications were introduced and are shown in Table 1.

Results and discussion

Figures 2 a-d show the status of desertification identified. From the total region studied (78,549,400 ha) 93.6 per cent (73,544,000 ha) shows differing degrees of desertification, where the categories were: slight (9.3 per cent), moderate (17.1 per cent), moderate to severe (35.4 per cent) and severe and very severe (31.8 per cent). The latter consists of highly degraded land, of almost no use to man and economically, in an irreversible state. The very severe desertification status class includes playa lakes without water accumulation. This status also comprises part of the landscape as a result of natural land degradation. There were clearly delimited "bad land areas" long before sheep colonization, but man's use of the land has made the degradation and widening tendencies more dynamic.

The ecological susceptibility of Patagonia depends on man's impact and his present methods of natural rangeland management, based on an extreme overuse of space and time. The consequences of this anthropogenic impact are also aggravated by periods of drought.

Provinces have suffered considerable soil and vegetal degradation. The fall in total sheep stocks occurred largely as a result of overgrazing and over-collection of fuel wood, this in turn led to a down turn in overall regional production. This situation had several consequences of differing levels of importance: a decrease in palatable species, xerophytism (drought-resistance) at different levels, dryness, water and wind erosion, salt excess, soil crusting and compaction, etc. Over the last 20 years, a 5,000,000 head decrease in sheep stocks was the direct consequence of the above and it led to a

Map Classification	Per cent of area in various desertification categories
Slight desertification	> 30 % of area in slight category < 40 % of area in moderate category < 30 % of area in severe and very severe category
Moderate desertification	< 30 % of area in slight category > 30 % of area in moderate category < 40 % of area in severe and very severe category
Moderate to severe desertification	< 30 % of area in slight category > 40 % of area in moderate and severe category < 30 % of area in very severe category
Severe and very severe desertification	< 15 % of area in slight category > 40 % of area in severe and very severe category > 40 % of area in very severe category



Figure 2 a. Per cent of area in the slight status of desertification.



Figure 2 b. Per cent of area in the moderate status of desertification.



Figure 2 c. Per cent of area in the moderate to severe status of desertification.



Figure 2 d. Per cent of area in the severe and very severe status of desertification.

loss of US\$553 million in wool and non-produced meat; a loss of 2,500 permanent jobs and a loss of 250,000 casual jobs per year (PRODESER 1995).

The use of severe and very severely desertified areas needs to be reconsidered. Recovery does not seem to be possible, and sheep-raising contributes to the advance of degradation and desert pavements into adjacent areas. Low productivity cannot be used as an excuse for the degradation of vast areas with loss of soils, plant cover and biodiversity in communities which group a wide variety of species, endemic and otherwise. In view of the high rates of desertification and habitat degradation, the identification and protection of areas of biological value in relation to the abundance of species or

the presence of endemic plants is necessary (Pisani *et al.* 1995).

From the digital cartography standpoint, when linking the different desertification conditions to the processes which originated them, a fragmentation in the continuity of landscapes according to the Lord-Norton Studies (1990) is found. When defined in said way, this concept may be applied to any domain within which continuity becomes important for the functioning of the ecosystem. In a more restricted sense, fragmentation occurs when a large extension of habitat is transformed into a series of small patches isolated from one another by a habitat matrix different from the original landscape (Wilcove *et al.* 1986). Habitat fragmentation in Patagonia

results from different anthropic activities which also lead to different desertification conditions. Human impact and natural disturbances periodically alter the structure and function of ecological systems.

Selective differentiation in grazing originates a particular sample of landscape ("environmental patches") where intensively grazed patches alternate with slightly grazed ones within a matrix where bare soil is generally a constant. Such anthropic action leads to instability in the system, and it makes overgrazed patches increase in size in either heavy weather or harsh natural conditions. A landscape with different levels of fragmentation and desertification results from this degradation process. It is generally agreed that the desertification process in Patagonia is largely the result of a poor use of natural resources. The consequences are always similar, i.e., a process which causes a constant reduction of the natural potential is started. How can this process be reversed or attenuated? First, by carefully and sustainably managing the resources available in the affected areas by harnessing, or the potential of existing resources not exploited. But, how can the sustainable use and management of natural resources be put into practice? However, there are many problems to be solved such as people's lack of awareness of the problem; inefficient rangeland management by technicians; poor technical capacity in the provinces; and unfavourable economic conditions. The answer is not simply one of just supplying and transferring technology.

Conclusions

Digital cartography representations of desertification are quickly and easily visualized to determine inherent risks or possible changes in conditions in the extra-Andean region of Patagonia. These data have provided for the first time an overview of the extent and environmental damage of the desertification process across the region. The maps show the general locations where problems exist. The severe ecological situation shown by the maps calls for the development of a

general strategy to overcome the desertification process. At the same time, the methodology proposed can be used retrospectively to establish the speed of the desertification process through analyzing NOAA/AVHRR LAC images taken at least 10 or 20 years ago.

From the analysis of the results, it is clear that the environmental degradation in the extra-Andean region of Patagonia - caused by man and exacerbated by nature - has already had deep impacts on the land's viability in the long term. The approach adopted in this study can be viewed as an assessment of a problem of landscape ecology, and therefore an assessment of processes involving physical, biological, climatic and human influences that alter landscape patterns.

Some of the direct or indirect attenuating and/or control measures for desertification in the region can be found in the Proceedings of the International Workshop on Plant Genetic Resources, Desertification and Sustainability (Montes and Oliva 1995). As has been stated, not only is the problem physical but it is also socio-economic, cultural and political. It is essential that substantial changes in attitude are made in the Patagonian community. To achieve this, a political decision which is based on an understanding of the real problem of environmental damage is necessary to avoid the social degradation implied in the desertification process. Settlements, health, education, housing and culture are empty words when the desert advances. Greater awareness of the problem is definitely important in order to ensure environmental preservation; to improve the conditions of land holding, to fully realize the possibilities of sustainably exploiting an economic unit; to plan technology transfer activities and to meet financial demands; and to grant social subsidies for field closures to avoid severe damage, if necessary.

As a final comment we recommend: (1) that due importance be given to landscape diversity when managing natural resources; (2) alternative livestock grazing schemes and management of the environmental heterogeneity are explored; (3) the revegetation or restoration of degraded areas; (4) that some areas are declared to be Provincial

Reserves; and (5) that livestock and the collection of firewood is forbidden, either temporarily or permanently.

Acknowledgments

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A New Predictive Tool for Identifying Areas of Desertification: A Case Study from Namibia

By Benny Aharoni¹ and David Ward²

Abstract

Identifying the sources of potential desertification has become a major field of scientific endeavour. Mapping the different causes of desertification allows for quick localization of the major causes of desertification of a region. As a consequence of the identification of these causes, priorities can be established for dealing with desertification by regional planning. In this study, we provide a technique to assist in the identification of areas of potential desertification. To achieve this, we mapped a variety of abiotic and biotic variables that may affect the process of desertification using a Geographical Information System (GIS). We then used Principal Components Analysis (PCA) as a non-arbitrary, statistical system for weighing these variables relative to one another. With these weighted variables, we were able to produce an overall, composite map of

priority areas for combating desertification. We used Namibia as a case study because it is the driest country in Africa, with a host of environmental problems that may be linked to desertification. Using the above-mentioned technique, we were able to identify priority areas that may suffer or be suffering desertification. Most of these areas are in the northern and north-eastern parts of Namibia.

Introduction

Arid, semi-arid and sub-humid zones cover one third of the earth and two-thirds of Africa. Desertification of these regions has become a major cause for concern, with about 170 million people affected by land degradation worldwide (Balling 1995). In the last decade, about 25 per cent of the fertile soil in these regions of Africa has been removed through desertification (Glantz and Katz 1987). Desertification is further exacerbated by frequent droughts in one or other arid or semi-arid zone in Africa (Darkoh 1994). With a natural human population increase

of 3.3 per cent per year in East and South Africa, there is great pressure on the land (Glantz and Katz 1987). This large rate of human population increase in Africa makes it vital to identify major problem spots to initiate research and education programmes to combat desertification before the process becomes completely irreversible (Chou and Dregne 1993).

Mapping the different causes of desertification allows for quick localization of the major causes of desertification of a region, in order to update priorities for dealing with desertification by regional planning. In this study, we provide a technique to assist in the identification of areas of potential desertification in Namibia. To achieve this, we mapped a variety of variables that may affect the process of desertification using a GIS and then provided a non-arbitrary, statistical system for weighing the importance of these variables relative to one another. With these weighted variables, we were able to produce an overall map of Namibia with a list of priority areas for combating desertification.

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The role of Geographical Information Systems in identifying problems

Geographical Information Systems have revolutionized the processing of geographical information by allowing researchers to simultaneously overlay maps of various factors affecting an environment to achieve a composite map of the interactions between the factors (Maguire *et al.* 1991). Traditionally, most applications of GIS have concentrated on the non-statistical analysis of the spatial coincidence of factors (Coppock and Rhind 1991). However, in some applications, mathematical techniques such as regression, kriging and universal kriging have been used to determine the behaviour of a response variable to several independent variables (reviewed by Ver Hoef 1993).

In any study that seeks to achieve a composite analysis of a variety of factors that may influence a process of interest, it is recognized that it is frequently necessary to weight these factors relative to one another because some factors are more important to that process than others. For example, in the case of factors that might influence desertification, some factors such as annual precipitation and human population densities may be more important than soil type. PCA is a statistical ordination technique that is ideally suited to the task of weighing variables in a way that is non-arbitrary and does not introduce the biased perception of the researcher as to the relative importance of the variables into the analysis. PCA effectively reduces a large number of often correlated variables (e.g. precipitation and potential evapotranspiration are often negatively correlated) to a smaller number of variables that are a linear, weighted function of the initial variables (see e.g. Morrison 1976, Flury and Riedwyl 1988, Jongman *et al.* 1995 - for further details of this technique, see *Methods* below). In this study, we use PCA to reduce a number of weighted environmental and biotic variables to a linear weighted function to

produce a composite map in a GIS of areas potentially affected by desertification.

Namibia: a case study

Namibia is the most arid country in Africa, and most of its land (93.2 per cent - UNESCO 1994) is desert or semi-desert with an arid climate (Van der Merwe 1983). Most precipitation falls in the north-east of the country, in which over half the population lives. Rains in Namibia are unreliable, soil quality is poor and the carrying capacity of the land is concomitantly low (Van der Merwe 1983, Davis 1993, Seely and Jacobson 1994). It is considered that 74.6 per cent of Namibia's land area constitutes a moderate to severe desertification hazard (UNESCO 1994). Annual deforestation is about 50,000 ha (UNESCO 1994), while overgrazing has caused thorn bush encroachment in large areas of the wetter, northern part of the country and land denudation in much of the dry, southern part of the country (Quan *et al.* 1994). Moreover, if the forecasted global climatic warming does occur, the most significant effects of this will likely be seen at the edges of deserts because they are already subjected to substantial climatic fluctuations and may be suffering from desertification (Warren and Agnew 1988). Hence, much of Namibia may be in danger of desertification.

The desertification process in Namibia is a subject of major concern (see e.g. Kambatuku 1994, Quan *et al.* 1994, Seely and Jacobson 1994). The process of desertification in Namibia is currently being studied by a number of research groups (see e.g. Strohbach 1992, Quan 1994, Shanyengana 1994) and is being financed by large aid packages from countries such as Germany (Namibian National Program to Combat Desertification, NAPCOD) and Sweden (Environmental Education, ENVIRO-TEACH), both run by the Desert Research Foundation of Namibia. The purpose of much of this research is to identify potential causes of desertification in Namibia, to find information and data on those potential causes from different sources, and to provide management and

education guidelines to combat desertification in Namibia.

Methods

Information on soils, vegetation, climate (specifically mean annual precipitation and potential evaporation) was obtained from Van der Merwe (1983). We also represent climatic regions according to the ratio P/PE, where P = mean annual precipitation and PE = potential evapotranspiration, as a conventional measure of the effectiveness of precipitation (Lettau 1969). Soil data were converted to categories indicating low, medium and high water-holding capacity (Klute 1986). Vegetation was categorized into 20 per cent classes of canopy cover.

Human population data were obtained from the most recently published national population census in Namibia (1991). Domestic livestock data were obtained from the 1994 annual livestock census conducted by the Namibian Department of Veterinary Services. In order to create a single scale for animals of different masses, we weighted the different types of animals according to their body masses raised to the power of 0.75 to account for the relationship between energy consumption and body mass (Schmidt-Nielsen 1990). For sheep, we used a mean mass of 50 kg, for goats 40 kg and cattle 500 kg. For both human and livestock data, data were entered according to the smallest spatial scale for which data were available. This usually meant that the spatial scale was the administrative regions delineated prior to independence from South Africa.

All data mentioned above were either digitized from maps in Van der Merwe (1983) (soils, vegetation and climate) or entered directly (human and livestock data) into a GIS, using ARC/INFO version 6.0 software. Human and livestock population data were entered as numbers per km² in this analysis.

In order to achieve an unbiased weighing of the variables in this analysis in a composite map showing potential areas of desertification, we used PCA. PCA searches for the most appropriate weighing of the variables in the study by first finding the best combination of

weightings (called component loadings) of the initial variables that explains most of the variance between data points in the dataset. This first combination is called the first principal component axis. Thereafter, second, third and more principal component axes are found that explain progressively less of the variance in the data in directions that are orthogonal (at a right angle) to each of the preceding axes. By definition, the first axis explains most of the variance in the dataset. Thus, using the component loadings of the variables in the first principal component axis as a new composite variable will explain most of the variance in the data by weighing the variables in a non-arbitrary fashion that does not introduce observer bias as to the relative importance of these variables. Once this new composite variable was derived, the data were entered into the GIS and divided into three equal-sized categories of potential desertification, indicating low (<33.33 per cent of the maximum value on the first principal component axis), medium (33.33-66.66 per cent of the maximum value) and high (>66.66 per cent of the maximum value) potential. A composite map of potential desertification was thus obtained.

Results

Abiotic variables

Precipitation in Namibia gradually increases from south-west to north-east (Fig. 1), while potential evaporation is highest in the south-east and gradually decreases towards the north-east

(Fig. 2). These two patterns lead to an overall climatic pattern of semi-arid in the northeast, hyper-arid in the west and south and in between (Fig. 3). The hyperaridity along the coast is caused by the cold Benguela current (Lindesay and Tyson 1990).

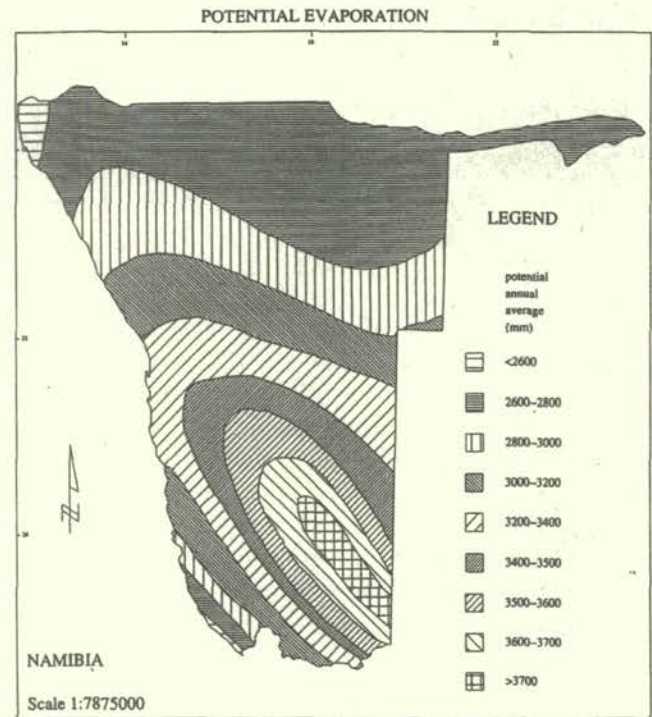


Figure 2. Mean annual potential evaporation in Namibia. Data from Van der Merwe (1983).

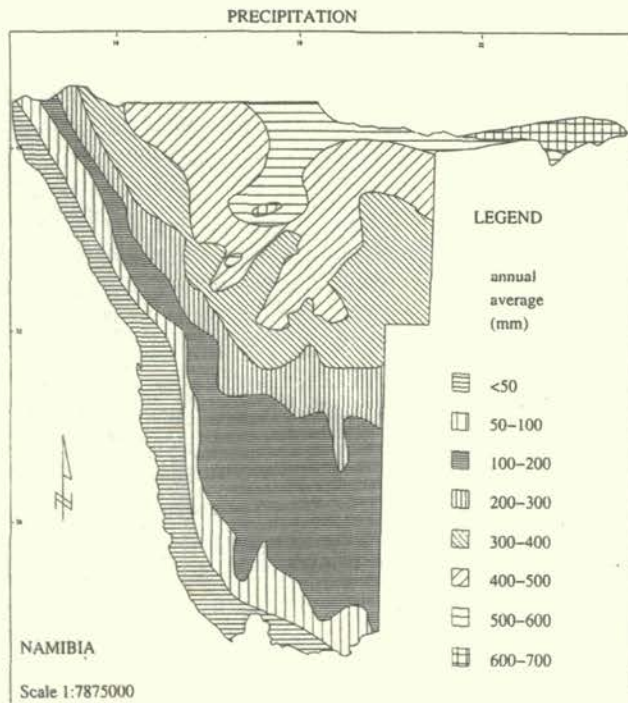


Figure 1. Mean annual precipitation in Namibia. Data from Van der Merwe (1983).

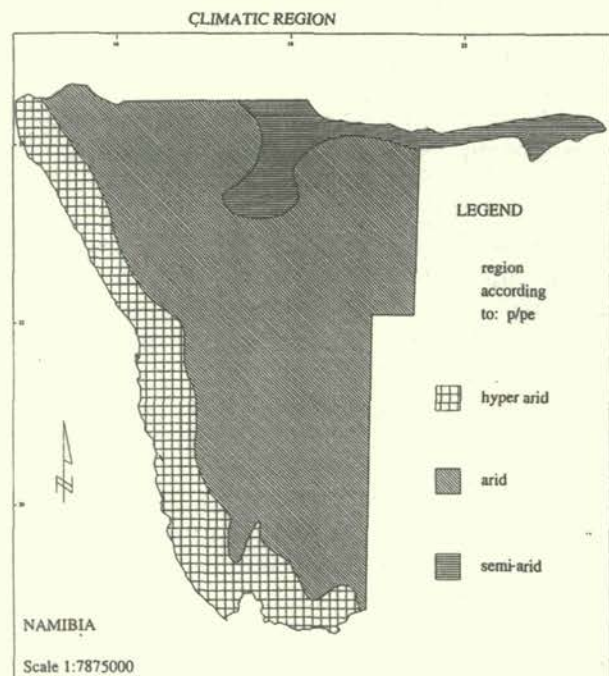


Figure 3. Climatic regions of Namibia, according to the ratio P/PE (see Methods for explanation).

The largest livestock populations occur in Owamboland, concomitant with the largest human populations (Fig. 8). Lowest livestock population densities are found along the coast, most of which is a national park. Other areas in the north and east present a patchwork of intermediate livestock densities.

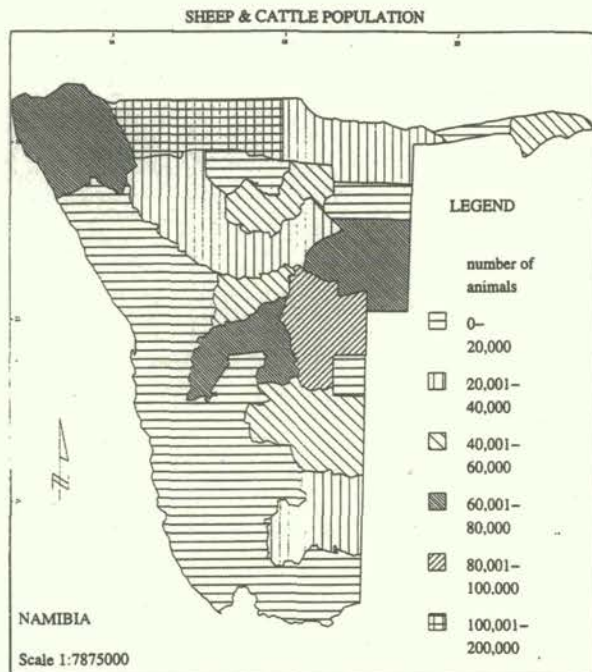


Figure 8. Total sheep, goat and cattle population per region in Namibia. The species were weighted according to their average biomass in order to put them in the same units. Thus, the numbers represent large stock units. Data from the national census of livestock in 1994 from the Department of Veterinary Services of Namibia.

Principal Components Analysis

The first principal components axis explained 44.22 per cent of the variance in the data. We used the component loadings on this axis only (Table 1) to weight the variables for the composite

Table 1. Component loadings on the first principal component axis for the variables included in the overall analyses.	
VARIABLE	COMPONENT LOADINGS
Mean Annual Precipitation	-0.840
Potential Evapotranspiration	0.667
Soil Water-holding Capacity	0.447
Vegetation Cover	0.618
Livestock Population/km ²	-0.741
Human Population/km ²	-0.587

map. The composite map (Fig. 9) of potential desertification shows high values in Owamboland where the largest human and livestock populations occur, together with Caprivi, Okahandja, Hereroland, Hereroland West and Gobabis. Intermediate values were obtained for Grootfontein, Otjiwarongo, Omaruru, Windhoek, Rehoboth and Hereroland East and Kaokoland. Also noteworthy in this map are the western and southern regions of Namibia, which are considered to be in low danger of desertification; these areas are already deserts and therefore cannot "desertify".

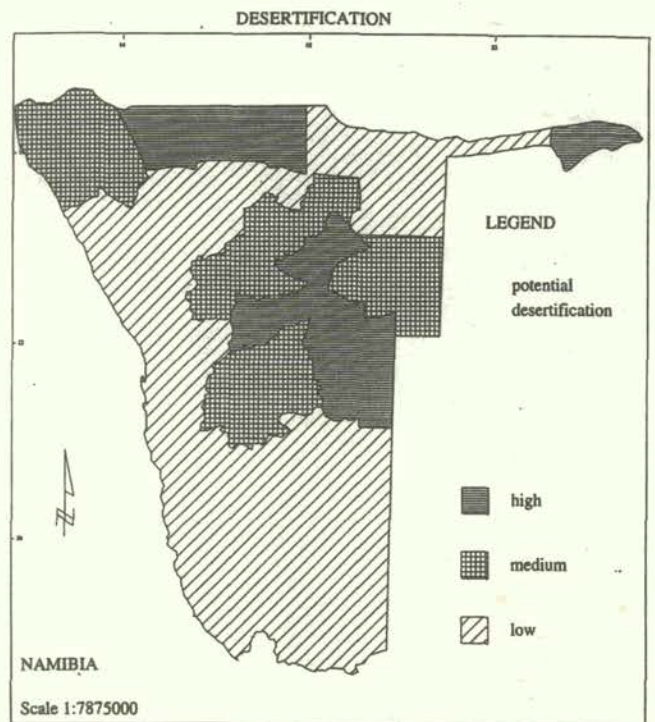


Figure 9. Composite map of desertification derived from the first principal component axis weightings (Table 1) of the variables in Figures 1-7 (excluding Figure 3, which is a function of the variables in Figures 1 and 2).

Discussion

This new technique of combining PCA and GIS provides an unbiased means of making predictions about areas that are likely to suffer desertification. This technique therefore avoids the pitfalls involved in arbitrary weighing of variables where *a priori* assumptions about the importance of a variable are inevitably supported by the conclusions.

In applying this technique to Namibia, desertification appears most likely in the northern part of the country, particularly in the north-east. Districts of special importance are Gobabis, Okahandja, Hereroland, Owamboland and Caprivi. Although annual precipitation is the most heavily weighted factor in this analysis (Table 1), the map analyses show that the combination of factors most likely to induce desertification are the large populations of animals and humans, the kind of soil and vegetation cover of the land. Although there is relatively high precipitation and a low rate of evaporation in these above-

mentioned areas, they are nonetheless most in danger of desertification. Thus, the quantity of precipitation does not bear directly on the carrying capacity of the environment. Indirectly, however, people may initially be attracted to the higher rainfall areas. Social, economic and political factors may lead people to remain in such areas even after the population exceeds the carrying capacity of the environment (reviewed by Quan *et. al.* 1994, Seely and Jacobson 1994).

Testing the model

We stress that this technique presents an hypothesis of areas at greatest risk of desertification, in this case in Namibia. The technique in no way confirms that these areas are suffering desertification. Thus, it is now necessary to follow up this work with field studies that specifically examine the potential for desertification. In Namibia, we recommend starting with a comparison of the eastern areas of Gobabis and Hereroland with the adjoining area of Mariental because these areas are similar in climate and vegetation but differ in other variables. These other variables, such as livestock population sizes, lead to the prediction of desertification in Gobabis but not in Mariental. Interestingly, human population sizes do not differ between these areas (Fig. 7). Another comparison could be made between Kavango and Caprivi which are similar in environmental but not population variables. The technique can be verified by showing that Caprivi and Gobabis/Hereroland suffer more from desertification and degradation than Kavango and Mariental, respectively.

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Endangered Ecosystem : Wildlife Ranching and Research

Dr. David Hopcraft¹

Background

We read of corruption, nepotism, one-party states, dictatorship, economic collapse, increasing tensions and violence. These, however, are insignificant compared to the two major problems affecting Africa. Degrading ecosystems and increasing human populations.

Looking at Kenya in the 20th century, the human population has increased nearly 100 times in less than 100 years. Nairobi which was 'two tin huts' at the turn of the century is projected to have a population of 6 or 8 million in the year 2000.

Accompanying this unprecedented increase in population is the degradation and desertification of most of Kenya's rangelands. More than half the land mass of Kenya, originally wooded perennial grasslands covered with wildlife, is now denuded bare earth, supporting in some areas unproductive thorn trees, decreasing numbers of domestic animals and negligible wildlife.

According to the Kenya Wildlife Service, (KWS), this process is continuing

at an accelerating pace. More than 50 per cent of Kenya's wildlife has disappeared since the hunting ban, less than 20 years ago. In the same time period the human population has more than doubled. Increasing demand for land by humans and their domestic animals is leading to accelerating loss of wildlife and rangeland ecosystems.

The scenario of more and more people needing more and more resources accompanied by less and less productive land can only increase starvation which, although common, will soon be the major feature of African life. There are already 30 million people facing imminent starvation in Africa, and the numbers will continue to grow.

Degrading lands. Desertification.

If we lose our land there is little hope for our future in much of Africa. The United Nations Dryland Ecosystems and Desertification Control Centre (DEDC-PAC) reports that more than three quarters of the earth's arid and semi-arid lands are in one stage or another of desertification

- this covers over one third of the earth's surface. Specifically this means the gradual loss of our trees and perennial grasses, and eventually annual grasses as well. Finally the soil is washed or blown away.

The process is one of continuing loss of diversity as one species after another disappears. Human activity in the rangelands or grasslands of the world, with the exception of the formation of National Parks, centres on the introduction and proliferation of domestic animals, always at the expense of wildlife. More people means more domestic and less wild animals. This is only the beginning of the loss of natural diversity. With the loss of the large herbivores, the predators go as do a wide variety of smaller species. The vegetational structure dependant on wildlife begins to change, with increasing loss of species diversity.

All this affects the insects and soil organisms which are directly responsible for the structure of the soils, ensuring rapid absorption of rain water. Less water penetrates into the soil, causing drought. The end result is degradation and the formation of wastelands. Finally, domestic animal numbers also decline and then they disappear from these lands.

¹David Hopcraft has spent much time during the last thirty years researching and experimenting with rangeland management. This has led him to realise the intrinsic part played by game animals in maintaining the health of the range. He is widely consulted both within and outside Kenya on his suggestions for the optimal use and rehabilitation of rangelands. The following article is a personal account of his concerns for the ranching sector and of some of his experience in the field. Dr. Hopcraft works from a ranch on the Kapiti Plains not far from Nairobi.

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A Group ranch

The best way of looking at this problem is through a specific example.

A few years ago, a well-respected Masai elder and good friend came to my house very much exercised by the fact that we were selling our livestock and moving towards stocking wildlife. On finding it was true he said "I thought wazungu (white men) were crazy, but not that crazy," the word spread fast.

In 1996 the chairman of a very large group ranch in the Rift Valley of Kenya, south-west of Nairobi in the Magadi area had heard the story and that we were making money from our wildlife. He and his advisors came for a visit and were very excited to see the very healthy state of our land. They asked if I would come and survey their area and help them.

My survey was carried out together with the chairman and a few selected elders. Degradation had turned much of the ranch into a wasteland. For two days we travelled the ranch and finally visited what they called forest land followed by big grassland plains. The forest area did still have some trees but little grazing, and the grassland plains were entirely without grass.

"What do you think of this?" they asked. In answer I took them to a pile of bones and asked, "What do you think of this?"

They understood the simile and we discussed the death of this land. We hunted for roots that might indicate that something was still alive, and then went to the termite mounds. The termites were dead. In rangelands this is equivalent to checking if there is still a pulse.

Later we went to the best and most productive part of the ranch on the east side of some large hills. There was some grass left and after an hour of travelling we found some giraffe. Here was the best watered area and yet there was major erosion. The land showed the 'ostrich skin' effect. High points or pimples, the soil held together by a small thorn bush or a grass clump, and eroded soil in between. I took a spear from one of the elders, resting each end on one of these high points. There was a four or five inch gap in the middle. The amount of top soil loss.

The group were horrified to understand this.

In the discussion held with the elders after a tour of their area they asked me what could be done. The situation is desperate. In 20 years they have virtually destroyed hundreds of thousands of acres. Vegetation is very sparse or completely gone. Large numbers of goats, cattle and sheep are removing the remnants. Wildlife, abundant a few years ago, is mostly gone, in hundreds of kilometres of travel we saw a dozen wild animals. The proliferation of *manyattas* (Masai homes) is incredible, as is the number of children in each *manyatta* and each *manyatta* has domestic animals. It was in the dry season and the cattle were being taken outside the ranch to find grazing or being sold for US\$ 10 or US\$ 15 before they died.

The Masai are traditional pastoralists, nomads using domestic animals and moving from place to place when grazing is depleted. This fits in with natural use patterns of wildlife who keep moving, following rain patterns and new growth. This is in effect rotational grazing, always leaving grass seasons for recovery and regrowth. As the pastoralists increase in number, available land is settled. There is no longer unoccupied land. Rotational grazing, the lifeline of grass, stops. As the land degrades and the vegetation disappears, so the overgrazing end point approaches where the decline of wild and domestic animals reaches zero.

Here then is the story, repeated all over Africa. The switch from wildlife to livestock, the resulting degradation of lands, and ultimately zero productivity. It is now 30 years that I have studied and worked in this field. I see how shortsighted and utterly suicidal our livestock land use paradigm is, combined as it usually is, with a lack of reasonable management, and accompanied as it is by loss of wildlife diversity. I see how natural wildlife ecosystems continue to be devastated and lost. I see the destructiveness of the transformation from nature's control to man's control, the complete coup of nature by man. I see biological diversity, of an order unparalleled on this planet, strangled, replaced by man and his domestic animals, an unsustainable system which itself collapses leaving

death and desolation in its wake. I see these costs as catastrophic as hundreds of thousands of square miles of Africa have been reduced to wasteland.

I quote here from my letter to friends after the visit.

"Meanwhile this is to let you know that my trip to the Masai group ranch of 01 Donyo Nyoike was a salutary experience. They have thoroughly screwed their land and resources, and much of the area is now beyond help. I started my meeting with the elders by asking why they invited me; Why wildlife? Why not cattle?"

The re-introduction of wild herbivores into their own ecosystems serves as a rehabilitation process by re-establishing natural multicultures, a diversity of animals. Each eats specific preferred vegetation, whose growth is often accelerated through hormones from the saliva. Food chains are re-connected allowing diverse species of fauna and flora to flourish.

Ecosystems are like giant computers with energy flows passing through myriads of interacting species or life forms. Human systems are monocultures of foreign animals needing constant care and protection. At first glance livestock and game appear the same. Most species are cloven-hoofed ungulates belonging to the same family as cattle, they eat grass or herbs. Yet the differences are crucial to the survival of the land.

Cattle have their own grazing preferences. Palatable vegetation is overgrazed and disappears leaving the coarser species which, along with invader vegetation, take hold while bare patches and erosion increase. The resulting loss of termites creates drought underground, reduces fertility, and stunts vegetation growth.

Wildlife on home territory are more successful than cattle. They have adapted to local diseases and need no expensive dipping or inoculations. They are adapted to dry conditions. Many species live their lives without water. Mechanisms have evolved that control water loss. Efficient kidneys use very little water. Body temperatures vary as in reptiles, and rise on hot days while cattle lose water through sweating and panting to keep cool.

Reabsorption of water from the large intestine eliminates the high water losses observed in cow manure. Droppings are dry, pelleted and covered in a mucous layer which maintains an anaerobic environment inside the pellet, allowing micro-organisms to use the nitrogenous waste and create valuable fertilizer. Cow dung exposes the micro-organisms to oxygen, killing them off and leaving nitrogen to be lost as ammonia and methane.

These adaptations allow wildlife to live far from water and eliminate the kind of compaction and trampling that result from livestock's daily trek to water. This compaction further dries out soils, reduces vegetation growth and creates erosion trails.

Apart from the above, there are economic advantages to wildlife use. Tourism and hunting are big earners in many African countries. The development of these activities, along with a management programme through culling and marketing the natural increase in the herds, allows for incomes that exceed those from cattle. To enhance this, cattle can be reduced and capital invested in financial markets, yielding higher returns than those obtained from cattle, especially on pastoral lands.

The partnership programme. The great experiment.

The discussion then turned to how all this could be transferred to their ranch. I explained how in 1989, I was invited by the Ministry of Wildlife to write the first policy paper relating to wildlife utilisation and management in Kenya and how this was then incorporated into Kenya's wildlife policy. They were excited to learn that some 50 ranches were given 'user rights' mainly in two districts of Kenya and that these are the only two areas in the country where wildlife numbers have increased. Everywhere else wildlife populations are declining. As a result, The Kenya Wildlife Service, (KWS) launched 'The Partnership programme'.

At the launch of this programme the director stated that the extension of this

wildlife or natural land-use system, the devolution of rights and responsibilities for wildlife to land owners and land-owning communities, would now be the central theme and goal of KWS, along with tourism and biodiversity. In order to achieve this, KWS has divided the country into eight ecological regions or zones each with an assistant director and a full compliment of personnel to implement the utilisation programme in each region. This allows more remote communities to receive encouragement, advice and operating procedures.

These events have brought home to landowners that alternatives exist in land use where none existed before. I explained to the group that in most countries, including the United States, landowners do not have the option of including indigenous species of animals in their ranching or land-use systems. They may only use foreign non-adapted animals. That is the law.

We went on to discuss that the most important part of this new programme is that income goes to the landowner whereas in the past hunting and tourism yielded income, but not to the landowner. Hence wildlife disappeared because it was not in the interests of the landowner to keep and protect it. This new breeze has led to a major paradigm shift. Five years ago, let alone 30 years ago when I started my research, land owners were simply not interested in wildlife. Now land-owning communities across the country are looking to benefit from wildlife.

Game ranching - natural land-use

The group wanted to know in practice what could be done. Included would be tourism of all sorts, tented camps, lodges, walking and riding safaris; hunting of all kinds, including bird hunting, and a culling programme for management of the herds. We discussed all these and how they would produce a variety of income streams. For them the central issue was how to start.

Management was clearly the key element. In this regard we initiated an inventory of the ranch. This is a very large

area, approaching three quarters of a million acres, and they do not know who or what lives there. This inventory will start with people, including children, the number of *manyattas*, cattle, sheep, goats and donkeys. We will then help with an inventory of their remaining wildlife species and numbers.

The issue of culling came up as it always does in areas where wildlife numbers are low. The facts are that in an unmanaged, (zero culling) situation the effect of predators is to increase the number of males at the expense of females and young. This is because males are less palatable and have bigger horns. With reduced breeding stock, populations do not increase. Also, infighting amongst males reduces successful mating. Culling, therefore, centres on excess male offtake, leaving the breeding herds intact and increasing populations, exactly as is done with cattle.

Income from a culling programme is never going to be very large considering the costs of the cull, preparation, inspection and marketing. However in my home area of Machakos district, income from culling provides at least a quarter to a third of the proceeds paid to shareholders. This combined with a well-selected tourist operation can yield significant income to the group. If hunting were to be sanctioned then income will be very significant, and this will add vital impetus to the desire of land-owning communities to conserve and protect their wildlife resources.

A quote from the United States President Roosevelt on his Safari in East Africa in 1915 is relevant here. "When genuinely protected, birds and mammals increase so rapidly, it becomes imperative to cull them. The foolish sentimentalists who do not see this are the really efficient foes of wildlife and of sensible movements for its preservation."

Hunting

In Kenya, the hunting ban remains in force. It is generally accepted that hunting is a major income earner in wildlife utilisation.

I tried to explain to the group the emotional reservations of conservationists

in our community. They could not understand this. In all my discussions with ranching people and communities in the country, the emotional aspect of this is never even raised. Surely decisions regarding utilisation, including hunting, must be based on the survival and needs of our ecosystems, our people and our wildlife. They must not be based on emotions.

In this context all sustainable methods of deriving income from wildlife must be pursued if we are to give incentives for its protection to our people. Without hunting the true value of wildlife will not be realized. We ask landowners to protect wildlife because it is valuable, but will not allow them to realize that value. It can be likened to legislating that a rancher may only sell the front leg of his steer and throw the rest away. The result would be an immediate loss of interest in cattle. Land owning communities will only protect and manage wildlife on their lands when they can see and realize its true value. All this is particularly relevant as some 75 per cent of wildlife lives on private or communally-owned land.

A few months prior to this meeting I had similar meetings with elders of a northern tribe called the Pokot. The issue of hunting had, as always, come up. The area in question is the Kerio Valley, where devastation of the land is fast approaching zero productivity. There are still a couple of hundred elephant left in the area, as well as some buffalo and other smaller species. Hunting of elephant is perhaps as emotional an issue as any in the wildlife field. Yet selling four elephant a year to hunters, or a 2 per cent cull, would bring in US\$ 100,000, more money than the whole group combined make in a year. This would provide income to the people allowing them to afford to reduce their domestic animals and institute rotational grazing and other rehabilitation techniques. This is now the only hope for the ecosystem to recover. Otherwise in five years there will be no elephant or any other animal surviving in the area.

Hunting in many countries has and still is being grossly abused. Hunting blocks are given out by governments, leaving scope for serious corruption, and at the expense of wildlife and whole ecosystems. With a utilisation programme

already in place in Kenya, complete with sanctioned offtake quotas, use of part of those quotas for hunting would greatly increase income, leaving control in the hands of the landowner, in whose interest it would be to manage it properly.

Land-owning communities across the country are considering this new possibility of wildlife utilisation, and seeking answers relating to costs and benefits. Returns to land resources using wildlife will determine the future of wildlife. Only multi-use wildlife systems will give the kind of returns that will make the difference.

Livestock

All this has to be considered in the light of the fact that returns from declining livestock numbers in pastoral areas are extremely low. Even on commercial ranches, negative return to capital has led to bankruptcy, and often subdivision, a sure recipe for ecological collapse in rangeland areas. In the western United States return to land (or capital) in ranching was less than 1 per cent fifteen years ago, falling to zero by the end of the 1980s.

Livestock is a thorny issue in Africa. In pastoral communities the tragedy of the commons pervades. The richer you are the more stock you own, feeding on common land. Benefits go to the individual not the community. The real tragedy is that nobody questions or seems concerned about this inequity. The man with the most cattle in the group proudly told me he had more than 500 cattle. I then asked the rest how they felt about this man unequally benefitting from their shared vegetational resource, considering the end result was the death of their land. There was an uncomfortable silence as the group glared at this man.

We then discussed income from domestic animals. Again we used the 500 cattle as an example and the owner detailed income and costs. We took the value of his stock and worked out the interest he would accrue invested in securities. This came out at seven or eight times more. Again they got the point, and are considering this alternative.

Recently I have been in touch with a Swiss vet who explained the rural Swiss

livestock system. Each livestock owner has the equivalent of a token in order to graze his animal. The number of medallions overall constitutes the maximum animals supportable on their land. These are inherited, purchased or auctioned every year. They develop a significant value, and at the same time protect against over-utilisation. We are at this point looking for donors to take a few of the Masai elders to Switzerland to see how this works, and try and adapt it to the local situation.

Conclusion

In terms of relative returns from livestock or wildlife, the debate is endless. The path being followed encompasses both. We discussed a limited livestock herd upgraded to produce milk for the communities and being grazed on a strict rotational basis. This herd would be relatively small to begin with until the grassland system recovered. There are a number of management tools available to speed up recovery and all of these would be implemented once livestock numbers were controlled.

On land that has not been completely destroyed there are options available for rehabilitation. Group, tribal and community lands, though seriously degraded, can in some cases be turned around. The group described want to do something before the last vestiges of their ecosystem perish.

There are solutions. The rehabilitation of wildlife for a variety of reasons does lead to rehabilitation of the land and vegetational resources. How this happens is fascinating and beginning to be understood. Our research over 30 years has given us clues and understanding of the strength and complexity of natural ecosystems and the adaptational features of indigenous animals. The reinstatement of these animals can re-establish energy systems and food chains, allowing for rejuvenation.

Wildlife is an essential component of rangeland survival, in fact the survival of any ecosystem. Nature not man holds the key to environmental rehabilitation and survival. Man's role must be to create the conditions that allow this to happen.

There was a long silence, and the chairman then explained by telling the group what we observed on our tour. I then asked the older members what the land was like when their parents left it to them as kids. Of course, they waxed eloquent and were very excited in their explanations of how wonderful it was, and how much grass there was, and how much wildlife. I then asked them what they were leaving for their children. There was another long silence.

The next meeting is planned for some 200 of the elders so that we can institute a real and properly organized management programme. They seem very keen to do it and I think may have realized that things must change if they are to survive and if there is to be anything at all left for the coming generations. It is quite evident to me that the historical influence of the unforgiving and relentless African environment continues to play itself out in the lives and thinking of the people here, through and beyond catastrophe brought about by blind adherence to the resulting mind set. It is equally sad that

the Western 'conservation' emphasis, skewed by the Walt Disney cuddly 'Bambi' approach, concentrates on the emotional rather than the real aspects of programmes that could alleviate the gathering storm of destruction of Africa's dryland ecosystems."

The wildlife alternative The first wildlife ranch

The meeting with the elders then turned to what could be done. I explained to the group how I had started on my own ranch. I explained that for 30 years I have worked on the broad concept of the utilisation of wildlife, with the hypothesis that this would be the only way to conserve our wildlife in Africa, and that the return of the wildlife could rehabilitate the primary productivity of our fast disappearing ecosystems. I explained that the initial studies centred on a comparison between cattle and game ranching and that these studies became the subject of a Ph.d

dissertation. The results were controversial, as livestock proponents could not accept the high wildlife production levels found in the study. The group were more interested in the findings that indigenous animals proved to reverse degrading range trends.

In fact, the initial ideas to start this research came from the observation that worldwide, the only rangelands that remain in pristine and healthy condition are those where wildlife, or native species, exist as the dominant fauna. My research confirmed this position and added the real possibility that the reintroduction of wild indigenous animals could lead to ecosystem rehabilitation.

To implement these ideas, necessary permissions were obtained and the first wildlife ranch, a wildlife and range rehabilitation programme, was initiated. Since its inception we have been experimenting with, and developing management systems for wildlife. The ecological findings and results are impressive and surprising. The economics even more so.

Ecological Study of a Section of the Accra Plains

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and

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Abstract

An investigation on species composition along transects and soil seed banks in a section of the Accra plains was carried out. Endozoochory of cow dung in the area was also undertaken.

Forty-one plant species belonging to seven life form categories were observed. The area was characterized by a relatively low density of tree species.

The soil seed bank study indicated a preponderance of grass seeds within the soil. Seeds of tree species were virtually absent. Germination of most of the grass seeds/grains were enhanced by light. Only *Desmodium scorpiurus* germinated under shade conditions; whereas seeds of *Phyllanthus amarus* and *Oldenlandia corymbosa* germinated under both light and shade conditions. *Cassia obtusifolia* germinated from cow dung denoting the possibility of endozoochory.

Introduction

The Accra plains consists of a triangular area in the southern part of Ghana. It covers an area of about 2,800 km² (Jenik and Hall, 1976) being bordered on the east by the lower reaches of the Volta river, the west by Winneba, the north by the Akwapim scarp, and the south by the Gulf of Guinea.

The plains are not a homogenous area, Jenik and Hall (loc. cit.) divided them into seven smaller geographical units based on the vegetation and the soil types. The northern boundary is a hilly forest whereas the eastern and western boundaries are the Guinea savanna. Although the vegetation of the Accra plains is referred to as savanna, it does not fit into any of the main savanna types found in West Africa; hence might better be referred to as a kind of steppe since the grasses in this very dry area of less than 750 mm rainfall annually, rarely exceed 80 cm in height (Lawson and Jenik, 1967; Jenik and Hall, loc. cit.).

The plains are spatially isolated from the other savanna areas and its anomalous dry climate with a combination of low rainfall, moderate and low humidity has given rise to the designated; "Accra-Togo

dry Coastal Climate", rendering it ecologically special.

The soil on the plains show great variation (Brammer, 1967). They closely reflect the underlying parent rocks and they are generally shallow and have a clay pan such that they are often subjected to waterlogging in the wet season, making them unsuitable for the growth of most woody plants. The soil is cracked during the dry season.

Termite activity is very pronounced on the Accra plains. They are mostly associated with thicket vegetation; and their activity may be contributing to the fairly high nutrient status of these spots on the plains (Lawson and Jenik, 1967).

The Accra plains are obviously under stress due to (i) the low rainfall (Benneh and Agyepong, 1990); and (ii) the increase in population on the plains. The sources of stress on the plains can thus be put into two categories: (a) abiotic which include the low soil moisture content and hence water stress (drought), the high ambient temperatures and light intensities; and (b) biotic or human-induced, due to population pressure on the land resulting from the persistent quest for: (i) fuelwood; (ii) harvesting of poles for the construction of huts, temporary canopies for social

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functions, village houses; (iii) grazing; and (iv) harvesting of fruits, medicines and other miscellaneous items.

Throughout the entire subregion fuelwood provides the energy for rural households and is the main source of cooking fuel in urban areas. Much of the wood is made into charcoal, because charcoal is light, burns hot but slowly and is easily broken up into manageable burnable lumps. However, making charcoal wastes 70 per cent of the energy of the wood even before it is dug out of the oven in which it is made (UNEP, 1993). It is generally assumed, however, that rural households in the subregion do not suffer from fuelwood scarcity; but it is evident that population pressure on vegetation has resulted in the scarcity of fuelwood (Milas, 1984).

On the Accra plains fuelwood harvesting is a main source of cash income for rural households. Due to the escalating population growth in Accra, large vehicles are often loaded with charcoal or fuelwood from the rural areas and are off-loaded in the city. This pressure on the vegetation is contributing significantly to the degradation of the environment in addition to fire as indicated by Lawson and Jenik, (1967). In some circumstances, the fuelwood harvesters and charcoal burners courageously violate the traditional taboos and encroach on some protected forests.

Ocansey (1985) observed in research on fuelwood exploitation in a village on the outskirts of Accra that the fuelwood trade to Accra and other urban centres was an extremely important economic activity especially during the fishing season. This most often coincides with the short dry season (July-August) when herrings are most often caught.

Grazing is a common feature of the Accra plains. Overgrazing is clearly a major contributory factor to the severe environmental degradation observed in most parts of the Accra plains. Leaves and fruit of drought-resistant plant species support livestock during the dry season. The practice of lopping to provide fodder

for livestock during the dry season accelerates the degradation of the already scanty vegetation. Occasionally, herdsman intentionally set fire to the grasses to stimulate the growth of dormant tussocks to enable their cattle to feed on saplings. Uncontrolled grazing and fires accelerate destruction of the existing vegetation, thereby interfering with natural regeneration. The plains thus experience bushfires twice a year (December to March and July to August).

Vegetation, although highly significant to human survival is often not given the importance it deserves and plant growth is erroneously considered inexhaustible, thus the natural regeneration of vegetation is being adversely affected by human-induced factors.

It is essential to understand the interaction within and between both natural biotic and abiotic components of the savanna ecosystem and the socio-economic components in order to design sustainable management strategies.

This work was conducted to investigate the possible natural regeneration of the vegetation on the Accra plains. The work was done near the Pinkwae Sacred Grove about 25 km east of Accra.

Materials and method

Soil seed bank determination

Two 500m transects were laid from the edge of the sacred grove into the adjoining degraded area. The transects were laid in an east-west direction. Subsequently, 5m² quadrats were laid at 10 metre intervals along the transects. All plants species within the quadrats were identified and their percentage composition within each quadrat also determined.

Soil samples were collected from each quadrat by marking out another one metre in the centre of each 5m² quadrat. The soil

samples were taken at 5cm depths. The samples were stored in polyethylene bags, tagged and brought to the laboratory for use to determine their seed bank composition.

The soil samples were thoroughly mixed in the laboratory and the heap from each quadrat divided into two batches. Each batch was put into 50cm x 30cm x 10cm wooden boxes after which one lot from each quadrat was placed under shade whereas the other was exposed to full sunlight.

The soil samples were irrigated daily with equal amounts of water. Measures were taken to prevent contamination of the boxes by foreign seeds through wind and animals. The date of emergence of the different seedlings and their identities at flowering or earlier in the vegetative phase were recorded.

Cow dung was also collected from the study area, broken up into smaller pieces, divided into the two batches and treated in exactly the same way as described above for the soil samples, in order to investigate endozoochory.

All the soil samples and the cow dung were sieved after some weeks to determine the availability of dormant seeds.

Results and discussion

Species diversity along the transects was relatively high. In all, 41 species were identified. However, most of the species were herbs and grasses. The dominant woody species in the area include *Azadirachta indica* and *Dichrostachys cinerea*.

The percentage composition of the species per quadrat along the transect are shown in Figs. 1) and 2). However, all the species could not be presented in a graphical form due to non-uniformity in occurrence.

Dichrostachys cinerea, where ever it appeared, occurred in clusters, thus forming thickets. This may be due to the thorny nature of the species thus making

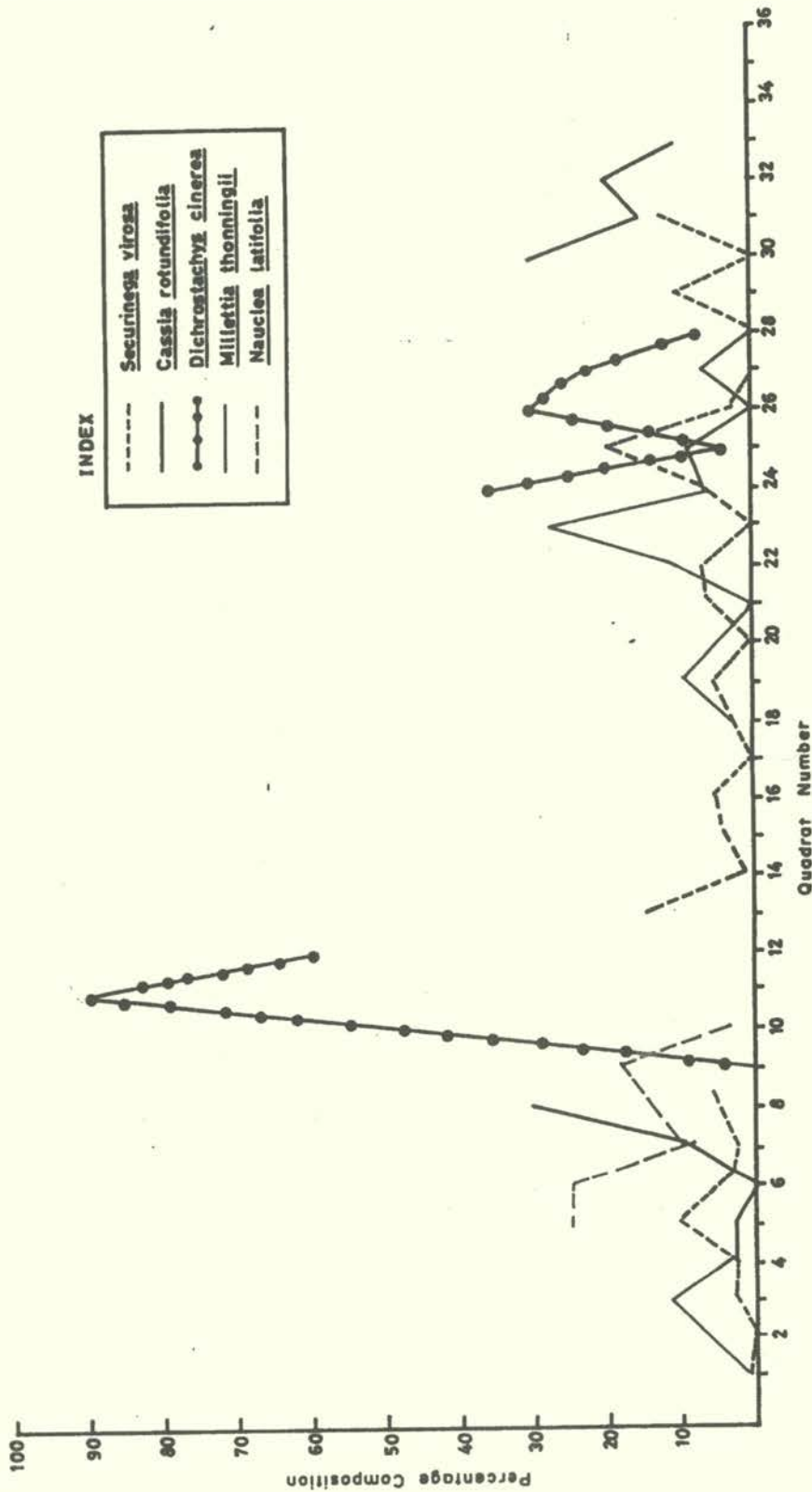


Figure 1. Percentage composition of species along the transect in the disturbed zone adjacent to the Pinkwae sacred grove on the Accra plains.

it difficult to handle by the fuelwood harvesters.

The species diversity and life form category along the transects is shown in Table 1. There were comparatively fewer trees than shrubs and herbs.

The woody species identified along the transects and thus at the study site were generally shrubs. The tree species include: *Azadirachta indica*, *Antians africana*, *Ficus capensis*, *Lannea sp.*, *Malachantta alnifolia*, *Millettia*

thonningii, *Morinda lucida*, *Terminalia avecinoides*, *Vitex doniana*, and *Zanthoxylum xanthoxylloides*.

The results obtained indicate that there were 41 plant species belonging to 23 plant families out of which nine were

monocotyledonous and 32 were dicotyledonous. The 41 species were composed of 14 herbs, nine shrubs, eight grasses, four trees, four climbers, one bulb, and one sedge. Out of the 23 families, the Poaceae and Papilionaceae were the most abundant with the rest of the families being represented by one or two species.

The species diversity in the study area seemed to be high, however, it is dominated by grasses and herbs. The trees are sparsely distributed contrary to the observation by Lieberman (1979) in the sacred grove where the species diversity was low with clusters of *Disopyros abyssinica*, *Drypetes parvifolia* and *D.*

floribunda. Normally, self perpetuation should be through reproductive phase, which leads to seed production. In some other species, however, there may be vegetative propagation in addition to seed production. However, it has been observed that in the study area, the regeneration of the tree species was mainly from

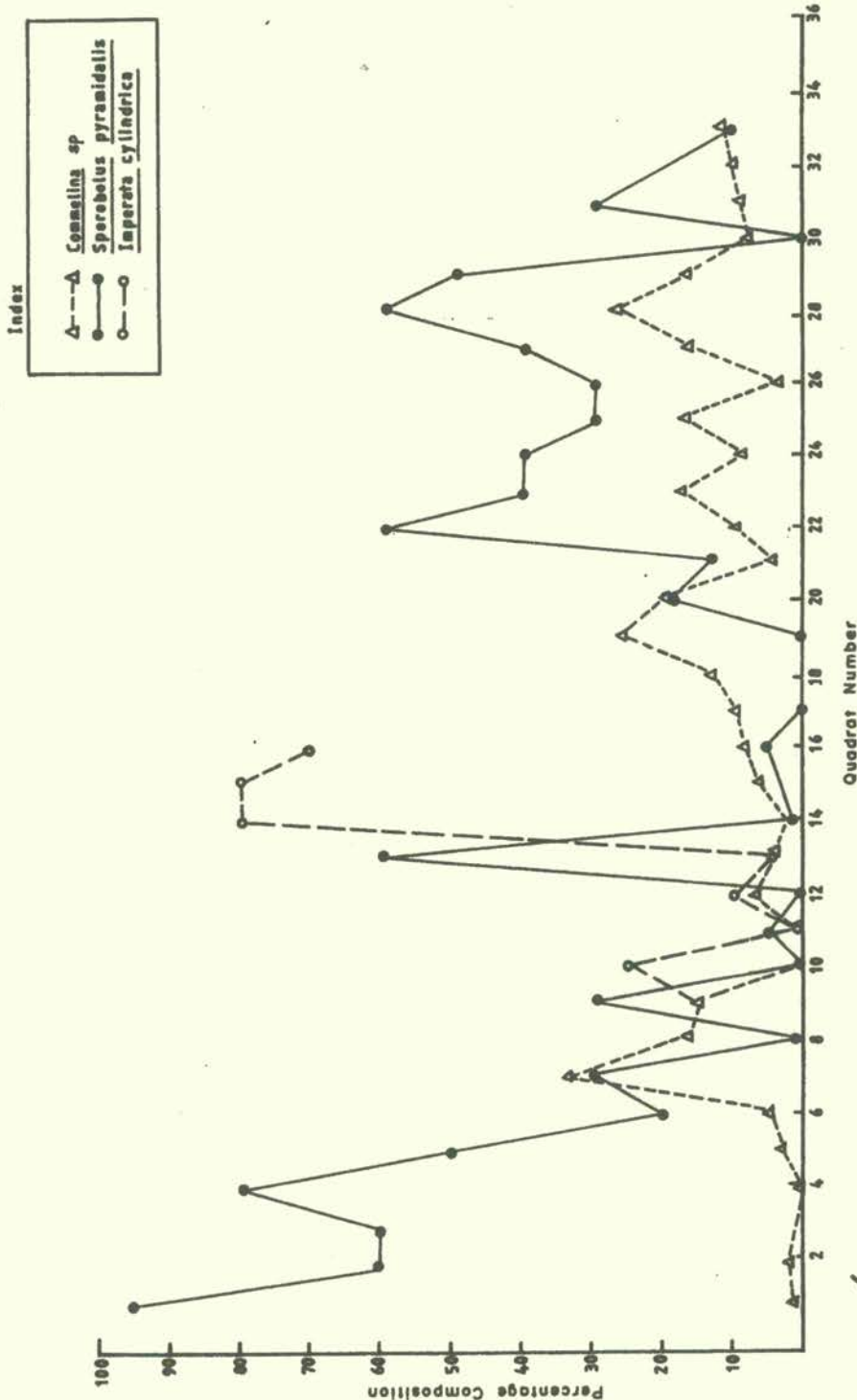


Figure percentage composition along the transect in the disturbed zone adjacent to the Pinkwae sacred grove on the Accra plains.

Table a: Distribution of species and life form category along transects

Species	Family	Life Form
<i>Abutilon manritianum</i>	Malvaceae	herb
<i>Allophylus africana</i>	Sapindaceae	woody herb
<i>Andropogon gayanus</i>	Poaceae	grass
<i>Aristida adscensionis</i>	Poaceae	grass
<i>Azadirachta indica</i>	Meliaceae	tree
<i>Cassia rotundifolia</i>	Caesalpinaceae	herb
<i>Chromolaena odorata</i>	Asteraceae	perennial shrub
<i>Chloris barbata</i>	Poaceae	annual grass
<i>Clausens anisata</i>	Rutaceae	shrub
<i>Commelina diffusa</i>	Commelinaceae	herb
<i>Corchorus trilocularis</i>	Tiliaceae	herb/woody annual
<i>Crinum ornatum</i>	Amaryllidaceae	bulb
<i>Desmodium gangeticum</i>	Papilionaceae	shrub
<i>Dichrostachys cinerea</i>	Mimosaceae	tree/shrub
<i>Ehretia cymosa</i>	Boraginaceae	shrub/small tree
<i>Evolvulus alsinoides</i>	Convolvulaceae	herb
<i>Griffonia simplicifolia</i>	Caesalpinaceae	shrub
<i>Hybanthus enneasplonum</i>	Violaceae	shrub
<i>Imperata cylindrica</i>	Poaceae	grass
<i>Lannea nigriflora</i>	Anacardiaceae	tree
<i>Leptadenia hastata</i>	Asolepiadaceae	twiner/woody
<i>Lonchocarpus macrophyllus</i>	Papilionaceae	tree/shrub
<i>Ludwigia decurrens</i>	Onagraceae	annual woody herb
<i>Millettia thonningii</i>	Papilionaceae	tree
<i>Nauclea latifolia</i>	Rubiaceae	shrub/small tree
<i>Panicum maxima</i>	Poaceae	grass
<i>Paullina pinnata</i>	Sapindaceae	woody climber
<i>Rhynchosporacy corymbosa</i>	peraceae	sedge
<i>Schwenkia americana</i>	Solanaceae	annual herb
<i>Scoparia dulcis</i>	Scrophulariaceae	herb
<i>Securinega virosa</i>	Euphorbiaceae	shrub
<i>Sida linifolia</i>	Malvaceae	perennial herb
<i>Sporobolus pyramidalis</i>	Poaceae	perennial herb
<i>Stachytarphyta jammicus</i>	Verbenaceae	herb
<i>Tephrosia purpurca</i>	Papilionaceae	woody herb
<i>Teramnus labialia</i>	Papilionaceae	perennial twiner
<i>Uraria picta</i>	Papilionaceae	woody herb
<i>Vernonia cinerea</i>	Asteraceae	annual herb
<i>Vetiveria fulvibabis</i>	Poaceae	grass
<i>Vitex doniana</i>	Verbenaceae	tree

coppicing; and thus the species were not allowed to go through the reproductive phase. It shows that species that could not coppice are completely lost after cutting.

The composition of the members of the Poaceae found in the area was similar to that reported by Schmitt and Adu-Nsiah (1993). The ability of the grasses to be established in this drought prone area may be attributed to the fact that as grasses, they are able to regenerate by producing new shoots from their underground tussock (Lawson, 1985).

Results obtained from the soil seed bank study indicate that large populations of viable weed seeds were buried in the soil. Similar observations have been made and reported by many investigators (Hall and Swaine, 1981; Bannister, 1978; and Wesson and Wareing, 1969;). The results indicated that the germination of most of the species required light and thus they are probably photoblastic. Other studies have revealed similar light-induced responses to the germination of other seeds (Mayer and Poljakoff-Mayber, 1989; Bannister, 1978; Wesson and Wareing, 1969;).

Although this study did not cover the effect of quality of light on germination, it is speculated here that the observed light induced germination of those seeds in the study could be similar to the phytochrome-induced germination of lettuce seeds (Leopold and Kriedeman, 1975; Mayer and Poljakoff-Mayber, 1989; Salisbury and Ross, 1985). For those seeds whose germination was induced by light, it appeared that the absence of light among other factors such as soil compaction, aeration, and the absence of water may have hindered their germination. Furthermore, the observation that the transfer of those seed boxes from shade to light resulted in the germination of *Cyperus rotundus*, *Mariscus alternifolius*, *M. flabelliformis* and *Scoparia dulcis*, clearly indicated that they were positively photoblastic.

The results obtained in the soil seed bank emergence study is summarized in Table b.

Species	Family	Life form
Emergence	from soil in the open	(Light)
<i>Aristida adscensionis</i>	poaceae	annual grass
<i>Cleome viscosa</i>	Cleomaceae	annual herb
<i>Chromolaena odorata</i>	Asteraceae	shrub
<i>Chloris pilosa</i>	Poaceae	grass
<i>Cyperus rotundus</i>	Cyperaceae	sedge
<i>Dactyloctenium aegyptium</i>	Poaceae	grass
<i>Euphorbia heyerophylla</i>	Euphorbiaceae	herb
<i>Eragrostis ciliaria</i>	Poaceae	grass
<i>E. tenella</i>	Poaceae	grass
<i>Frimbristylis trifolia</i>	Cyperaceae	sedge
<i>Mariscus alternifolius</i>	Cyperaceae	sedge
<i>M. flabelliformis</i>	Cyperaceae	sedge
<i>Mollugo nudicanlus</i>	Molluginaceae	herb
<i>Oldenlandia corymbosa</i>	Rubiaceae	herb
<i>Phyllanthus amarus</i>	Euphorbiaceae	herb
<i>Physalis angulata</i>	Solanaceae	herb
<i>Scoparia dulcis</i>	Scrophulariaceae	shrubby weed
<i>Securinega virosa</i>	Euphorbiaceae	shrub
<i>Spigelia anthelmia</i>	Loganiaceae	shrub
<i>Sporobolus pyramidalis</i>	Poaceae	perennial grass
<i>Stachytarpheta indica</i>	Verbenaceae	herb
<i>Syndrella nodiflora</i>	Asteraceae	herb
<i>Vernonia cinerea</i>	Asteraceae	herb
<i>Desmodium scorpiurus</i>	Fabaceae	herb
<i>Phyllanthus amarus</i>	Euphorbiaceae	herb
<i>Oldenlandia corymbosa</i>	Rubiaceae	herb
ENDOZOOCHOROUSSPECIES		
<i>Cassia obtusifolia</i>	Caesalpinaceae	woody annual

Mayer and Poljakoff-Mayber (1989) reported similar observation of light induced germination in several temperate seeds.

The results of the seed bank study also showed that *Desmodium scorpiurus* germinated only under shade or reduced light conditions; whereas those of *Oldenlandia corymbosa* and *Phyllanthus amarus* germinated under both shade and full sunlight conditions. This observed germination under shade conditions does not lend itself to explanation but one wonders whether this may have something to do with hormonal action during germination. It has been observed that all reports on light and hormonal effect on germination were on temperate region species. This result therefore is giving a clue to the possibility of factors such as light, dark and hormones affecting germination in the tropics.

It was also observed that germination of *Cassia obtusifolia* seeds in cow dung was possible under full light conditions. The presence of *Cassia obtusifolia* seeds in the cow dung indicated that it probably passed through the guts of the animal. The question to ask here, however, is whether this process or action may have aided germination of the species? Since there was no *Cassia obtusifolia* seedlings observed in the seed boxes under both light and shade conditions, it may be deduced that the passage of *C. obtusifolia* seed through the guts of cattle most probably helped to stimulate germination; in which case this can represent an example of endozoochory. It is believed that gastric or intestinal juices modify seed coat structure, making it more permeable to water and gases, thus resulting in germination. Work by Tybirk (1991) also reported the dispersal and enhancement of germination by the passage of seeds through the guts of animals. The report indicated that most members of the Caesalpiniaceae are endozoochorous due the presence of a hard and shiny seed coat.

The observation that no tree seed germinated in the seed bank study under either shade and light conditions could be an indication that there were no tree seeds in the soil. Sieving the soil after several weeks did not show the presence of any seeds left in the soil.

Conclusion

The natural regeneration of the study site is not possible within a very short time. However, serious efforts must be made to reclaim the vegetation before further irreversible degradation of the environment occurs. The rate of degradation on the Accra plains calls for urgent attention.

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Rangelands and Animal Production: Constraints and Options

Dr. M. Younas¹

Abstract

Livestock production is the second biggest economic activity after crop husbandry for the rural population of Pakistan. Of the 120.84 million people in the country, more than 82 million (68 per cent) live in rural areas. Without giving proper care and attention to livestock kept in villages, remote areas and rangelands, the dream of uplifting the socio-economic conditions of the rural poor cannot come true and the expected economic increase in this sector cannot be envisaged. More than four million people in the country depend directly or indirectly on deserts and rangelands. To develop the livestock sector in toto, the needs of small landholders, landless livestock owners or tenants need to be met. The kind of husbandry innovations needed demand technologies that are cost effective, efficient, practicable and suited to local conditions. Such innovations should be widespread and on a scale which will make the livestock production system more sustainable and viable on efficient rangelands. The feeding needs of livestock have to be met if we want them to fulfil

their genetic potential. A vast area (62 per cent) of the country is rangeland and can help bridge the gap of the nutrient requirements of livestock.

Introduction

The livestock of Pakistan is well adapted to hot and humid conditions, tolerant of tropical diseases and good converters of poor quality roughage into milk and meat. Yet despite the high yielding native meat and milk breeding stock, little attempt has been made to select quality animals. The same applies to the task of maintaining pure bred lines or of breeding selectively for qualities adapted to local conditions. Any surviving animal tends to be retained as a member of the herd. Although survival is an essential quality, it should not be the only motivation for rearing livestock, survival of course, is the top priority for the animal itself, the first 70 to 75 per cent of the nutrient intake goes to body maintenance. It is only after the nutrients necessary to maintain vital bodily functions are satisfied that secondary production attributes will be fulfilled. Yet such attributes are of course the reason why, at least in theory, the animals are raised by humans.

The provision of feed stuff of adequate

nutritional quality is likely to be the most limiting factor to increasing livestock production, provided there is a market demand for the livestock products. This is not to suggest that aspects such as breed improvements, and disease control are unimportant. They should be considered concurrently. But in most situations animal numbers and production will be controlled by feed supply. Breed improvement and health measures will have little effect unless nutritional requirements are met.

Feeds and the fodder situation

The area under fodder production totals about 2.7 million hectares, which produces 58 million tonnes of fodder, which is not sufficient to meet even the maintenance requirement of the livestock. The present day position and expected scenario under the prevailing conditions is presented in Table 1. According to the National Coordinator for Fodder Production at Pakistan Agricultural Research Council (PARC) (Bhatti, 1995), the increase in milk production has largely been due to the greater availability of green fodder in the recent past. This is

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Table 1: Feed supply balance (requirements and availability) (Million tonnes)

	1976			1986			2000		
	DM	TDN	CP	DM	TDN	CP	DM	TDN	CP
Requirement	79	43	8	113	61	11	154	83	15
Availability	68	35	6	89	43	8	118	61	10
Deficiency	11	8	2	24	18	4	36	22	5
Deficiency (per cent)	13	19	29	21	29	33	23	27	34
DM - dry matter CP - crude protein TDN - total digestible nutrient									

very much in line with the recommendations of the NCA (1988) that suggested if "all animals in milk receive a full diet which meets their daily appetite without changing the feed mix i.e; maintaining the present low nutrition mix, this alone could increase milk yield by 100 per cent. According to Qureshi (1992) the present situation is that the livestock feed pool is deficient by 21 per cent of total dry matter (DM), by 29 per cent of energy and by 33 per cent of crude protein (CP) requirements. The present fodder supply is a third less than the actual needs and the area under fodder crops has reduced during the past decade or so without any significant corresponding increase in yield per acre. The present day aim of animal scientists should be to enhance the productivity of livestock per unit rather than increasing the production by the total number of animals, which is impossible to do anyway without filling the rumens of the individual animals.

What to speak of barani and rangelands, the production of fodder per acre is low in irrigated tracts also. The huge contribution of livestock (which largely depends on natural grazing lands) to the economy is also substantial. Keeping in view our livestock numbers and their requirements, range productivity is very poor. It indicates the importance of the livestock industry, which ultimately depends on rangelands.

Rangeland Resources

Of the total 80 million hectares of country, 49 million hectares are under different ranges. Pakistan has both arid and mountainous rangelands. The area under ranges in Punjab is 40 per cent, Sind 55 per cent, North West Frontier Province (NWFP) 60 per cent and 79 per cent in Balochistan totalling 62 per cent of the country overall (Table 2). Rangelands are areas devoted to livestock production from

Table 2: Necessary statistics about rangelands in Pakistan

Distribution of rangelands by province

Province	Total Area (MH)	Rangeland (MH)	Percentage (per cent)
Punjab	20.63	(51.00 ma)	8.30 (20.26 ma) 40
Sind	14.09	(34.82 ma)	7.80 (19.27 ma) 55
NWFP	10.17	(25.13 ma)	6.10 (15.07 ma) 60
Balochistan	34.72	(85.79 ma)	27.40 (67.70 ma) 79
Total	79.61		49.50 62.18
Nothern Areas	7.04	(17.39 ma)	2.10 (5.19 ma) 30
AJ & K	1.33	(3.29 ma)	0.60 (1.48 ma) 45
Sub total	8.37		2.70 32.25
TOTAL	87.98		52.20 59.33
MA -million acres;MH - million hectares			

natural or semi-natural vegetation. Rangeland vegetation includes shrublands, grasslands and forests. Our rangelands extend from alpine pastures in the north to the Arabian Sea in the south. Rangelands constitute the single biggest land use in Pakistan. They are generally defined in a negative sense as areas being climatically or topographically unsuitable for economic cropping or sown pastures.

Type and nature of the range resources

Rangelands in Pakistan consist of alpine to temperate and mediterranean ranges in the western mountains to arid and semi-arid desert ranges in the Incus Plains (Mohammed, 1989) and from sea level in the south to over 8,800 m in the north. Extreme climatic variations are the result of extreme elevation ranges and monsoon rains. About 70 per cent to 75 per cent of the country is arid to semi-arid. Summers are extremely hot while winters are mildly cold to very cold. Rainfall varies from 100 mm in the South to more than 1,500 mm in the north. Central and southern plains consist of fertile soils but annual rainfall is low averaging less than 250 mm. The northern snow-covered mountains of the Himalayas, the Hindu Kush and the Karakorum ranges are the main source of runoff for the mighty Incus river and its tributaries. As a result, water from the Incus and its tributaries is used to develop the largest canal irrigation system in the world.

Production potentials of rangelands

Although high potential rangelands are well represented in the north and north western regions of the country, extensive semi-desert or desert ranges in the provinces of the Punjab, Sind and Balochistan are also to be found. Except for parts of Chaghi and Kharan Districts of Balochistan, most of the deserts in the country are man-made and have resulted from a long history of overgrazing and mismanagement and vegetation deterioration. As a result of continued unwise range use, the current trend of retrogression is still progressing



Iple iple (Lucaena leucocephala) grown at Barani LPRI (Livestock Production) Research Institute Kherimurat ranges in District Attock.

(Quraishi *et. al.* 1993). The consequent outcomes of such negative (downward) trends may take several forms.

Scope of livestock production on ranges

The main cash income of the barani and rangeland areas is livestock, which is readily accessible. The livestock population is under severe nutritional stress as the base of its feed supply has been progressively eroded. The productivity of rangelands and wastelands is very low due to over-grazing and the carrying capacity of these lands has been reduced to 50 per cent or less. There have been few reseeding programmes, and feed and fodder availability for livestock is becoming scarcer by the day. However, if the rangelands are to play their role in fulfilling animal feed requirements, they need proper attention.

In deserts, sheep, goats, cattle and camels are kept for milk production, draught power and transport. Cattle, are reared in defined areas where water and grazing facilities are usually available, sheep, goats and camels follow either nomadic or transhumant systems. Nomadic flocks keep moving constantly in search of grazing. Grazing is generally

free, but in winter during shortages of natural grasses, shepherds may need to buy feed from other sources. The nomads tend to sell their animals during periods of feed scarcity, therefore, the price of sheep and goats is slightly lower in winter than in the rainy season.

Under the transhumant system, the whole human population and their livestock wealth migrates from the desert areas or cold regions of the northern

rangelands to the nearest irrigated or low-lying lands (Younas *et. al.* 1993). This migration, however, usually creates stress on feed resources and affects the grazing capacity of the host lands. This shifting also affects feed and meat prices in the market.

Scope of range productivity improvement

The primary productivity of our rangelands has been adversely affected due to misuse and overgrazing. Except for a few areas, rangelands are under producing. Due to continued harmful practices the current retrogression of range vegetation is continuing (Quraishi *et. al.* 1993) resulting in (a) a decrease in desirable forage species; (b) reduction in their vigour and (c) an inability to compete and reproduce; (d) an increase in undesirable species; (e) deterioration in watershed values; (f) damage to the production of quality forage; and (g) depletion of wildlife. According to one estimate 75 per cent of the country is subject to erosion. Deteriorating watersheds are yielding poor quality water, and unregulated stream flows are endangering the life span of our costly dams. The annual loss due to the silting of the Mangla and Tarbela reservoirs alone has been estimated at Rs. 112 million



Camels grazing in Barani LPRI Kherimurat, Attock range areas.

(Mohammed, 1989). Wildlife is already on the verge of extinction. It is estimated that most of our rangelands are producing barely 10 to 50 per cent of their present potential.

The graziers

Land deterioration has naturally resulted in a reduction in the quantitative and qualitative production of range livestock and their products. The grazier being unaware of proper livestock improvement or management, practices often keeping too many animals because the number rather than the quality of livestock is a status sign for him. This results in poor pasture and rangeland management leading to overstocking and land degradation with inadequate fodder production for use year-round or especially during the arid and winter seasons. Decline in forage yield has naturally resulted in reduced livestock production. The education and training of the grazier about proper range livestock management or improvement operations and practices is a must. Large numbers of livestock rather than the quality of his livestock still continues to be a grazier's prestige symbol.

Future scope of improving rangelands

As one estimate (Quraishi *et. al.* 1993), states that our ranges are producing between 10 to 50 per cent of their potential. A lot of potential exists for improvement if graziers are given proper assistance with regard to their environment, vegetation and livestock management. The rangelands cannot be brought at par with the rolling hills, pastures or prairies of the West, but they can produce enough biomass from graziers to meet the feeding needs of their livestock. This job can not be accomplished by the government alone, the people on the ground and the public and private sector must be involved. It is not simply a matter of managing deserted lands it is also a matter of happiness and prosperity, welfare and well-being of more than four million people directly or indirectly dependent on rangelands.

Synopsis of policies and measures

The diversification of agriculture has received its main impetus from national policies directed at achieving food self-sufficiency or meeting export demands for certain agricultural commodities. At the farm level, this has resulted in an intensification of production, sometimes with a more diverse but at other times a less diverse cropping or land use pattern. However, rangelands have been neglected and yet are the areas which need to be considered for optimum exploitation to produce maximum forage value for livestock improvement. The following measures are listed in order of priority:

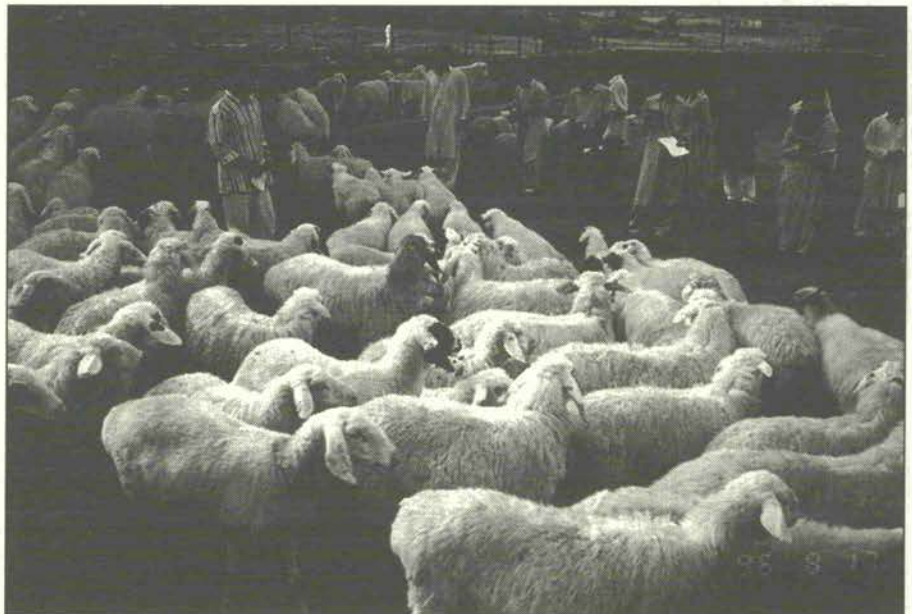
National range policy

Past efforts at the proper management of rangelands have been hampered by the lack of a comprehensive objective. The Central Treaty Organization (CENTO) Range Team (1962) emphasized the need for a range policy for Pakistan. They recommended that Government should define the types of public lands which should be used for range purposes, and that all rangelands be developed, and

managed, primarily for livestock production consistent with a multiple land use concept. The National Forestry Committee (1972) recommended the need for a comprehensive wildland management policy to regulate range management, watershed management and forestry. The need for holding a National Range Management Conference is warranted to revise and update the policies made to date and to put ideas into practice concerning increased vegetation for livestock improvement. The creation and establishment of the Range Society in Pakistan, The Federal Range Development Agency (FRDA) for the purpose of cooperating and liaising with South Asian Association for Regional Cooperation (SAARC) countries was initiated in the workshop held in Islamabad in 1996. Better results are expected from this platform.

Institutional development

To develop and manage vast rangeland resources, independent, effective and mandate-oriented organizations need to be created at provincial and federal levels. These organizations will be exclusively responsible for planning, developing and implementing range management



Sheep flock maintained at Barani LPRI Kherimurat, Attock ranges.



Cattle in a paddock at Barani LPRI Kherimurat, Attock..

schemes covering planning, technology transfer, policy development and the provision of trained manpower. Institutional development is also necessary so that, along with the livestock experts, the integrated efforts of agronomists, economists and range researchers etc. can be ensured for achieving desired targets.

Reservations for livestock improvement

Rangeland areas should be reserved for increased and improved livestock production requirements and for drought cattle but also for getting the best results out of difficult areas and for building up a possible export market in beef and mutton. Indiscriminate and unscientific practices of shifting cultivation and breaking of rangelands for agriculture has proved unrewarding and has done considerable harm by impoverishing lands, thereby reducing their productivity and ability to support livestock. Shifting cultivation should be stopped in arid/semi-arid zones and on steep slopes. Regulated, scientific methods should be adopted whereby fodder crops could be cultivated to help support the maximum number of livestock compatible with correct land usage and for higher

economic returns. Fattening yards or feedlots should be encouraged wherever suitable.

People's involvement

The rangelands cannot be developed through Government efforts alone. The development of rangelands should be programmed on the basis of involving the public through (a) the allocation of land to private parties; (b) credit facilities; (c) assistance in the exploration of underground waters and the sinking of tube wells; (d) extension of technical knowhow for livestock rearing and pasture development; (e) provision of better marketing especially through cooperative efforts; and (f) facilities necessary for settling people on new lands should be extended, in order to ensure people's cooperation, support and participation; (g) NGO's should be involved at all levels of project formulation and execution; (h) livestock holders should also be involved and need to be convinced of the benefits of changing from subsistence livestock production to business oriented farming; and (i) establishment of farmers associations for improved inputs and proper sale of livestock and products.

Introduction of pilot projects

Pilot projects should be started in different social and agroecological zones (AEZ) to establish working methods which can be extended to larger areas. These pilot projects should aim at finding out the necessary provision of facilities in an area owned by a party or by a whole tribe to enable the tribe to lead a settled life and to prevent the overexploitation of the area.

Incentives and services

In view of the difficult nature of the work and the difficult terrain in which the people will have to operate pilot projects, the Government needs to cater for the distribution of land to private parties with different types of incentives and facilities such as tax free leases and the provision of other assistance. It may also be possible to give long leases to the people who operate in these areas with incentives, for instance, no land revenue for the first 10 years because the lessee will have to invest large sums on the development of the dry areas without any income for the first 10 years. Suitable technical as well as economic incentives should be provided to attract people and encourage their participation in range management programmes. Such incentives may be (i) exemption of 15 per cent surcharge on machinery for meat and poultry; (ii) exemption of livestock and poultry farms from income tax for the next 10 years; (iii) exemption of import duty on the import of poultry feed micro ingredients by feed millers; (iv) introduction of livestock insurance on a pilot project basis; (v) livestock shows in Barani and rainfed areas; and (vi) awarding prizes to the best owners and breeders.

Range legislation

The First Range Management Conference was held in 1966, which served to emphasize that the existing legislation did not meet the peculiar needs of the rangelands. In 1970 the working group on range management set up by the Government of Pakistan (GOP) recommended that a Range Management Act should cover (a) a range management

agency; (b) provisions to regulate grazing on public and private lands; (c) the creation and functioning of grazing associations; (d) settlement of rights; (e) incentives and services; (f) a range research programme; and (g) appropriate punitive powers. In order to obtain the rational use of rangeland a minimal legal support and framework are necessary and need further revision.

Fodder production for stall feeding

Unless we consider fodder as an essential crop and give it a prime position in our cropping system, we can't boost the productivity of our animals. The Government is spending more than Rs 500 million to 700 million on the import of milk every year (Economic Survey, 1993-1994). By increasing our domestic production not only do we increase per capita availability of milk but we can redirect this huge amount of money to other goods and services. Meat prices are also soaring because of the high prices of feed. By giving due attention to actions needed for an increased fodder situation, and to making our pastures green, we can improve the status of livestock in Pakistan. Multi-cut fodder is the solution of the problem faced by livestock owners in the times of scarcity and it would also reduce the pressure on rangelands. Any extra can be converted into hay for rainy days. The evolution and promotion of high yielding varieties and of fodder crops in irrigated and barani areas along with multiplication and adoption of existing high yielding varieties is urgently required. Treatment of crop residues especially stalks and stoves in barani areas to improve feed quality and the use of urea-molasses-blocks (UMB) are also needed.

Extension activities

The extension staff of the Departments of Animal Husbandry and Agriculture and other related fields have to contribute towards creating awareness about the need for improvement of rangelands and the production of green fodder for livestock. Various FAO projects and NGOs involved in agriculture are undertaking seed

production trials in all localities including those in far flung and remote areas. Before these projects wind up the GOP role needs to be enhanced to make this technology available to end-users throughout the country. Strengthening extension services and encouraging feed manufacturers to provide advisory services to the users as part of their sale support programme should be promoted.

Tribal ranges

In many of the range areas grazing and other rights belong to certain tribes. Therefore, some of the pilot projects should aim at the establishment of tribal ranges where the unity of the tribes may be maintained and facilities provided to the tribe as a whole. Such programmes could be organized through any agency (such as UAF, PARC, SAARC, ADB, ABAD, CHIDS, etc.) or through a Board consisting of representatives from the Departments of Animal Husbandry, Forestry, Agriculture, Cooperative and Land Revenue, etc.

Proper management and sale of products

To optimize economic returns from rangelands, efforts should be made to ensure proper management, feeding, breeding and marketing. Preparation of livestock feeds from agro-industrial wastes and by-products should be encouraged. In order that the overgrazing of rangelands be eliminated or minimized, surplus livestock should be utilized by creating facilities for maximizing the off-takes. This would require the streamlining of management, marketing, processing, packing and even export of livestock and their products. A pricing system based on live-weight and meat quality grades if feasible, should be introduced.

Veterinary cover

Control of internal and external parasites through efficient and adequate drenching and dipping operations needs to be facilitated. Production will automatically increase by about 25 per cent to 30 per cent if range animals are free from parasitic

infestations. The use of prophylactic measures and proper veterinary cover is a must to make animals as well as the range healthy.

Breeding policy

Production of high quality bulls, rams, bucks and their distribution to interested breeders for breeding needs to be facilitated. Upgrading of livestock through selection and breeding should be promoted. Animal registration at a later stage could be an incentive for livestock owners.

Summary

The livestock population in the small holder as well as commercial sectors is increasing rapidly every year as compared to the available feed resources. It is, therefore, necessary to put more emphasis on increasing livestock productivity to meet the protein and caloric requirements of people, than to increase livestock numbers. Increasing the area under fodder is a difficult option under present circumstances. Such expansion could be either into desert, semi-desert, barani land, but good management of rangelands is the only viable option which has plenty of scope for livestock improvement and future exploitation.

There is no viable alternative to better management, the rangelands deserve special attention to produce maximum forage to support the livestock sector to feed the exploding population of the country. The focus, of those who aim and dream to increase rangelands for enhanced livestock improvement, rests on three main areas: exploitation of range vegetation; proper and efficient management of livestock; and the social aspects related to such.

Last but not least, with a growing awareness of the "quality of environments" and the needs of society, rangeland ecosystems shall assume an important role in terms of open space, landscape, recreation, water and clean air in the days to come. Although deserts and semi-desert areas are extensive, they should not be considered as "waste-lands".

From a livestock expert's point of view, they are potential grazing lands. With experience, knowledge and the technology available to us, these areas can produce forage and fodder. This will boost livestock production as well as provide food, cover and protection to wildlife resources. Properly motivated and devoted personnel can make the deserts bloom and provide better living conditions not only for range dwellers but to the ever-increasing population of the country.

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Desert Reaches Europe¹

Emma Gabunshina describes how desertification has caused an environmental crisis in European Russia and the struggle, assisted by UNEP, to combat it

The dark shadow of desertification has now fallen upon Europe, which once seemed far removed from the problem so prevalent in Africa and Asia. Desertification - processes of degradation of dry farmland - is starting to affect many European countries. Russia, the largest country on the European continent, is no exception: already more than 100 million hectares are either affected by desertification or under threat of it.

Desertification processes are already well under way in the Astrakhan, Volgograd and Rostov regions, the Altai krai and the Republics of Tyva and Dagestan, while parts of the Krasnodar krai and the Stavropol krai have also been affected. Areas under threat include land in the Voronezh, Saratov, Orenburg, Omsk, Chelyabinsk and Chita regions, and in the Republics of Khakasia and Buryatia.

Perhaps the worst situation, however, is to be found in the Kalmyk Republic, the most arid region of the European part of the Russian Federation. Over 80 per cent of its territory is now in the grip of

desertification, and almost half is either severely or very severely affected. This is surpassed only by the deserts of Central Asia.

Degradation of the once unique pastures of the Black Lands of the Republic has led to the first man-made desert in Europe, with areas of open and blown sand. Satellite photography confirms that large quantities of this sand are blown well past the boundaries of the Republic during dust storms, reaching the borders of European countries beyond Russia.

In 1993, President Ilyumzhinov of the Kalmyk Republic declared a state of



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emergency in response to a major deterioration in the state of the environment. The crisis resulted from intensive land degradation and a shortage of water, together with the increasing, human load on the natural environment over the last few decades and extreme natural conditions, causing a decline in the health of the population and falls in both life-expectancy and the quality of life. These, in turn, threatened the gene pool of the Kalmyk people - and pointed the way towards ecological ethnocide.

Following the declaration of a state of emergency, there was a timely visit to the Republic by a UNEP staff member and subsequent financial support from UNEP to the National Action Programme to Combat Desertification in the Kalmyk Republic, drawn up in line with the main principles of the international United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification. National Action Programmes, which define the strategy to be used to combat desertification and to moderate the consequences of drought, are one instrument to be employed in implementing the Convention.

The Programme developed in Kalmykia, largely through the efforts of locally-based scientists, has been approved by the Government of the Republic. The next task is to ensure that the Programme is smoothly integrated into the Republic's plans for social and economic development. I would like to thank the Executive Director of UNEP, and the Director of the Dryland Ecosystems and Desertification Control Programme Activity Centre, for their understanding and for the financial support made available to the Republic.

One of the Programme's projects, presented at the eighth session of the International Negotiating Committee for the Elaboration of an International Convention to Combat Desertification, by President Ilyumzhinov, and named Creation of a European Aridity Centre, was discussed at the session and became

an official Convention document, reference A/AC.241/60.

We are considering setting up a European Aridity Centre in Kalmykia - the region most vulnerable to desertification in the continent - as one way of addressing the problem as it affects European countries. One important argument in favour of this is that our unique natural environment is unmatched in the world and provides an opportunity to preserve the steppe region gene pool, a genetic data bank for the planet. Besides, it makes sense to site a centre to combat desertification in the place where it is most needed.

The idea is supported by Russian and foreign scientists, and was approved by the Russian Academy of Sciences at the touring conference - Problems Associated with Studying Arid Ecosystems and Combating Desertification - held in Elista in November 1995.

Linking Europe to the world

The Centre could become the European link in a larger, international system, since developing a global network of research institutions and other structures to address the problems of combating desertification has been envisaged as a way of assisting the Convention.

It is very unfortunate that Russia has not yet become a signatory to the Convention to Combat Desertification, though this is still under consideration. The Convention seeks to address desertification problems in all countries, and Russia's involvement would undoubtedly create a more favourable climate for developing practical cooperation with key bilateral and multilateral donors in order to implement environmental projects and programmes in the regions of the country exposed to desertification and drought.

Nevertheless, we are already carrying out a wide range of measures to prevent

land degradation and drought in Russia. Work is going on in the Astrakhan region, the Dagestan Republic and the Kalmyk Republic to implement the Federal Programme entitled "A general plan to combat desertification of the Black Lands and the Kizlyar Pastures", while in Volgograd the Institute of Forest and Land Improvement is making good progress in its work. By presidential decree, large-scale planting operations are carried out every spring and autumn in desertified areas in the Kalmyk Republic, much work is being done to optimize the network of protected natural areas, and so on.

Further initiatives

The President has also announced an initiative to set up an Association of Arid Regions of Russia and to establish a Special Federal Programme to protect areas of the Russian Federation from the processes of degradation. The aims are to stimulate action to combat desertification at a Russian level, to improve the effectiveness of measures aimed at agreeing National Action Programmes and to draft recommendations for creating and implementing a subregional, regional and joint Action Programme for Russian conditions in line with the United Nations Convention. The President's idea has been warmly welcomed in the other regions of Russia that are worried about the state of their land.

People have been conscious of their dependence on the land since time immemorial. In ancient Egypt, for example, it was called the gift of the great Nile, in Hellas it was known as woman and mother, while in Russia they called it the mother-provider. Losing soil fertility was equivalent to a national disaster. This is why it is now important to grasp that the first European desert is no longer a myth. It is a reality. If this process is not halted, Europe could share the fate of Africa.

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An Integrated Approach to Inter-regional Cooperation and Major Activities within the Inter-regional Programme of Action to Combat Desertification and Drought¹

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Foreword

The countries of Eastern Europe, the Caucasus and Central Asia constitute one of the most extensive areas affected by the spread of desertification and drought.

The preparation and signing of the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, gave tremendous impetus to activities to combat desertification and drought. In a number of countries of Eastern Europe, the Caucasus and Central Asia, work commenced, with the support of international organizations, on the elaboration of national or republic-wide plans and action programmes.

At the same time, an increasing number of managers and specialists have become aware of the need for closer coordination of their activities and for the creation, not only of national, but also of Inter-regional action programmes on desertification control.

The Convention to Combat Desertification also directly proposes, where necessary, subregional and/or regional action programmes to enhance the effectiveness of national programmes (Article 11).

The first review of subregional activities to combat desertification was prepared, with the support of the Convention secretariat, by the Desert Institute of the Turkmen Academy of Sciences in October 1994.

A conference on desertification control was held in Almaty in 1995, with the support of the United Nations Environment Programme (UNEP). At this conference, it was stressed that desertification and drought control is an important element in national sustainable

development strategies. Certain priority activities were identified and views were expressed on the need to determine the framework for a possible Inter-regional programme of action.

In June 1997, on the initiative and with the support of the Convention secretariat and UNEP, an Inter-regional conference was held in Tashkent on promoting the ideas of the Convention in the region.

As well as considering progress concerning the signature and ratification of the Convention and the review of the preparation of national action plans and the exchange of experience, the conference also discussed the issue of the preparation of an Inter-regional plan of action.

In this connection, the CCD Secretariat and UNEP offered to prepare a draft outline for such an Inter-regional programme of action, which would form the basis for discussions at the conference.

¹ A concept paper presented at the Interregional Conference on the Implementation of the UNCCD, 10–12 June 1997, Tashkent, Uzbekistan.

The problem of desertification and drought in countries of the Commonwealth of Independent States (CIS)

Arid, semi-arid and dry sub-humid areas cover a significant portion of the countries of the Commonwealth of Independent States (CIS). According to current estimates (Glazovsky, Orlovsky, 1996), the total area of dry and arid regions, with a ratio of precipitation to potential evapotranspiration lower than 0.65, is now more than 4.6 million sq km (table 2). This area is home to more than 17 million people.

An even greater area is covered by territories subject to the effects of drought. Regions with a drought probability higher than 25 per cent, in addition to dry and arid regions, cover a significant area of the Republic of Moldova, Ukraine, the south of the Russian Federation and the Transcaucasus, while regions with a drought probability below 25 per cent also include areas further north, as far as the latitude of St. Petersburg in the European part of the region (60° north), part of the south of Siberia and even central Yakutia.

A considerable proportion of the dry and arid territories of this part of the world is subject to desertification. Approximately 140 million hectares of grazing land require urgent restoration of their vegetation cover. Millions of hectares of irrigated land have been salinized and waterlogged. Not less than 25 million hectares of other agricultural land, outside irrigated areas, have been lost as a result of the discharge of irrigation water, the flooding and salinization of the soil, and the adverse effects of construction work. A decline in the fertility of the soil and soil erosion have led to a loss of productivity of arable land of between 30 and 40 per cent.

The countries of the region have always given careful attention to desertification and drought control. Local specialists have been responsible for the development of a number of new

Table 2 Area of dry and arid regions (with a ratio of precipitation to evaporation ≤ 0.65) (thousands of sq km)

STATE	AREA	STATE	AREA
Azerbaijan	40	Russian Federation	610
Armenia	12	Tajikistan	95
Georgia	6	Turkmenistan	488
Kazakhstan	2,627	Uzbekistan	440
Kyrgyzstan	145	Ukraine	136
Republic of Moldova	13		

agricultural production technologies, which safeguard the high quality of the environment; the development of new varieties of plants and new breeds of livestock; and for the development of measures and its use over large areas of dune fixation and land reclamation. There is considerable scientific potential in the region and specialized journals on the management of natural resources in dry and arid regions are common, readily available. The region has also made a significant contribution to desertification control on a global scale. Between the years 1978 and 1991, of 61 international courses to train desertification control specialists, 24 were held in this region. At those courses 793 people from 64 countries underwent training (Statutes of Desertification, 1992).

At the same time, owing to the complexity of desertification problems and certain specific circumstances, it has thus far proved impossible to stabilize desertification and to reverse the degradation of the environment.

It should be noted that this region has a number of specific features which intensify the economic and social consequences of desertification. In terms of its specific natural features, it is one of the few arid regions of the world with negative winter temperatures and a short cropping season. Unlike many other arid countries, it is impossible to obtain two or three harvests a year. The specific social and economic features of the region are such that, for the last 70 years, farming has been carried out under conditions of rigid centralized state control. Currently, the region is undergoing a feverish restructuring of its systems of state control, its economy, its social relations and the psychology of its inhabitants. The transition period is also bringing with it a

number of additional difficulties relating to desertification control.

Precisely for these reasons, the countries of the region have been actively involved in preparations of the Convention to Combat Desertification and a number of countries have already signed the Convention.

In accordance with the provisions of the Convention, a number of countries, republics and regions, with the support of international organizations, have embarked on the elaboration of national, republic and regional plans of action for desertification control.

At the same time, it is becoming increasingly evident that a successful solution to the problems of desertification will only be achieved through united efforts. At the present time, on the initiative of Kalmykia, an association of members of the Russian Federation affected by desertification is being established in the Russian Federation.

At the meeting of CIS countries in 1995 in Almaty, views were expressed by many specialists and representatives of different states concerning the need to prepare a joint Inter-regional programme of action.

Main objectives of the Inter-regional programme of action

The main objective of the Inter-regional programme of action consists in tackling problems of desertification and the prevention and mitigation of the consequences of drought through joint efforts and joint actions by countries of the region.

These actions require the coordination of national efforts and also the implementation of a number of bilateral and multilateral projects.

The Inter-regional programme must draw the attention of Governments and the public to problems of desertification control and promote the mobilization of resources.

Implementation of the programme could lead to the creation of a network of regional and national desertification control centres.

The Inter-regional programme should complement and enhance the effectiveness of national programmes and other activities in the area of desertification and drought control. It should ensure the fullest possible use of the potential of countries in the region.

The Inter-regional programme of action may incorporate specific coordinated joint programmes and projects for the control of desertification and drought, the utilization of transboundary natural resources and the resolution of social and economic problems related to desertification.

In general, the Inter-regional programme of action should be directed at ensuring the sustainable development of dry, arid and drought-prone regions of the participating countries.

Possible elements of the Inter-regional programme of action

The Inter-regional programme of action should, first and foremost, incorporate those areas of activity which are of interest to all participants; it is intended to tackle a range of inter-State problems, as well as those problems which can only be solved by pooling the potential of the participating countries. Several priority areas may be identified from the full range of activities for the control of desertification and drought.

Assessment, monitoring and forecasting

The adoption of any decisions must be based on information. As things stand,

we know the overall scale of desertification in the region and we have detailed information on certain aspects of the problem. At the same time, there is a lack of reliable information on many important issues. For example, we do not know how much water actually enters the disappearing Aral Sea, since the hydrological stations in the rivers are situated at a considerable distance from the sea and do not take into account stream-flow loss in the lower reaches of the deltas.

It is not known how much water reaches the various irrigated fields. Many misunderstandings arise through discrepancies in assessment of the flow and quality of river water by the different States concerned.

Analysis shows that the existing monitoring network must be further developed. New hydrological and meteorological stations must be opened, state-of-the-art methods for water measurement and information transmission must be introduced and remote-sensing methods must be widely used.

It should be pointed out that, at the current time, the very foundations for a system of monitoring desertification are lacking. It is not known how many stations are needed for a thorough and timely assessment of the situation, nor with what frequency the various observations should be conducted. There are no general analyses of the state and resources of space monitoring of desertification.

Clearly there is a need for special consideration to be given to establishing as rational as possible an observations network in the frontier districts of the different countries and a system for information exchange.

A joint early warning system on drought, dry winds and other hazardous natural phenomena must be specially developed and set in place.

Azerbaijan, Kazakstan, the Russian Federation and certain other States have a wealth of experience and state-of-the-art technologies in the area of space-based monitoring. A joint system for the space monitoring of desertification must be set up within the framework of the Inter-regional programme for all countries of the region.

Following the collapse of the USSR, access to many highly valuable resource materials relating to geology, hydrology and meteorology was severely impeded for the new neighbouring States.

At present, in the Russian Federation, work is under way on the creation of a unified state monitoring system, designed to ensure objective and comprehensive information on the state of the environment. It is possible that this experience could be used for the creation of a unified system for the monitoring of desertification and drought.

The primary task is the forecasting of climate change, drought, dry winds and other adverse natural phenomena, which will only be effective if it makes use of the entire observation network and the pooled scientific potential.

It is essential that management decisions be adopted on the basis of an assessment of the level of desertification and degradation of the environment and the regional subdivision and zoning of territories. A number of States in the region are working on the identification of environmental disaster areas. It is clear that there is a need for the exchange of experience in this area and, in many cases, also for coordinated approaches to the identification of such areas, so as to ensure equal social protection for citizens with regard to the consequences of desertification and drought in the frontier districts of different States.

Utilization of freshwater and water management in international river basins

The problem of the utilization of freshwater is one of the most acute problems faced by arid and sub-arid regions. It is rendered even more so by the extremely uneven geographical distribution of water resources and the spread of the major river basins over the territory of several States (tables 3, 4 and 5).

In many States, under modern farming systems and the prevailing technologies for water utilization, water resources are almost completely depleted. Vast quantities of water are lost in transportation.

An enormous problem also arises in connection with the utilization of drainage flow from irrigated territories. According to available data, approximately 60

Table 3: Major river basins

River	Basin areas thousands of sq km	Flow cu km per year	Basin States
Amur	1,855	423	Russian Federation, China, Mongolia
Irtys	1,643	89.1	China, Kazakstan, Russian Federation
Ili	140	14.7	China, Kazakstan
Syr Darya	219	37.2	Kyrgyzstan, Tajikistan, Uzbekistan, Kazakstan
Amu Darya	309	79.5	Tajikistan, Afghanistan, Turkmenistan, Uzbekistan
Ural	237	11.6	Russian Federation, Kazakstan
Terek	43.2	8.5	Georgia, Russian Federation
Kura	188	17.9	Turkey, Georgia, Armenia, Iran, Azerbaijan
Dnieper	504	53.5	Russian Federation, Belarus, Ukraine
Dniester	72	8.66	Ukraine, Republic of Moldova

Table 4: Renewable river flow resources and ground water resources (cu km per year)
(Environment in the Commonwealth of Independent States, 1996)

State	River flow resources		Ground water resources	
	Total	Per person (thousands of cu m)	Total	Per person (thousands of cu m)
Azerbaijan	25	3	5	0.7
Armenia	8	2	5	1
Belarus	58	6	18	2
Georgia	61	11	4	1
Kazakstan	121	7	44	3
Kyrgyzstan	49	11	13	3
Republic of Moldova	13	3	1	0.2
Russian Federation	4,262	29	228	2
Tajikistan	98	17	6	1
Turkmenistan	73	18	2	0.5
Uzbekistan	108	5	22	1
Ukraine	219	4	21	0.4

million tonnes of salts are washed away every year from irrigated areas with drainage runoff and these subsequently flow into rivers and accumulate in lakes and scenic areas (Glazovsky, 1987).

It is therefore necessary to find a joint solution to the problem of water utilization and conservation of water resources.

Clarification is needed on the distribution of water between States, taking into account variations in flow, seasonal fluctuations and water quality. New technologies must be developed to ensure a reduction in water use, particularly for irrigation purposes, and to reduce water losses. There is a particular

need for the introduction of economic mechanisms to regulate water use, including payment for water. Joint efforts must be directed towards utilizing drainage water. As a general approach, a programme of measures for the restoration of water resources and their quality could be set up in the framework of the Inter-regional programme.

Undoubtedly, much is being done in this area on the basis of bilateral and multilateral cooperation between water management authorities of the countries of the region, but there remain some complex and unresolved problems which need to be addressed within the context of the Inter-regional programme of action, in close coordination with other activities in this area.

Management of land resources

The main arable lands and rangelands in the countries of the region are situated (with the exception of reindeer grazing lands) precisely in dry and arid areas (table 6). It is in these areas that most agricultural production takes place. Most of the States are characterized by a high level of land utilization. Thus, the level of land tillage in Ukraine is the highest in the world - 55.2 per cent (Matveev, 1995).

At the same time, the difficult natural conditions under which agriculture is conducted in these areas are further exacerbated by the rapid degradation of the land.

According to data of the Inter-State Statistical Committee of CIS (Environment of the Commonwealth of Independent States, 1996) salinated soil covers 60 million hectares of the agricultural land of the region, while (solonetz) soils occupy 97 million hectares and stony soils 62 million hectares.

A total of 475 million hectares of agricultural land is subject to water and wind erosion, including 177 million hectares of arable land. In the northern Caucasus, practically all agricultural land is eroded or under threat of erosion. In the Volga area, in the southern Urals and in western Siberia, at least 25 per cent of arable land is subject to erosion. In Ukraine, a total area of 10.2 million hectares of arable land (33 per cent) is

Table 5: Utilization of water resources (cu km per year) Environment in the Commonwealth of Independent States, 1996)

State	Water intake	Utilization of water				Losses due to transport	Discharge of waste water into reservoirs	
		Σ	Industry	Agriculture	Communal farms		Σ	Polluted water
Azerbaijan	14.63	10.77	3.49	9.79	0.39	3.84	4.27	0.26
Armenia	3.95	2.53	0.41	2.27	0.55	0.68	0.75	0.24
Belarus	2.44	2.33	1.29	0.32	0.71	0.1	1.73	0.09
Georgia	3.64	3.48	1.32	1.3	0.84	0.5	1.34	0.23
Kazakstan	30.82	26.11	5.75	19.03	1.33	6.22	6.04	0.24
Kyrgyzstan	10.92	8.26	0.3	7.67	0.29	1.86	1.12	0.002
Republic of Moldova	2.71	2.56	1.6	0.72	0.25	0.11	1.83	0.016
Russian Federation	86.86	77.12	45.21	15.35	14.33	8.55	60.2	24.64
Tajikistan	13.54	11.53	0.50	10.64	0.41	2.45	4.92	0.04
Turkmenist an	24.0	20.12	1.6	18.03	0.27	5.56	4.3	no data
Uzbekistan	71.47	53.21	5.0	45.0	2.15	14.9	31.6	0.26
Ukraine	21.0	22.57	11.5	7.04	4.53	1.65	15.0	4.87

eroded; in Armenia, soil erosion is taking place over an area of 12,000 sq km; in Georgia, 8,550 sq km of agricultural land is affected by water erosion; in Azerbaijan, this figure is 13,700 sq km; in the Republic of Moldova, 7,000 sq km; and in Kyrgyzstan, 5,500 sq km. In Tajikistan, the area of eroded and wind-eroded land has reached 97.9 per cent of the area of all agricultural land. The area covered by ravines is in excess of 10 million hectares and their total length exceeds 1 million km.

In a number of districts in the south of Russia and in Ukraine, there has been a steady decline in the humus content of the soil. Thus, over the last 100 years, the quantity of humus in the arable land of Ukraine has decreased by one third (Matveev, 1995).

The area of irrigated arable land totals 18.4 million hectares. Deficiencies in the planning, construction and operation of irrigation systems have led to a situation where, over 20 years, from 1970 to 1990, degradation of the soil, shortage of water and the off-take of irrigation systems have caused not less than 2.5 million hectares to be withdrawn from irrigation. The area of irrigated land affected by secondary salinization exceeds 6 million hectares. In the Russian Federation, out of 5 million hectares of irrigated land, 739,000 hectares (or 15 per cent) are in an unsatisfactory condition.

Approximately 1.8 million hectares of land have been disturbed as a result of the extraction of minerals and construction activities.

Under the Inter-regional programme, a survey could be conducted of the state of land, following a common methodology, and experience exchanged on ways of combating the different types of soil degradation and on the development and introduction of new technologies.

There is one further important area for joint activities in land management and the conservation of land resources. In many countries of the region, current changes in the forms of ownership of land, combined with efforts to resolve certain major economic and political problems, are leading to the emergence of

a number of new environmental problems. It is essential to develop new legislation, new standards and new land management technologies appropriate to the changing conditions of land ownership.

Utilization and restoration of rangelands

Rangelands make up the greater part of the agricultural land of dry and arid areas (table 6). At the same time, the predominant form of desertification in many parts of the region - in terms of area - is the degradation of the plant cover of rangelands. In Kazakstan, degradation of the plant cover of rangelands can be

Table 6: Distribution of agricultural land in countries of CIS by natural zones (million hectares) (Kruzhilin, 1995)

Natural zone	Arable land and fallow land	Hayfields and rangelands
Northern taiga	1	9
Southern taiga	46	35
Forest steppe and steppe	168	83
Desert and semi-desert	18	192
Mountainous areas	9	52

Table 7: Salinized arable land in CIS states, 1 990 (millions of hectares)
(Pavlovsky, 1995, corrected by the author)

State	Arable land		
	Total	Including salinized	As percentage
Azerbaijan	1.6	0.63	39.4
Armenia	0.5	0.02	4.0
Belarus	6.2	-	-
Georgia	0.8	0.06	8.1
Kazakstan	35.7	12.1	33.8
Kyrgyzstan	1.3	0.32	24.5
Republic of Moldova	1.8	0.03	1.7
Russian Federation	134.1	12.9	9.6
Tajikistan	0.9	0.07	7.7
Turkmenistan	1.2	1.0	83.3
Uzbekistan	4.5	1.58	35.1
Ukraine	34.2	2.8	8.4

30 to 40 per cent seriously disturbed and 15 to 20 per cent have been withdrawn from agricultural use and have turned into sandy wastes and badlands (Status of Desertification, 1994). This can be attributed to the excessive loads placed on rangelands (which, in certain areas of Armenia, for example, exceed the maximum limits 6-7 fold), to problems relating to the watering of livestock (desertification near wells), and also to changes in the composition of herds (in Kalmykia, the proportion of camels in the overall population of livestock has declined since the Revolution in favour of sheep from 40 per cent to 6.7 per cent).

Currently, as a consequence of the collapse of the USSR and the acquisition of sovereignty by States and autonomy by regions, as well as military activities in a number of districts, the traditional livestock herding routes and the rhythm of summer and winter grazing areas have been disturbed.

It is evident that the restoration of rangelands and efforts to optimize their use, together with the development of proposals to restore traditional herding methods, should form one of the main focuses of the Inter-regional programme.

observed over 600,000 sq km; in Turkmenistan, over 185,000 sq km; in Uzbekistan, over 140,000 sq km; and in the Russian Federation - taking only the areas of Kalmykia and Astrakhan region - over 60,000 sq km. As a result, the productivity of rangelands has been reduced by 40 to 60 per cent. Within

sandy rangelands, the area of open and shifting sands has increased from 5 to 10 to 20 to 30 per cent. In general, within semi-desert and desert areas, which contain 193 million hectares of grazing land, only 15 to 20 per cent of rangelands are still in a satisfactory condition, while 30 to 40 per cent are moderately disturbed,

Table 8: Area of forests, harvesting of timber and forest restoration, 1995
(thousands of hectares)

State	Under forest cover a/	Harvesting of timber b/	Total reforestation	Including planting and sowing
Azerbaijan	992	0.3 c/ (12)	4.2	1.6
Armenia	334	0.4 (98)	3.0	2.0
Belarus	7,372	22 (83)	23	21
Georgia	2,758	2 (41)	14	1
Kazakstan	10,504	39 d/ (36)	36	25
Kyrgyzstan	843	no data (96)	12	3
Republic of Moldova	315	1.4 e/ (24)	2.4 e/	1.4 e/
Russian Federation	763,500	815 d/ (24)	1562 d/	391 d/
Tajikistan	410	no data	5.3 c/	no data
Turkmenistan	4,127	no data	35 d/	35 d/
Uzbekistan	1,909	4 f/	40 c/ (109)	no data
Ukraine	8,621	21 d/ (89)	33 b/	30 b/

a/ According to latest information (1988-1994).

b/ In brackets - as a percentage of the estimated area under forest cover.

c/ 1990.

d/ 1994.

e/ Data for districts on the left bank of the Dniester not available.

f/ 1988.

Restoration of forests

For many countries of the world, deforestation is one of their most acute problems. In general terms, the problem of deforestation does not, at first glance, appear particularly severe for most of the States of the region, since the forest resource potential is not fully utilized (table 8). One feature of this region, by comparison to many other regions in the world affected by desertification, is that only a relatively small part of the harvested timber is used as fuel wood, as the supply of other energy resources to the population and industries of many of the countries of the Commonwealth is reasonably good.

At the same time, the real picture is not quite so favourable, since, in certain States, and also in many districts of particular States, the volume of harvested timber exceeds the planned level necessary to ensure an environmentally acceptable level of forest utilization.

In addition, in most States of the Commonwealth, recent years have seen both a general decline in reforestation measures and a particular decline in the areas of planting and sowing of timber plants - a vital form of forest restoration.

It is essential that forest restoration activities should be properly coordinated.

Conservation of biological diversity

A serious problem in dry and arid areas is the conservation of biological diversity, since it is here that up to 1,900 species of

plants, 300 species of birds and 70 species of mammals are to be found in a single area. The percentage of rare species in the overall composition of flora is as high as 12.5 per cent while the number of rare species of animals included in the Red Books of different States varies, depending on the area, from 30 to 130 (Atlas of the Environment, 1995). The number of species included in the Red Books is given in table 9.

One important means of conserving the biological diversity is through the creation of protected areas. A fairly good system of protected areas has been established in the countries of the Commonwealth (table 10). Despite immense financial and organizational

problems, this system is being maintained and even extended. Suffice it to say that, over the last five years, the number of protected territories has increased in most of these countries.

At the same time, most countries face serious problems relating to the provision of funding, logistic support and professional staff for protected areas. It is essential to mobilize additional sources of funding, to introduce new working methods and to train professional staff. The need for joint efforts and for the exchange of experience in these areas is self evident.

Notwithstanding the fairly broad network of reserves, it should be pointed out that, in certain scenic or wilderness

Table 10: Protected natural areas (data from Environment.. 1996)

State	Number of protected areas			Total area (thousand hectares)
	Total	Reserves	National Parks	
Azerbaijan	14	14		192
Armenia	5	4	1	214
Belarus	4	3	1	458
Georgia	17	16	1	189
Kazakstan	9	8	1	920
Kyrgyzstan	7	5	2	164
Republic of Moldova	5	5		19
Russian Federation	124	94	30	38,142
Tajikistan	3	3		86
Turkmenistan	9	8		819
Uzbekistan	11	9	2	824
Ukraine	20	16	4	418

Table 9: Number of species included in the Red Books

State	Animals	Plants
Azerbaijan	110	160
Armenia	99	392
Georgia	65	161
Kazakstan	87	291
Kyrgyzstan	42	65
Republic of Moldova	29	26
Russian Federation	246	562
Tajikistan	141	226
Turkmenistan	88	52
Uzbekistan	63	163
Ukraine	85	151

areas, the number of such reserves is clearly insufficient. For this reason, there is a need for joint efforts to establish and develop an essential and optimally effective network of reserves.

In addition, for historical reasons, one type of protected area has been most developed in the countries of the region - the reserve, while, in many other countries of the world, the predominant type of protected area is the national park. While acknowledging the vital importance of reserves, joint efforts are also required to create a system of national parks.

Migrations of people connected with desertification and drought and their social and economic problems

Desertification brings with it a number of negative social and economic consequences. Profits fall and with them the standard of living of the population, the number of jobs declines, social tension rises and migrations of people take place.

Accordingly, the term: "persons displaced for environmental reasons" has been proposed to designate those people forced to change their place of residence by an abrupt deterioration in the quality of the environment in the areas of their traditional domicile.

At the present time, more than 10 million people in the world are forced every year to change their place of residence as a result of drought and desertification. The problem has been taken up, inter alia, by the special conference entitled "Desertification and Migrations of People", organized by the United Nations as part of the preparation for the Convention to Combat Desertification (Almeria, 1994); the international symposium entitled "Displacements of Populations caused by Environmental Effects and Impacts on

the Environment resulting from Mass Migrations of Populations", in Savane de Bogie in 1996; and the CIS Conference on Refugees and Displaced Persons, held in Geneva in 1996.

Unfortunately, no special research has been conducted on this issue in the area in question and it is only discussed in isolated studies of a tentative nature, although there are incontrovertible facts pointing to its importance. Suffice it to recall the drought of the 1920s in the Volga area, when several million people migrated from the disaster area. In 1996, on the initiative of the International Organization for Migration, the Refugee Policy Group and the Centre for Policy Analysis and Research on Refugee Issues, the Office of the United Nations High Commissioner for Refugees (UNHCR) and the Institute of Geography of the Russian Academy of Sciences, a special study of the problem has been undertaken. The project is being carried out by staff from the Institute of Geography of the Russian Academy of Affairs, Dr. A. S. Shestakov and Dr. V. N. Streletsky, with the assistance of many specialists from countries of the Commonwealth.

At the current time, in the arid and sub-arid regions of the Commonwealth countries, there are areas where population displacements are taking place as a result of the deterioration of the environmental situation.

Aral region

More than three million people live in the area adjacent to the Aral Sea. As a result of the desiccation of the Aral Sea, the salinization of the soil and the pollution of the environment, particularly of freshwater, an unfavourable environmental situation has developed in this area, which, in turn, has provoked a number of adverse social and economic consequences. The number of jobs in such economic sectors of the Aral region as shipbuilding, fishing and hunting has declined, profits have dropped and unemployment has risen. The most critical situation has risen in those areas directly adjacent to the former sea. Three districts of Kazakstan (Kazal, Aral and Chelkar) have, by government decree, been officially declared environmental disaster areas (State Report on the Environmental Condition ..., 1996).

The Aral environmental disaster area in Uzbekistan is entirely contained within the territory of the Republic of Karakalpakstan. Roughly one and a half million people live in this area. The desiccation of the Aral Sea has primarily affected the welfare and health of the population. Many people have lost their jobs and, as a result, their standard of living has drastically declined. An intensive outflow of population has started.

Migration data for the last 35 years (table 11) show that the initial traditional

Table 11: Total migration in the territory of the Republic of Karakalpakstan over the period 1960-1996 (Compiled by A. S. Shestakov and V. N. Streletsky from materials from the Kazak Statistical Office)

Year	Town	Village	Total	Year	Town	Village	Total
1960	625	-254	371	1987	1,246	-1,416	-170
1965	1,005	-125	880	1988	-1,745	-3,364	-5,109
1970	804	-272	532	1989	-2,121	-2,780	-4,901
1975	1,032	-111	921	1990	-3,019	-1,764	-5,683
1980	812	-591	221	1991	7	-351	-344
1981	-1,178	-316	-1,494	1992	-3,032	1,837	-1,195
1982	95	-448	-543	1993	1,013	-334	679
1983	976	-545	431	1994	-1,636	-103	-1,739
1984	4,533	-1,630	2,903	1995	-4,043	-1,436	-5,479
1985	2,399	-1,422	977	1996	-4,904	-2,404	-7,308
1986	760	-1,067	-307	TOTAL	-7,461	-118,896	-26,357

process of urban drift, sharply increased from the mid-1980s and turned into a general outflow of population from Karakalpakstan. It was precisely in this period that the deterioration of the environmental, social, and economic situation was most evident. Overall, over the period 1985-1996, 43,800 people migrated.

The loss of population is most strongly felt in those sectors of the population with secondary specialized education (84.3 per cent) and higher education (18.1 per cent). Such a process has a significant adverse impact on the general quality of the population.

The environmentally disadvantaged districts of the Aral region within the frontiers of Kazakstan cover an area in excess of 594,000 sq km, inhabited by more than 1.5 million people (constituting 9.4 per cent of the population of the country). There are 30 urban and 580 rural settlements in the area.

Properly speaking, three districts form part of the environmental disaster area: the Aral and Kazal districts of the Qyzylorda region and the Chelkar district of the Aqtobe region. In total, over the period 1994-1995, the population of the Qyzylorda region declined by 12,000, despite the growth rates of the population, which have slowed slightly, but remain very high (Aral district - 22.6; Kazal district - 26.9; Chelkar region - 24). This demonstrates that the natural growth in population is no longer sufficient to compensate for these artificial losses, even in areas with traditionally high birth rates and large families.

As a rule, it is the more active members of the population, of employable age, who leave. In the town of Aralsk alone, as a result of the desiccation of the Aral Sea, 13 fisheries and ship-repair enterprises have closed, the source of employment for a significant proportion of the population. As a result, in two of the largest towns of the Aral area - Novokazalinsk and Aralsk - the population consists mainly of children up to the age of 15 (more than one third). A situation is developing in which there is an acute surplus of employable but unemployed people. More than half of all families have one or two unemployed members. At the same time, in the environmental

disaster areas, profits are significantly lower than in the country as a whole (by 67 per cent) and even lower than in other, less affected districts of Qyzylorda region itself (by 58 per cent).

In 1992, the Republic of Kazakstan adopted an Act (30 June 1992) on the social protection of citizens affected by the environmental disaster in the Aral area, as well as a decree of the Cabinet of Ministers of Kazakstan on measures to implement the Act. In accordance with these instruments, various privileges are introduced for the population of the Aral area: compensatory payments, and a system of measures for the rehabilitation of the area. The Act provides for the indexing of all payments in the disaster area (by a coefficient of 1.5-2.1), supplementary leave, material assistance for the purposes of recuperation, benefits for pensioners and invalids, priority medical services for mothers and children, housing benefits and the reduction of municipal charges. For the implementation of this programme, however, funds are short and the Act and its implementation decree are being given effect only to a very limited extent.

Migrations caused by sea-level rise of the Caspian Sea

Another group of environmental migrations in a number of Commonwealth countries and in Iran is caused by sea-level rise of the Caspian Sea.

Although this process is not directly connected with desertification, it affects many arid and sub-arid regions of the Caspian littoral, exacerbating the consequences of desertification, and in a number of cases even intensifying the processes themselves.

Over almost 100 years, from 1837 to 1933, the level of the Caspian Sea only fluctuated to a relatively insignificant extent, within a range of between -25.3 and -26.5 metres; over the period from 1933 to 1997, however, the level of the sea dropped by almost three metres (from -26.1 to -29 metres). But, since 1978, there has been a sharp rise in the level of the Caspian Sea. Over the last 18 years it

has risen by 2.6 metres and has reached the -26.9 metre mark.

The current economic potential of the Caspian littoral was established during the period of the regression of the sea at sea levels of -27 to -28 metres. At the same time, the area was intensively settled, with the establishment of a network of settlements and infrastructure. Since that time, the area of the sea (over the period 1978-1995) has increased by 11.2 per cent, leading to the submersion or waterlogging, as a result of high water, of a significant number both of these settlements and of economic facilities.

The sea-level rise of the Caspian Sea is leading to an acute deterioration in the health and epidemiological, environmental and social situation in the littoral zone, causing the inundation of agricultural land and considerable economic losses as well as threatening the very viability of certain settlements. Part of the built-up areas of such significant settlements as the towns of Makhachkala, Derbent, Kaspiisk, Lagan, Kamyzyak, Baky and Cheleken are threatened by flooding and destruction.

The sea-level rise is provoking migratory processes in districts adjacent to the Caspian, although these processes are only now starting to be studied. The only data currently available concern Kazakstan and the Russian Federation.

There are two regions of Kazakstan in the Caspian area: Atyrau and Mangistau, and the large majority of their population resides precisely in the littoral area (80.4 per cent and 53 per cent respectively). The total population of Kazakstan, which is faced by the threat of losing their houses and being forced to change their place of residence is depicted in table 12. Virtually two thirds of the population of the Atyrau region may suffer as a result of sea-level rise.

Over recent years, there has been steady migration from the area. In particular, in 1994, migration from Atyrau region totalled 4,584 people, and from Mangistau region 18,750 people (Regional.. 1996).

The population of urban settlements has been most severely affected by such migration. Over the period 1993-1995, the populations of the regional capital Atyrau (from 151,400 to 144,900) and

Table 12: Population in the inundation zone of the Kazak section of the Caspian littoral (Clarification of the Main Provisions ..., 1996)

Region	Population (thousands)	In the inundation zone	
		(thousands)	percentage
Ayrau	452.0	274.94	60.8
Mangistau	325.9	29.8	9.1
Total	777.9	304.74	39.2

Aqtau (from 173,900 to 152,900) have been significantly reduced as a result of inundation. These towns are home to the greater part of the entire population of the littoral area. The city of Atyrau requires urgent measures to protect housing and economic facilities from waterlogging and inundation.

A particularly complex situation could

develop in the future if the level of the Caspian Sea continues to rise, leading to the inundation of many settlements (table 13).

Kalmykia has traditionally been affected by migration over the last few decades. Thus, in 1992, 1,837 people migrated and in 1993 to 3,292 people. The environmental causes -desertification

and sea level rise of the Caspian - are important factors in this process, but they do not operate independently: they work in conjunction with an entire complex of social, economic and ethnopolitical factors.

The influence of sea-level rise of the Caspian on migrations of people can be clearly seen from the example of the littoral Logan district of Kalmykia, where migration in 1995 alone amounted to 554 people.

At the same time, it should be borne in mind that the phenomenon of environmental migrations in the Caspian area subsumes an entire range of problems, connected not only with present day migratory flows but, first and foremost, with the potential need to resettle people in the future. If we take into account the forecasted sea-level rise of the Caspian Sea to the -25 metre mark, by the year 2005 following the "worst case" scenario, (Environmental Security of Russia, 1995), failure to apply protective measures, will mean that, in the Astrakhan region, Kalmykia and Dagestan, eight towns and urban settlements and 105 villages, with a total population of around 197,000 people (table 14), will fall directly within the area adversely affected by the Caspian Sea.

Particular danger is posed by the flooding of built-up urban areas, where the greater part of the population of the coastal area is concentrated, as well as most of the recreational and holiday facilities and the production and social infrastructure.

Migration from areas affected by the consequences of the accident at the Chernobyl power plant

Despite the fact that 11 years have elapsed since the Chernobyl accident, the problem of eliminating the consequences of the accident remains acute. Even by the end of 1994, the total area with caesium-137 contamination levels of one curie and more per square kilometre amounted to 40,000 sq km in Ukraine, 46,000 sq km in Belarus and 60,000 sq km in the Russian

Table 13: Number of settlements affected by flooding in the Kazak part of the Caspian littoral (Regional Statistical Year Book of Kazakstan, 1996)

Region	Level of the Caspian					
	Flooding period			High water periods		
	-26.6	-26.0	-25.0	-26.6	-26.0	-25.0
Ayrau	10	30	67	66	61	36
Mangistau	2	3	8	6	5	
Total	12	33	75	72	66	36

Table 14: Settlements of the Russian Federation falling in the inundation and flood-affected area in the event of the further sea-level rise of the Caspian Sea

Indicator	Dagestan	Kalymkya	Astrakhan	Total
Number of towns	4	1	3	8
Urban population (thousands)	85.2	16.3	31.5	133.0
Rural population (no. of settlements)	14	4	86	105
Rural population (thousands)	4.4	2.2	57.3	63.9

Federation (Environment in the Commonwealth of Independent States, 1996). In 1995, 1,442 people were evacuated from affected areas in Belarus, 1,370 in the Russian Federation and 4,940 in Ukraine. Approximately 50,000 people are still awaiting compulsory evacuation.

It is perfectly evident that the migration of populations as a result of desertification and drought and other unfavourable natural phenomena in arid and dry areas constitutes a major Inter-regional problem. Dealing with the causes of migration, providing assistance to the population of crisis areas, ensuring the social and political adaptation of refugees in their places of resettlement, particularly in other States, providing the necessary jobs and obtaining legislative remedies to problems of migration - are just some of the joint measures that must be taken.

Other social and economic problems may be discussed and addressed within the framework of the Inter-regional programme. These may include, for example, the establishment of a joint insurance system in the event of drought or other unfavourable natural phenomena and efforts to define the optimal economic structure in desertification and drought areas, taking into account Inter-regional communications.

Health of the population

The deterioration of the environmental situation has a direct effect on the health of the population. This is particularly evident at the current time in the Aral area, where, as a result of the environmental crisis and the deterioration of social conditions, the mortality rate has risen, as well as the morbidity rate for those with cardiovascular diseases, typhoid, cancer and hepatitis. Among children, 60 per cent of those surveyed showed abnormal deviations in health and, in some areas, the infant mortality index is above 110. This is not surprising, since, for example, in Qyzylorda region, 64.8 per cent of water samples from surface reservoirs and reservoirs in water-use areas do not meet the health norms in terms of their chemical indicators and 100 per cent of the samples fail on

microbiological indicators (1995 Environmental Information Bulletin ..., 1996)

Following the deterioration of environmental, social and economic conditions caused by the sea-level rise of the Caspian, the mortality of children in the Atyrau region is also on the increase. The deterioration of conditions for the raising of children - who make up approximately 35 per cent of the population - constitutes one of the reasons for the outflow of population.

Virtually all States of the region demonstrate problems relating to human health in industrial centres and in districts where there is extensive use of chemicals in agriculture. It is clear that the Inter-regional programme could assist in resolving this most important and urgent problem: the deterioration of the health of the population.

Restoration of land affected by military and industrial activities

The States of the region are characterized by a significant level of industrial development. Overall, industrial production exceeds agricultural production approximately fourfold. For that reason, problems inherent in industrial countries, primarily the industrial pollution of the environment and the destruction of natural landscapes for construction purposes, are typical for the region in question.

Within arid and sub-arid regions, there are a number of localities whose unfavourable environmental situation is due to the operation of specific and highly environmentally pollutive economic facilities. As an example, we can take the Astrakhan gas condensing plant. The upgrading of the operation of the Aksaraisky gas condensing mineral deposit and the commissioning of the gas processing plant has led to the swift increase, since the period 1987-1988, of the volumes of pollutants entering the atmosphere. At the present time, a programme is under way to resettle the entire population of the village of Seitovka (Krasnoyarsk district, 8 km south of the

settlement of Aksaraisky). Consideration is also being given to the possible resettlement of other villages in the areas surrounding the gas condensing plant. It should be pointed out that in certain meteorological conditions discharges from the Astrakhan gas condensing plant reach as far as Kalmykia.

Progress towards a solution to the problem of the re-use, treatment and disposal of toxic wastes is very slow. In the Stavropol area of the Russian Federation alone the accumulation of such wastes is in excess of 4.4 million tonnes, including more than 1,200 tonnes of hazardous wastes (1995 State Report on the State of the Natural Environment ..., 1996).

A particular problem for the countries in question is posed by the severe influence on the environment of the military and industrial complex.

According to available data, in the former USSR, 42 million hectares of land came under the jurisdiction of the Ministry of Defence (State of the Environment ..., 1994). In addition, periodic use was also made of a further 22 million hectares. The condition of these areas varies considerably. On the one hand, in certain cases, the fact that these areas were closed to casual visitors and utilization favoured the preservation of the environment and, at the current time, a number of such areas have been returned to the national economy and are being developed for the organization of reserves and national parks.

On the other hand, the activities of the armed forces often led to the degradation of the environment. In a number of military facilities, there was attested pollution of the soil and groundwater, with the accumulation of sinks of waste fuel on the surface of groundwater. These sinks were formed over a period of decades and serve as a source of pollution for surface reservoirs and catchment areas for drinking water.

A specific factor affecting the environment is pollution by rocket fuel components. Research conducted in areas where the separating sections of carrier rockets have fallen in arid and sub-arid areas reveals significant adverse polluting effects. Near the Kapustin Yar launch site (Russian Federation), the high-level

concentration of two of the most hazardous pollutants-asymmetric dimethylhydrazine and asymmetric dimethylamine - have reached levels in the soil as high as 43 TLV (for asymmetric dimethylhydrazine), and in plants of 65 TLV (for asymmetric dimethylhydrazine and asymmetric dimethylamine) (1995 State Report on the State of the Natural Environment ..., 1996). In areas where rocket sections have fallen to the ground, following launching from the Baikonur launch site, there are also recorded cases where the asymmetric dimethylhydrazine TLV levels have been exceeded in the soil, in plants and surface water.

It is essential that an extensive survey be conducted of areas where rocket components have fallen to earth, with a view to studying all components of the natural environment and developing regulations covering the impact of rocket and space technology on the environment and the population.

Conservation of natural and cultural monuments

The impact of desertification is also felt in natural and cultural sites situated in arid and sub-arid areas. As an example, we can take the unique architectural, historical and cultural monuments of Khiva, where soils containing groundwater have gradually been drawn up, (the levels of these groundwaters have risen as a result of unsound irrigation techniques). A similar situation may be observed along the Volga and Dnieper rivers, where, as a result of the construction of large reservoirs, a number of historical and cultural sites have been submerged.

It is essential to prepare an inventory of all natural and cultural monuments which are threatened by the development of various desertification processes and to improve the legislation designed to ensure the preservation of these monuments, as well as to develop and implement measures aimed at their preservation.

Scientific cooperation and transfer of technology

The countries of the region have a significant scientific potential which should enable them to conduct research in all areas of desertification control. Space does not permit us in this report to go in detail into each of the priority areas, but for the purposes of discussion we may consider a possible list of such areas:

- Establishment of an optimal system for the monitoring of desertification and drought;
- Development of methods for monitoring desertification and drought, including remote-sensing;
- Development of methods for assessing the impact on the environment, the condition of land and the critical nature of the environmental and economic situation;
- The development of a scientific basis for legislation, taking due account of the need to combat desertification and drought;
- The development of new methods for the purification and treatment of water;
- The development of an optimal system of protected areas;
- The development of new varieties of plants and strains of agricultural livestock;
- The development and introduction of new agricultural technologies;
- The development and introduction of new irrigation methods;
- The development and introduction of economic methods for the management of natural resources;
- The identification of an optimal structure for the economy of specific areas, taking due account of the load-bearing capacity of their ecosystems;
- The identification of an optimal structure for agriculture, taking due account of the load-bearing capacity of the ecosystems, their economic and technological potential and traditions;
- Forecasting of global climate changes in dry and arid regions of the Commonwealth;
- The elaboration of sustainable development approaches, strategies and programmes for regions affected by drought and desertification.

Organization of the Inter-regional programme of action

Possible structure of the Inter-regional programme of action

The pooling of efforts by countries in the region in combating desertification and drought necessitates the coordination of national action, the implementation of a number of joint projects and programmes and the coordination of activities with other international programmes.

The preparation and implementation of the Inter-regional programme of action will require the coordination of the efforts of national and international, State and non-governmental organizations, scientists, businessmen and representatives of the mass media. For that reason, it is essential to establish a managerial structure for the programme. One of the possible structures is the following:

Programme Council

Programme Secretariat

Programme Working Groups:

- On assessment of the spread of desertification;
 - On information, monitoring and the early warning system;
 - On legislation and standards;
 - On problems relating to the use of water resources;
 - On the use and conservation of soils and land resources;
 - On biological resources and the conservation of biological diversity;
 - On prevention of deforestation;
 - On the use of grazing land;
 - On public health;
 - On social and economic problems of desertification;
 - On energy problems;
 - On culture and education;
 - On science and new technologies;
 - On coordinating the activities of non-governmental organizations and the mass media;
 - On the development of local initiatives and activities at the local level;
- Programme projects

Training courses

Centres

National networks of Inter-regional Programme institutions and organizations

The council of the Inter-regional programme of action will direct all the activities of the Programme. Its members must include authorized representatives of the participating countries, the heads of the programme's working groups, the head of the secretariat, representatives of the main international organizations involved in desertification control, environmental protection and development and a representative of the secretariat of the Convention to Combat Desertification. The council should work in close contact with the Inter-State Assembly of the countries of the Commonwealth, the Inter-State Ecological Council and international organizations and it should coordinate action against desertification with other countries not participating directly in the programme.

The programme secretariat should provide organizational backup for the programme's activities. The size of its permanent staff should be determined by its actual workload. It is presumed that it should be small, particularly in the first phase.

The programme's working groups may include both managers and specialists in specific priority activities of the programme. The task of the working groups is to organize the development and coordination of action in specific areas.

The programme may carry out its work in the form of specific projects. These projects may take the form of research, practical activities or demonstrations.

Basic and further training courses, both ad hoc and on a permanent basis, may be arranged for specialists working in desertification and drought control.

Within the context of the programme, it may prove necessary to organize centres, such as a desertification space monitoring centre, an information centre, etc.

All the activities of the Inter-regional programme should be based on national institutions and organizations, which should form a single network and complement one another.

It is quite possible that, as the programme develops, it will become necessary to organize other structures responsible for the implementation of one or another function.

Role of non-governmental organizations in the establishment and development of the Inter-regional programme of action

Particular attention must be given to the role of non-governmental organizations in the work of the programme.

For a long time, while non-governmental organizations have existed in most of the countries of the region and while some of them have developed rapidly (for example, the association Znanie), they have not differed essentially from State organizations, with respect to their main sources of funding, their accountability to State authorities and the arrangement of their work. In the mid-1980s, in many republics - now independent countries - the work of non-governmental organization started to develop rapidly. An enormous number of new organizations have been formed and the forms and methods of their work have changed. In general terms, we may say that in many countries in the region non-governmental organizations have become genuinely independent organizations playing an important role in public life and with a perceptible impact on the evolution of society, including in the area of environment and development.

It may be presumed that, within the framework of the Inter-regional programme of action, it should be possible to coordinate and promote the activities of many non-governmental organizations in the area of desertification and drought control.

Non-governmental organizations could play an important role in mobilizing the various sectors of society and social groups behind specific measures for controlling desertification and in disseminating information about the

programme. Non-governmental organizations should be represented on the council of the programme.

Capacity-building, education, training and public awareness

The different countries of the region have different potentials, but it is still fairly evident that, in general terms, their capacity in the area of desertification and drought control needs to be strengthened. This, together with the mobilization of resources, calls for an entire range of measures.

Education and training are decisive factors in many areas of human activity, including desertification and drought control.

This aspect should be included in the Inter-regional programme of action. Regular courses to improve skills and train specialists could be set up on the basis of a number of organizations and institutions in countries of the region. These courses could also provide training for specialists from many other countries of the world, in particular, developing countries.

It is extremely important to enlist the support of the local population in tackling problems at the local level. Unfortunately, the rigid centralized management system imposed on countries of the region over a very long period has affected the mentality of many people, predisposing them to delegate their rights and duties to the authorities, even when dealing with specific problems at the local level. It is essential that there should be a broad exchange of experience in ways of involving the population in tackling such problems, in ensuring the participation of different sectors of the population and in introducing services and methods for the dissemination of knowledge and experience. Efforts should be made to ensure that the people themselves are the most important participants in the elaboration and implementation of the programme.

For the effective control of desertification and the implementation of the programme, it is also essential to mobilize funds. It is important that the

disbursement of these funds is properly supported and, in certain cases, it may be necessary to restructure the expenditure part of the budget and to redistribute donations and credits.

The existing scientific and technological potential available for use under the Inter-regional programme will have to be reviewed.

Preparation of an agreement on the Inter-regional programme of action

The Inter-regional programme of action could be prepared in several stages in various areas:

- The decision in principle by the participating States on the establishment of the programme and the formation of a group of experts to prepare the agreements on the programme, to draft the programme itself and the other basic organizational instruments;
- The disbursement of funds for the development of the preparatory instruments;
- The preparation of the agreement and drafting of the programme and basic organizational instruments;
- The holding of a meeting of representatives of the States of the region and of international and non-governmental organizations for the signing of the agreement on the Inter-regional programme of action and for the adoption of the basic organizational instruments. The adoption of a decision on the council of the programme;
- The establishment of the secretariat;
- The establishment of working groups;
- Fund-raising for the international programme of action;
- The development and implementation of the substantive part of the programme.

At the same time, it would be advisable to make efforts to develop and to adopt a regional annex to the Convention to Combat Desertification, which would help

consolidate the international status of the Inter-regional programme of action.

Support for the preparation of the Inter-regional programme of action

The preparation of the Inter-regional programme of action requires the support of public opinion, an understanding of the problem by the decision makers and financial, methodological and legal backing.

Clearly, it must have the firm support of the participating States and those non-governmental organizations which have an interest in the programme. At the same time, financial and technical assistance must be sought from a number of international organizations, in particular, the specialized agencies of the United Nations, especially the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP), as well as the Food and Agriculture Organization of the United Nations (FAO), the World Meteorological Organization (WMO), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World Health Organization (WHO) and the secretariat of the Convention to Combat Desertification. Assistance should also be requested from the World Bank and from various non-governmental and religious organizations.

It is extremely important that the leaders and citizens of regions affected by desertification and drought and non-governmental organizations should speak out in support of the programme.

The media should give the widest possible coverage to the actual problem of desertification control, as well as to the United Nations Convention to Combat Desertification and an explanation of the goals, tasks and anticipated results of the Inter-regional programme of action.

In the initial stages, financial support will be needed to prepare the agreement and the basic organizational instruments, to hold the meeting of representatives of

the States and international organizations for the purposes of signing the agreement, to organize the secretariat and to hold the first meetings of the council and the working groups.

Financing of the Inter-regional programme of action

Most of the activities associated with the implementation of the programme in each of the participating countries will probably have to be funded mainly by the countries themselves, in the first instance, from their national budgets. Joint activities (specific projects, work of the secretariat) could be funded from a common budget, based on the agreed contributions of each State and individual donors. Some programme activities could quite possibly be fully or partially self-financing. This applies, for example, to specialist training courses and the organization of the desertification space monitoring system. Naturally, funding for the interregional programme of action may be drawn from different sources: State, international, private and public. At some stage, it may also be possible to organize funding from other additional sources. The following is a general list of the possible sources of funding:

- National budgets (for measures at the national level but within the framework of the interregional programme);
- Transfers from national budgets for joint activities within the framework of the programme;
- Local and regional budgets;
- National and inter-State environmental and other funds;
- Raising funds for specific projects from major international financial institutions such as the Global Environment Facility (GEF), the World Bank and the European Bank for Reconstruction and Development (EBRD);
- Assistance from the specialized agencies of the United Nations, such as UNDP, UNEP, FAO, UNESCO, WHO and WMO;
- Concessional loans and credits from

various sources, guaranteed by the participating countries;

- Funding via inter-State assistance programmes;
- Fees for training courses;
- Paid services;
- Environmental insurance;
- Lotteries.

Fundraising is an extremely important independent task in the organization of the programme. Its success will, to a large extent, depend on the clarity with which the goals, tasks, specific projects and anticipated results of the programme are presented.

Links with other initiatives and programmes

It must be clearly understood that the interregional programme of action will not begin operating in a vacuum. A considerable number of international and national programmes are already being implemented, various intergovernmental commissions are already at work and a number of important and interesting projects are being carried out by non-governmental organizations. A number of national and foreign funds are active in the region. It is not possible to review and list all these initiatives and programmes within the scope of this document. We shall confine ourselves to listing the main groups of organizations active in the region and associated in one way or another with desertification control.

Inter-State bodies of the Commonwealth of Independent States: First of all, we should list the Interparliamentary Assembly and the Inter-State Ecological Council. It would be both necessary and useful to establish the closest possible relations between the programme and these bodies, which are very active in work to harmonize the environmental legislation and standards of different countries, discussing problems relating to the use of inter State natural resources, including water resources, and publishing reports and statistics on environmental and development topics.

Inter-State bodies of regional groups: Examples include the Aral Fund and the

Inter-State Council for the Aral Sea, which coordinate the environmental renovation and efforts to address the social and economic problems of the Aral region.

Projects of the international financial institutions: In virtually all States of the region there are projects under way, funded by one or another of the major international financial institutions, such as the World Bank, EBRD, the Asian Development Bank, the Islamic Development Bank, etc.

In many cases, these projects are already well developed and well advanced. Thus, for example, the project on the Aral Sea basin, financed by the World Bank and implemented by five Aral basin States, embraces many very important areas of desertification control: the development of a monitoring system, management of water resources, improvement of reclamation systems, etc. The biodiversity conservation project being carried out in the Russian Federation also has a direct bearing on desertification control, since it includes such components as a strategy for the conservation of biological diversity and the development of protected areas.

Activities of the specialized agencies of the United Nations: UNEP, UNDP, UNESCO, WHO, WMO, FAO and UNHCR are also active in all countries of the region. Most are also involved in projects with a direct bearing on desertification control.

Activities of other specialized inter-State organizations: Recent years have seen the rapid development of the North Atlantic Treaty Organization (NATO) scientific programmes in countries of the region. Several important working meetings have already been held on problems related somehow or other to desertification control.

Activities under international programmes: A number of international scientific programmes (Taxis, Copernicus and others) are working successfully in the region, in support of promising scientific research projects. Since 1992, the Commonwealth countries have been benefiting from the international programme "Leaders in the field of environment and development", which is geared towards training and preparing future leaders in this field.

Bilateral cooperation and assistance under bilateral agreements: Most European countries, Canada, Japan, the United States of America and a number of Arab countries are providing financial, technical and, to some extent, methodological support for a number of projects in countries of the region.

Activities of private and public funds: Projects are being carried out in the region by the World Wide Fund for Nature (WWF), the Soros Foundation, the MacArthur Fund, the Ford Foundation, the Rockefeller Foundation, the Konrad Adenauer Foundation, the Aga Khan Foundation, the Global Infrastructure Fund, the World Conservation Union (IUCN), the British Environmental Knowledge Fund and many others.

Activities of non-governmental organizations: According to preliminary estimates, some 300 organizations working in the area of environment and development are active in countries of the region. Admittedly, many of these are only local or national in scope. Among those organizations which have a network in all countries of the region and are particularly active in the area of environment and development are the Social and Environmental Union and, more recently, Greenpeace International.

During preparation and implementation of the programme, provision must be made for an exchange of information and close coordination between all these organizations and the programme itself. At present, there is no systematic exchange of information and, as a result, projects are sometimes duplicated. Given the necessary financial support, the programme should perhaps assume responsibility for the exchange of information and coordination between the different organizations working at the interregional level on problems relating to desertification and drought.

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Social Aspects of Land Degradation in Central Asia

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Summary

Vast areas in Central Asia are subject to desertification. From a societal point of view desertification starts when consumption exceeds production. The gap between consumption and production can be filled in three ways: a decrease in consumption, an increase in production and through external aid. This paper looks at the social response to desertification at the local level in the Tedzhen district of Turkmenistan. Political instability, poverty and racial conflicts are the main reasons behind people's migration from Central Asia. Millions of Russians have left the countries of the region. The mass departure of skilled people can be considered an obstacle to capacity-building.

Land degradation and the social response

Desertification, being a destructive process affects not only the physical but also the social environment. From a

societal point of view desertification begins when consumption exceeds production. The gap between production and consumption increases more and more as desertification progresses. This gap can be filled in three ways: a decrease in consumption, through external aid, and

an increase of production (Fig. 1). A decrease in consumption can be achieved by regulating population growth. An increase in production can be achieved by improving degraded land. External aid can, in the short term help the local people to survive.

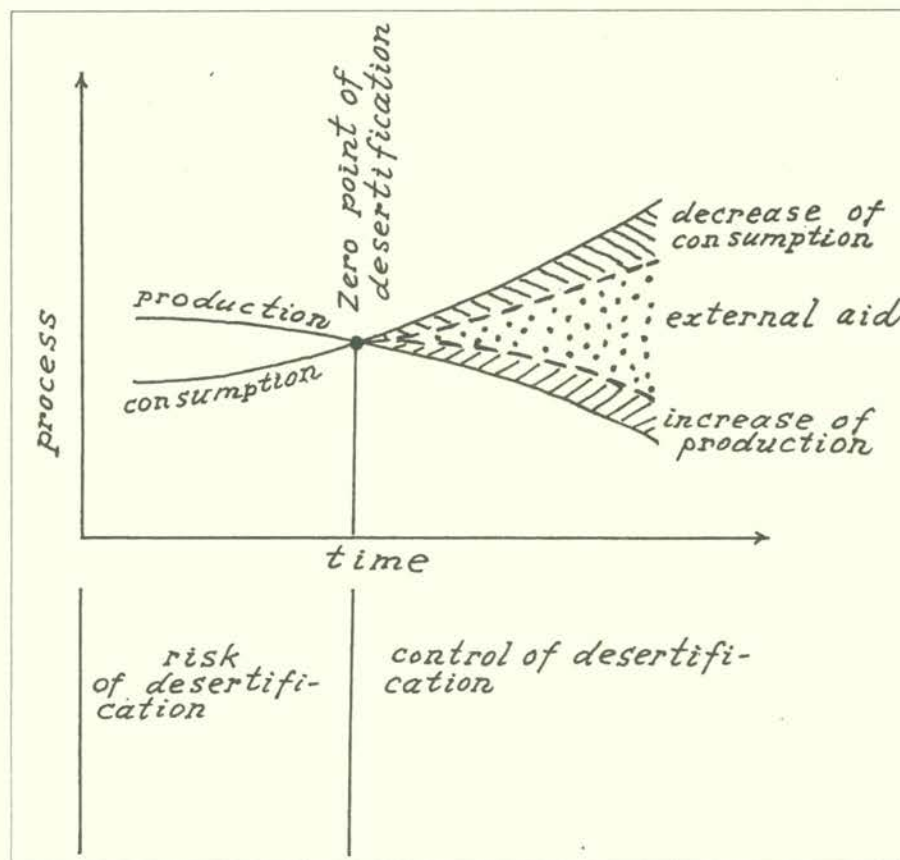


Figure 1. Correlation between production, consumption and desertification

Figure 2 gives data in graphical form on population growth and production in Central Asia. These data embrace the territory of Central Asia as defined by Soviet geographers. This area includes the southern part of Kazakstan, and the territories of Uzbekistan, Kirghizstan, Tajikistan and Turkmenistan. One can see that the high population growth in the 1950s accentuates the gap between production and consumption. This period marks the beginning of intensive desertification in Central Asia. Population growth is an important social factor causing desertification.

N.G. Kharin *et al.* (1993) found that Central Asia was severely affected by desertification. Of the land in the Aral Sea basin 8.5 per cent was severely desertified, 33.1 per cent was moderately desertified and, 58.4 per cent suffered slight desertification. Desertification was caused by over-irrigation, overgrazing and the withdrawal of river flow from the Amudarya and the Syrdarya rivers.

The living standards of people is shown in Table 1 below. One can see that the consumption of food fell after the proclamation of independence in 1991. Selective questioning of the population

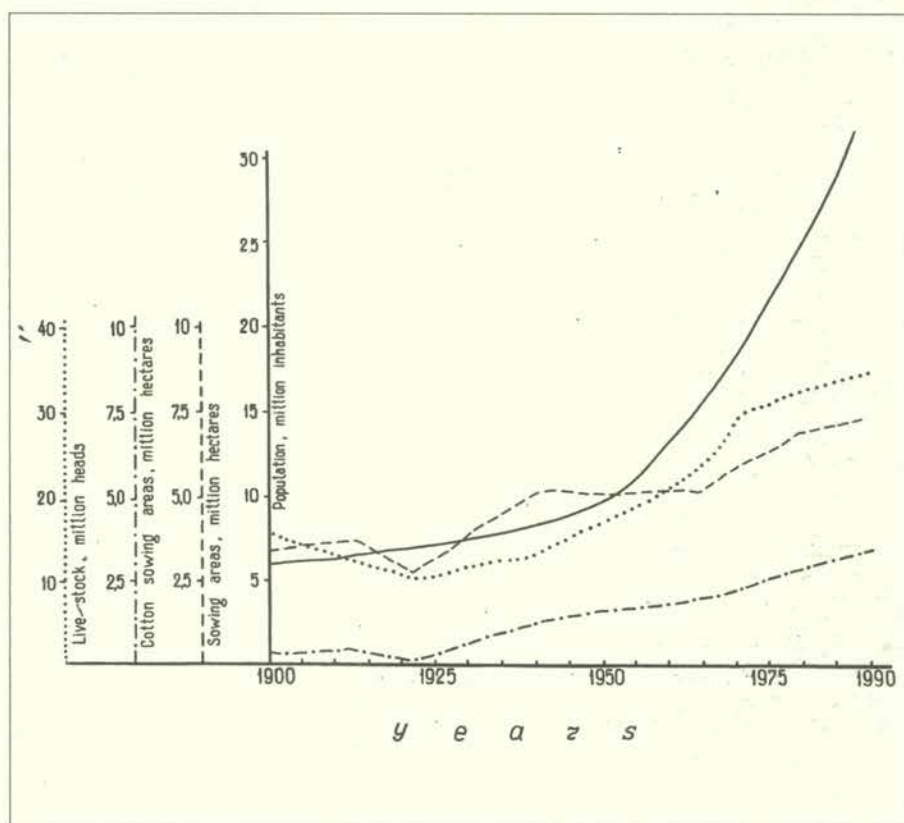


Figure 2. Growth of population, livestock and sown areas in Central Asia (K.K. Palen, 1910, Central Asia, 1969, National economy of the USSR, 1991).

Table 1: Consumption of food per inhabitant, kg/year in Central Asian countries (Economy of CIS, 1993)

Countries	Year	Meat	Fish	Milk	Eggs	Sugar	Vegetable oil	Grain	Potatoes	Vegetables	Fruits (including berries)
Kazakstan	1985	48.0	10.9	260.0	217.0	37.1	9.8	146.0	89.0	90.0	22.0
	1992	63.0	7.0	270.0	180.0	26.2	9.0	160.0	80.0	64.0	17.0
Kirghizstan	1985	34.0	6.5	182.0	124.0	31.9	9.1	144.0	65.0	98.0	25.0
	1992	40.0	1.9	212.0	117.0	23.6	7.4	135.0	62.0	71.0	23.0
Tajikistan	1985	27.0	3.3	152.0	104.0	25.2	11.4	178.0	35.0	91.0	38.0
	1992	12.0	1.3	111.0	57.0	9.7	8.1	110.0	17.0	17.0	21.0
Turkmenistan	1985	37.0	4.6	168.0	92.0	27.6	8.0	168.0	31.0	111.0	18.0
	1992	30.0	1.5	177.0	72.0	20.0	8.5	170.0	23.0	29.9	31.0
Uzbekistan	1985	28.0	5.0	180.0	170.0	2.8	11.2	177.0	26.0	107.0	31.0
	1992	21.0	2.1	167.0	67.0	12.6	12.4	162.0	23.0	27.9	43.0

conducted in 1990 shows that the supply of the main food products was insufficient from most peoples' point of view (Table 2).

Populations in areas affected by desertification suffer first of all from bad quality of water. In zones of ecological disaster the people consume food contaminated by pesticides and other chemicals used in agriculture (N.G. Kharin, 1997). In the Tashauz velayat and other districts of Turkmenistan chemicals are accumulated in storage lakes and water reservoirs. For example, water of the Sarykamysh lake is contaminated by pesticides and other chemicals brought in by drainage water. In spite of that, fishing has been continuing in this lake.

B. Uraev, (1995) found that in October 1995 the daily catch of *od* (a fish from the carp family), pike, perch, (Caspian roach) and other fishes totaled 24 MT. People also consumed fish from the Khauz - Khan and other storage lakes of Turkmenistan. According to S. Seiitkurbanov (1991) 0.7 mg of pesticides and other harmful chemicals per 1 kg of fish were registered in fish caught in these lakes.

Tedzhen case study

A sociological study was conducted by the Desert Research Institute, Ashkhabad as part of a project on Turkmenistan preparatory activities to combat desertification (A. G. Babaev, N. G. Kharin, 1994). The experimental area was located in Tedzhen etrap (district), which belongs to Akhal velayat. The Karakun canal and the Tedzhen river are the main waterways in the area. The Tedzhen is "a lost river". From ancient times to the present day its water has been taken for irrigation. The amount of salts found in the water measure 0.9 - 1.7 g/l.

The ecological degradation of the area under consideration is closely correlated to physical features and human activity. The main factors stimulating the degradation of land are: flat topography, heavy mechanical composition of soils, salinization and water logging,

Table 2: Results of a selective questioning of the population in 1990 (Survey of population, 1991).

Countries	Percentage of people who believed they had enough to consume								
	Bread	Grain	Potatoes	Dairy products	Sugar	Confectionery	Vegetables	Fish and fruits	Meat
Kazakstan	97.5	81.7	74.9	59.4	27.7	26.1	34.3	26.4	23.7
Kirghistan	96.6	86.1	74.4	49.4	31.2	44.3	48.7	35.9	16.7
Tajikistan	95.7	75.8	76.9	54.0	25.6	20.7	51.1	22.9	8.0
Turkmenistan	99.1	88.9	71.1	52.0	50.9	39.7	44.6	38.3	24.0
Uzbekistan	99.2	88.1	82.5	43.5	44.7	50.5	47.5	28.0	10.7

insufficient length of drainage network and overgrazing of rangelands.

The length of the drainage network totalled 28 linear km per 1 hectare, instead of 40 to 50 linear km recommended by scientists. Irrigation canals, 4,000 km in length were constructed in earth beds, that caused 50 per cent loss of irrigation water. In general, moderately and severely degraded soils formed 60 per cent of irrigated fields.

The physical features of soils were bad because of the use of heavy tractors which pressed and sealed the earth's surface. Soil fertility was low because of the absence of crop rotation and manure. The length of protective forest belts is short. Planted trees and shrubs have died under conditions of saline soil and salinized ground water.

In 1992 the cultivated area totalled 27,1165 hectares, of which 42 per cent were by cotton, 29 per cent grain crops 20 per cent lucern and the remainder vegetables. Productivity of agricultural crops was low, for example the cotton yield was 1.9 MT per hectare.

The population consists of 19 ethnic groups (among them, Turkmen, Russians, Kazakhs, Persians, Tatars, Uzbeks, Bashkirs). The people lived in harmony and no clashes were registered. The distribution of population by age groups is given below in Table 3.

The age structure of the population in Tedzhen is common to all the Moslem countries of Central Asia. Those under 15 years totalled 43 per cent, the working population (15 to 60 years) totalled 52 per cent. The elderly (those over 60) - only five per cent. These figures testify to the low standard of life in rural communities of Turkmenistan. The bulk of the working population (27,300 persons) is employed in agriculture, about 50 per cent are herdsman and the other half are agriculturists.

Potable water in Tedzhen is of bad quality because of the high content of salts, pesticides and other chemicals. The bulk of the population consumes water from irrigation canals and wells. Only 55 per cent of the population is provided with water lines. Insanitary conditions account for the high mortality rates, especially those of children. Forty-three babies per 1,000 die before the age of one.

Nutrition is poor, most food products (meat, vegetables, fruits, melons) are produced by the people themselves. In general foodstuffs are of low calorific value. According to the information from the Tedzhen Sanitary-Epidemic Station, children in kindergartens, (3 to 7 years of age) received 219 to 1241 kg/calories per day instead of the 1,870 kg/calories recommended. Young people, (15 to 18 years) received 615 to 886 kg/calories per

Refugees and desertification

A noticeable migration of people from Central Asia began in the 1970s and consisted largely of Russians. During 1986 to 1990 more than 736,500 people left Central Asia and more than 481,500 left Kazakhstan (N. F. Glazovsky and A. S. Shestakov, 1995). Traditionally, the local Moslem populations of the region are not very mobile; they prefer to live and to die on the land of their forefathers. The growth of towns and industrial centres in the region during the Soviet period stimulated the movement of people from the country to the towns, but this migration was not catastrophic.

The situation changed drastically after 1991. Millions of Russians and other newcomers have been leaving the countries of Central Asia. N. F. Glazovsky and A. S., Shestakov (1995) explain the reasons of this migration, as follows: "sovereignization", ethnic discrimination and armed conflicts. Poverty and destruction of social services could also be factors.

Out of 840,000 Russians living in Kirghizstan, 100,000 left the country in 1993 (A. Chelnokov, 1993). In Kazakhstan, 300,000 Germans left the country in 1993, the rest, totalling 400,000

Table 3: Distribution of population by age groups in Tedzhen (A. G. Babaev, N. G. Kharin, 1994)

Age Groups	Population in the countryside		Population in Tedzhen town	
	Number	Percentage	Number	Percentage
<5	10643	17.4	6524	16.2
5-10	8668	14.1	5304	13.2
10-15	7581	12.4	4621	11.6
15-20	6438	10.5	3852	9.6
20-25	6006	9.8	4262	10.6
25-30	5440	8.9	3831	9.5
30-35	4320	6.9	3035	7.6
35-40	2903	4.7	2064	5.1
40-45	1496	2.4	1123	2.8
45-50	1386	2.3	1062	2.6
50-55	1622	2.6	1270	3.2
55-60	1607	2.6	1074	2.7
60-65	1208	2.0	852	2.1
65-70	810	1.3	550	1.4
>70	1144	1.9	735	1.8
Total	61272	100.0	40159	100.0

day instead of the 3,400 they needed.

There were 16,714 school children in 33 schools. However, 19 school buildings were not suitable for teaching purposes. In some schools children learned in shifts.

Medical services in etrap (per 10,000 people):

	Tedzhen etrap	Turkmenistan as a whole
Number of doctors	12.0	36.0
Number of trained nurses	68.0	98.0
Number of beds in hospitals	76.0	114.0

Data on infectious diseases in etrap are given in Table 4

Table 4: Infectious diseases in the Tedzen etrap (A.G. Babaev, N. G. Kharin, 1994)

Diseases	1991		1992		1993	
	Number of sick people	Deaths	Number of sick people	Deaths	Number of sick people	Deaths
Enteric fever	44	2	49	None	18	1
Dysentery	218	3	250	2	223	2
Hepatitis	342	5	121	2	204	2
Diseases of the respiratory system	240	4	160	None	773	None
Measles	1	None	10	None	82	None
Tuberculosis	28	8	33	7	26	5

intended to leave the following year. Forty-five thousand Russians left Kazakhstan in 1992 (B. Lysenko, 1994). According to Glazovsky and Shestakov (1995) the annual rate of migration in Kazakhstan totalled 1.02 to 1.18 million people per year, of that number 600 to 700 thousand migrated outside the country, the rest moved inside Kazakstan.

United Nations organizations, in particular the United Nations High Commissioner for Refugees (UNHCR) defines refugees as those people who are outside the country of origin because of the fear of persecution for reasons of race, religion, nationality or political opinion. However UNHCR does not use the term "refugees" for persons who leave countries under the pressure of economic or environmental constraints. In this case the term "displaced persons" is used, in spite of such terminology a new term "environmental refugees" is used in scientific publications. In many countries of the world environmental refugees are not a myth but a reality. The people living

in Russia during 1992 to 1996, but this small sum of money couldn't solve the problem.

Refugees or "displaced persons" are a big problem for Central Asian countries and for Russia. The Russians, Germans and others who left Central Asia left a vacuum of technical potential in Central Asia. Scientists, engineers, doctors and other skilled people leaving Central Asia cannot be replaced by locals in the immediate future.

Concurrently local people are migrating from the country to towns where they try to find jobs and better social services. Such moves spell 'ecological disaster' as desertification and social constraints combine forcing people to migrate (Table 5).

The mass movement of people within Central Asian countries and outflow of refugees beyond the region aggravates the problem of desertification and transmits this problem to the social and political spheres. In implementing the Convention to Combat Desertification

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Palen, 1910, Central Asia, 1969, National economy of the USSR, 1991).

Table 5: Increase of town population in the zone of ecological disaster in Central Asia, thousand people (A. G. Babaev, N. G. Kharin, 1994a)

Towns	1959	1970	1980	1989
Kzyl - Orda	66	122	157	153
Nukus	39	74	109	169
Urgench	44	76	100	128
Tashauz	38	63	84	112

in Central Asia are political or environmental refugees, but it is very difficult to divide them up into these categories.

A UNHCR office was opened in Moscow in 1992, Mrs. S. Ogata, the head of UNHCR visited Moscow in 1996. She said: "The world community needed four years to be aware of the problem of refugees in Russia and other former Republics of the USSR". (V. Mikheev, 1996). The UNHCR office in Moscow gave 35.8 million dollars as aid to refugees

attention should be given to this phenomenon of desertification i.e. the induced migration of people at local and regional levels.

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Poverty, Desertification and the Impact of Drought in Ethiopia

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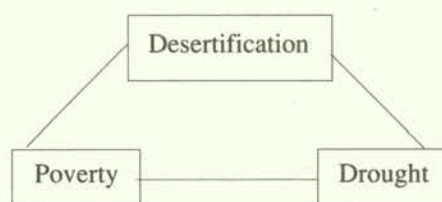
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General

Poverty, desertification and the impact of drought are interwoven problems. Poverty, here, means an inability to satisfy the basic needs of food, clothing and shelter; whereas desertification refers to land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities (UNCED, 1992). This article emphasizes the human aspects of desertification: a progressive deterioration of the biological potential of arid, semi-arid and dry sub-humid areas mainly due to poor resource management practices. Poor biological potential in turn aggravates poverty, especially in a predominantly agrarian society; and they continue to reinforce one another. Desertification, according to Babaev (1996) is a product of complicated interactions between social and economic systems (diseases, poverty, hunger, unreliable economy) and natural factors (droughts, water erosion, soil salinization, degradation of vegetation). Although the

interrelation of poverty, desertification and drought is complex, the following simple model can be used for the purpose of this paper.



The removal of vegetation cover increases surface runoff and surface reflectivity; reduces energy receipt at the surface and accelerates evaporation from the soil; alters the local atmospheric moisture balance and eventually leads to weather changes which may manifest themselves in the form of drought. Drought in turn aggravates poverty. Poverty, however, may not directly lead to droughts unless through the indirect impact of desertification. Activities which bring about changes in soil texture and structure, soil crusts, salinization, siltation and falling water levels impoverish the productivity of land on which the Ethiopian people depend for their basic needs. As the degree and extent of desertification increases over time, less and less will be obtained from the same piece of land if there is no substantial technological input to improve

productivity. The positive correlations between high population density and improved resource management (conservation) which researchers arrived at recently in Machakos, Kenya, Northern Nigeria and Guinea do not seem to have been the case in Ethiopia. Even the Konso tradition of centuries of conservation within Ethiopia has not influenced the surrounding areas for reasons that have yet to be studied. The trend of progressive land impoverishment, accompanied by rapid population increase, forces people to try even the least productive land as a means of survival. People who live under such conditions are highly sensitive to droughts, even if they are mild and rare. This article attempts to show the linkages between poverty, desertification and the impact of droughts in Ethiopia.

History of desertification in Ethiopia

Holy (1980) when describing the history of land degradation states that the most decisive epoch was the time when humans settled down and started turning pastures into farmland. It was a time of significant interference by humans in the natural process of soil erosion and soil formation. Intensive exploitation of the land disturbed the natural soil vegetation cover and

exposed its surface to the effects of erosive agents such as water and wind. Erosion has accelerated, there are but rare examples of humans overcoming the erosive agents and introducing forms of agriculture that do not destroy the land.

In Ethiopia, as in any other country, the most important epoch of accelerated soil erosion most likely started with the beginning of sedentarization and crop cultivation which of necessity required the clearing of fields and the exposure of soil to erosive agents.

The Ethiopian highlands had been inhabited by agricultural Hamites long before the Axumite Civilization around 3000 BC. Although some writers such as Merid (1986) held the view that sedentary agriculture originated independently in the highlands of Ethiopia, Greenfield (1969) wrote that the beginning of agriculture in the fifth millennium BC in western Sudan extended to Ethiopia and that the Negro people of the west moved into the western lowlands of Ethiopia and thence to the plateau bringing agriculture with them. These ancient sedentary settlements probably covered the highlands of Eritrea, Tigray, Wollo, Gondar, Gojam and the northern portion of Shewa.

The Agaus of Ethiopia are cited as examples of an early agricultural people who quickly learnt how to develop agriculture by discovering new groups (strains) of plants and by domesticating the donkey and discovering how to breed mules (Greenfield, 1969). The relatively more efficient ox-drawn plough was used for more than one thousand years before the Christian era when the hoe was the only widely used agricultural implement in many parts of the Horn of Africa (Merid, 1986). The Semites who reached Ethiopia in about 1000 BC also increased the agricultural population. The influx of the Sabeans (Semites) is said to have continued for several centuries. The Semitic people who came across the Red Sea are believed to have contributed to the improvement of the already existing agricultural system, and hence increased exploitation of the land. The contribution of the Semites to the improvement of the then Ethiopian agricultural system is believed to have been in both farm implements and new agricultural crops

since they originated from the Middle East, a renowned area for domesticating plants. Improved agricultural practices (in terms of implements and seed varieties) attracted more and more people to agricultural activities which meant more clearing, more erosion and the eviction of greater numbers of wildlife (steadily progressing desertification).

During the decline of the Axumite Civilization and the accompanying weakening of its military glory, many people turned to agriculture to earn a living. The difficulty of relying on the sale of incense and ivory (at the time major trade items) due to expanding cultivation practices also contributed to rapid forest clearing, erosion and the general impoverishment of the biological potential of land. With the increase in the agricultural population, people began to move south, southwest and westward in search of new agricultural land rather than improving the management of existing land.

Some writers such as Berhe Wolde-Aregay (1996) wrote about environmental degradation in Ethiopia witnessed by foreign travellers as early as 1699 and in the early nineteenth century. In many parts of northern and central Ethiopia closed forests were completely cleared by the 1830s and 1840s (Berhe Wolde-Aregay, 1996) and never recovered.

The history of Ethiopia has been characterized by civil war, instability and lack of strong central government. There were several regional kings (during the *Zmene Mesafint*) who were autonomous, and who fought frequently among themselves over territories and founded towns largely on the basis of the availability of fuel-wood, construction material and drinking water. As the towns grew, the forests were depleted and no tree was planted to replace them until the reign of Menelik (some 100 years ago) who, among other things, introduced the eucalyptus tree. That marked the first (perhaps unintentional) attempt at natural resource conservation in the history of Ethiopia.

For a long time, when there was no one single strong central government, forests served as shelter for outlaws who imposed themselves on farmers demanding various tributes for the ever

mobile regional kings. Looting by the army of newly arriving lords or regional kings, heavy taxes and tributes, and the manual labour demanded by representatives of regional kings added to the vagaries of weather and weather related pests (locusts, worms and crop diseases) kept Ethiopian farmers poor. Farmers always gave out more than they could afford but got nothing in return. The burden persisted for generations and the possibility of improvement was bleak. As a result, a certain nonchalance prevailed among farmers about forest and other natural resource conservation, with the exception of natural vegetation cover around church compounds. Moreover, the farmers have always been preoccupied with the satisfaction of their immediate basic needs and have never found the opportunity to prepare for the future. Desertification, therefore, continued unchecked for centuries, especially in the established agricultural areas of Tigray, Wollo, Gondar and northern Shewa.

The status of desertification today

Despite a long history of sedentary agriculture in most parts of Ethiopia, wise natural resource utilization is lacking. Present-day land use is hardly any better than in the past. Crops such as barley which were introduced several centuries ago are still being widely grown as a staple food without any improvement in cultivation methods or seed quality. Poor cultivation methods, fine tilth cultivation for fine seed crops such as *teff*, and monocropping in rows has persisted for generations. Desertification, in the form of land clearing and soil erosion continues unabated.

Some sources indicate that soil loss in Ethiopia reaches some 400 tons/ha/year in areas where there is no ground cover (Hurni, 1988). Half of the loss of the soil comes from cultivated land which accounts for about 13 per cent of the country. Most of this degradation takes place at altitudes of between 1700-2600 *masl* where agricultural production is at its most concentrated. Other estimates indicate that about 42 tons of soil per

hectare are lost from arable land (Madams, 1989). Similarly about 74 per cent of Ethiopia's total livestock (estimated at 79,583,000) herd is reared at the same altitude (WRI/UNEP/UNDP, 1994). Over 95 per cent of the total population of the country is found in the highlands. The general slope of the agricultural and settlement zone varies between 20 per cent and 40 per cent (Timberlake, 1985). About two-thirds of the farmland is said to be on slopes of over 25 per cent. The high concentration of people, livestock and wide-spread cereal crop cultivation has, therefore, led to various levels of land degradation (desertification) in the country. The intensity and geographical distribution of desertification is shown in the map on the previous page.

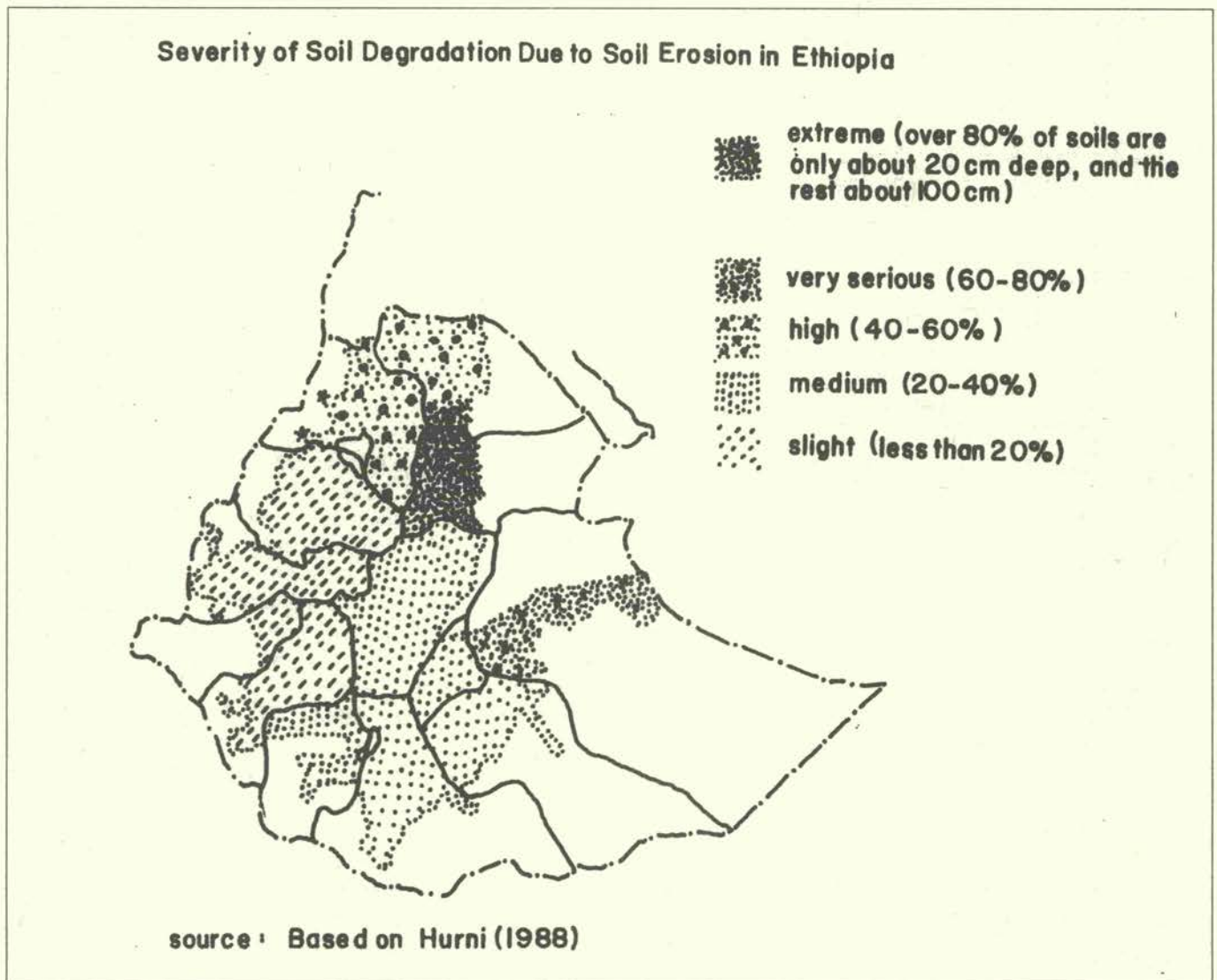
The highlands are estimated to cover

an area of 54 million hectares (i.e. 49 per cent of the total area of the country). Fourteen million hectares (26 per cent) of the highlands are seriously degraded, whereas thirteen million hectares (24 per cent) of the highlands are moderately degraded. Over two million hectares (4 per cent) of the highland soils are said to be too shallow to support any cultivation (UNDP/FAO/LUPRD, 1988). Hans Hurni (1988) estimated that about 35.4 per cent of the highlands (areas above 1,500 *masl*) have soil depth of less than 35 cm, whereas 18 per cent are less than 10 cm deep. These shallow soils are found mainly in the old agricultural settlement areas of Tigray, Wollo, Gondar and northern Shewa where rainfall is short in duration (2-3 months) as compared to the length of the growing season of the major cereal

crops (barley of 125-day variety, wheat of 100-day variety and maize of 100-180 day varieties) grown in the area. The rainfall is also very unreliable (coefficient of variation ranges between 30 - 40 per cent). The outlying lowlands being relatively flat and thinly settled suffer the least as shown in the map.

Crop types and desertification

In addition to the relatively long established agricultural practices in the northern part of Ethiopia, the type of crops grown (mainly annuals) also contribute substantially to insidious land degradation. The most prevalent crops grown in the northern parts of Ethiopia



are barley, wheat, *teff*, sorghum, maize, millet, horse beans, soya beans, chickpeas, flax, lentils etc.). These crops, not only do require frequent tilling, they also need a comparatively large area since the yield per labour and per unit area is low as compared to *inset* (false banana), tubers, root and tree crops which are more widespread in the southern parts of Ethiopia. A World Resources Institute (WRI) (1994) report indicates that the average yield in 1990-1992 was 1,282 kilograms per hectare for cereals, whereas, for root crops and tubers the average yield was 3,616 kilograms per hectare. Moreover, most of the annual crops consume more man-days than do perennials. The monetary value of cereals per unit measurement is also much lower than that for perennial crops grown in the south and southwest of the country. Although poverty is widespread in many parts of the country, the northern parts are more severely affected as was witnessed in the mass famines and deaths during and immediately after the 1970 and early 1980 droughts.

The following table shows the impact of annual crops on desertification as compared to perennial crops and livestock grazing.

sow what seeds they had left. But Wollo today is a moonscape of treeless hills and valleys. All the land that an ox can climb or a man can stand upon has been cultivated. Farmers even suspend themselves by ropes to sow hillsides too steep to stand upon.

Although Timberlake's report was based on the observation of an exceptionally dry year (1984), treeless terrain and very steep cultivated hillsides are common features even in normal years in Tigray, northern Gondar and northern Shewa and Wollo. Other reports support such gloomy views of the conditions of desertification in Ethiopia. A report by UNDP/FAO/LUPRD (1988) states that by 2010, three fourths of the *awrajas* (sub-divisions of provinces) will be unable to meet subsistence food needs if population growth continues at the present rate (2.9 per cent per year) and technologies used in agriculture remain unchanged. Hans Hurni (1988) added that there will be a livestock crisis by 2004 when all the pasture will be fully used, and a crop land crisis by 2017 when all cropland will come under production to support the population. An IUCN report based on findings by Adrian Wood and Michael Stahl (1990) also states that soil

to, among other factors,; (a) frequent changes of mandates of concerned government departments; (b) ineffectiveness of some of the adopted methods such as Food For Work Program (FFWP); (c) coercive approaches of the former socialist government; and (d) insecurity in land ownership and wrong approaches of policy implementation. It is unfortunate that the twenty-year soil conservation exercise does not change the present picture of desertification. The impoverishment of the land over the ages through careless resource extraction is still a reality. The above factors as well as many social, cultural and political factors, make the situation at present extra hard for Ethiopians to improve their livelihood. Poverty among farmers is made worse and worse by impoverished land resources.

Poverty

Although many people are aware that Ethiopia is one of the poorest countries in the world, a clearer picture may be obtained by looking at some of the commonly used poverty indicators such as gross domestic product, per capita income, health and education services and population growth. Table II shows the overall economic status of the country and the economic trend since 1973.

Table II shows a general declining rate of growth in GDP and in per capita income since 1973. This trend if it continues will end up in stagnation and perhaps lead to a decline in the absolute value of GDP. The situation becomes worse when inflation is brought into the picture. The currency (Birr) has been devalued by about 300 per cent since 1992, without equivalent adjustments in the income of the people; and there has not been any evidence of increased production as a result of the devaluation. The per capita GDP after 1992 in equivalent US\$ is shown in Table II. If we make an optimistic assumption that the 1994 GDP was 1.0 per cent higher than the GDP of 1990, the 1994 GDP would be 9394.01 million Birr (equivalent to US\$ 1445.232 million). If we make the same assumption on the per capita GDP, the

Table 1. Estimated rates of soil loss on slopes in Ethiopia

Land cover	Area covered as	Estimated soil loss (tons/ha/hr.)	Total soil loss	
	(%) of the country		mill.tons per year	% of total
Annual crops	13.1	42	672	45
Perennial crops	1.7	8	17	1
Grazing and browsing	51.0	5	312	21

Source: Hans Hurni (1988).

Areas covered by annual crops account for 45 per cent of the total soil loss in the country. Grazing which contributes about 21 per cent of the soil loss is also important. Timberlake (1985) observed the following in Wollo in 1984:

Throughout the region, farmers harnessed up weak oxen and began to

erosion and deforestation have been major constraints to Ethiopia's current development and will threaten future prosperity of the country. A report by Berhe Wolde-Aregay (1996) on twenty years of soil conservation in Ethiopia, gives a picture of ineffectiveness in the attempts of the government mainly due

Table II. Overall and per capita GDP in Ethiopia for selected years

Period	*GDP (Mill) (Birr) rate (%)	*GDP (US\$ equivlnt.) (Birr)	Annual growth equivlnt.)	**Per capita GDP rate (%)	**Per capita GDP(US\$)	Annual growth
1973	6834	3301.45	-	159.2	76.908	-
1978	7032	3397.1	2.0	204.3	98.696	2.6
1983	8610	4159.42	2.4	238.6	115.266	2.3
1986	8237	3979.23	1.9	244.5	118.116	2.0
1990	9301	4493.24	0.4	242.0	116.91	0.1

*estimated at constant factor cost

**estimated at current market prices
equivlnt. = equivalent

Source: National Bank of Ethiopia (1973-1990) Annual Reports in UNCED National Report: Development Trends, Rio de Janeiro, Brazil, 1992.

242.0 Birr/person would increase to 244.42 which is equivalent to (244.42/6.5) US\$ 37.603 per person. The per capita GDP 1994 was, therefore, about US\$38.0. This estimate is close to the report of the Ethiopian National Energy Committee (1986) which gave 207.11 Birr (US\$31.863) per person per year in a rural village, Abogordo, in Shewa. The same Energy Committee (1986) reported a per capita income of 165.8 Birr (US\$25.508) per year in Egebumbe Village in Hararge Province. In small, medium and large towns the situation might be slightly better than the above villages; yet the average estimated per capita income in Addis Ababa (where it is the highest) was only 626.6 Birr (US\$ 96.4). If similar studies were conducted in many parts of the country, the situation would probably be more or less the same. Other estimates such as Asmerom Kidane's (in UNCED National Report, 1992) indicated a faster rate of decline in the GDP. The population growth rate on the other hand has been high. Asmerom Kidane is quoted in a UNCED National Report (1992) to have made the following estimates of population growth rate:

The high population growth rate will most likely aggravate poverty and will threaten environmental conservation.

As far as health services are concerned, by 1990 there was one doctor for 30,000 people; one nurse for 14,000 people and one health assistant for 5,000 people. Only 11 per cent of the rural population had access to safe drinking water in 1990 (WRI., 1994). Per capita average calories available (as percent of needed, 1988-1990) was 73 per cent. Life expectancy at birth (1990-1995) was 47 years. The conditions in education services are not any better. In 1987/1988 there were an average of one teacher for 47 students (Central Statistical Office, 1987/1988) in government schools. Private schools are few and insignificant in terms of student intake and the training and employing of teachers since the socialist revolution of 1974. Environmental education is only a very recent phenomenon little known or understood by most of high school and elementary school teachers as environmental education is not incorporated in their training. The few informal workshops conducted on the environment involve mostly high level

Period	Population growth rate	Period	Population growth rate
1970-1974	2.3%	1975-1979	2.6%
1980-1984	2.8%	1985-1989	2.9%

officials. No effort, worth mentioning, has been made to encourage farmers about the true benefit of environmental conservation; because questions such as, How shall we survive today? Who benefits from the conservation activity? How do we know the piece of land being conserved will remain ours and our childrens? Will arise. These questions raise the issue of poverty, equitable distribution of benefits and the issue of land holding systems (land security). Consequently, conservation suffers, desertification ensues and continues, land refuses to yield enough and poverty prevails leaving the people very sensitive to the vagaries of droughts.

Impacts of droughts

Droughts have always occurred irregularly in different parts of Ethiopia. Although their impacts have not been properly documented, they have been known as *Kifu Ken* (bad days) when animals died, crops failed, people ate wild fruit, roots and berries which, under normal conditions, were not eaten. Stories relate that the *Kifu Ken* were accompanied by widespread diseases and mass deaths.

The droughts of the 1970s and 1980s were widespread and covered many parts of Eastern Europe, Australia, the former USSR, China, North America, India and most parts of Africa. The impacts of those droughts were, however, much lower in other parts of the world than in Ethiopia. The droughts affected many parts of Somalia, Djibouti, Kenya, the United Republic of Tanzania and Sudan; but Ethiopia proved to be less resistant than neighboring countries. The droughts of the 1970s and early 1980s caused economic and social instabilities of varying degrees in different parts of the country. Crops failed; domestic animals died; livestock prices fell dramatically; people vacated their houses and left their localities for other places and urban areas in anticipation of better livelihoods elsewhere. Family ties loosened and broke; traditional rules and regulations on the use of water, pasture, land and other common resources were violated, political instability occurred.

The drought of 1971-1973 is said to have led to a loss of 80 per cent of the cattle, 50 per cent of the sheep and 30 per cent of the goat populations in Ethiopia (NMSA., 1989). During the drought of 1975-1976 about two to three million people were affected; and the figure increased to 4.3 million people in 1978-1979 (RRC., 1990). During the 1984 drought, the estimated number of affected people reached 7.9 million (NMSA., 1989). About 100,000 to 250,000 people perished due to food shortages in Ethiopia (Garcia, 1981).

There were mixed feelings about the impact of drought in Ethiopia in the 1970s and early 1980s. The mass media in Ethiopia gave an impression that drought was responsible for the food shortages and deaths of people and livestock in the 1970s and 1980s. Brief presentations by the Relief and Rehabilitation Commission (RRC.), the Early Warning and Planning Services, Ethiopia (1990) and the National Meteorological Services Agency (NMSA., 1989) tried to explain the food shortages and deaths of people and livestock in terms of some seasonal rainfall anomalies. They indicated that Wollo and Tigray encountered below normal rainfall between 1975-1976 during the growing season. Southern and southeastern Ethiopia experienced failure of rains during March-May, 1975-1976. According to NMSA (1989) the major rainy season was late by 15 to 30 days and the amount was less than normal in many parts of Ethiopia in 1982. Many donor agencies and the world community at large, probably, had the same impression that the food shortages and famines in Ethiopia in the 1970s and 1980s were due to persistent droughts. A lot of research publications on droughts by the scientific community, (stimulated by the widespread disaster in the Sahel in general and in Ethiopia in particular), strengthened the impression that drought was the major factor responsible for the tragedies of the 1970s and 1980s in Ethiopia. But none of the drought studies were able to establish that droughts (per se) caused the damages inflicted on Ethiopia.

Other groups of people attribute the Ethiopian tragedies of the 1970s and 1980s mainly to socio-economic and political conditions rather than droughts

as such. Garcia (1981) went to the extent of questioning the occurrence of droughts which were blamed for the widespread tragedy in Ethiopia in 1972/1973. Garcia (Op. cit.) argued that (in 1972/1973) 75 per cent of the Ethiopian districts received normal rains in the major growing season of 1972 and, hence drought could not be responsible for human and livestock lives lost in that period. According to Garcia (1981) droughts of similar magnitude were experienced in Kenya and the United Republic of Tanzania, but those droughts were contained without causing any serious repercussions to livestock and human lives.

Droughts only revealed deep-rooted socio-economic problems that impoverished the people who could then be easily victimized by even mild droughts. Odingo (1972) attributed the severe impacts of droughts in Ethiopia to the following four factors:

- Population expansion and increased exploitation of marginal lands.
- Increased urbanization over 100 years, a situation which led to firewood crises and clearing of woodlands for firewood and charcoal production.
- Exponential increase in livestock and thus overgrazing accompanied by burning of grasslands.
- Semi-feudal land tenure system that prevailed prior to the 1974 coup d'état (i.e. during the reign of Haile Selassie). About 75 per cent of the farmers' produce went to land owners who could also evict the tenants at their will.

Conditions during the Ethiopian socialist Government were not any better.

- Land reform undertaken in 1974 was soon followed by the establishment of peasant associations which were entrusted with land administration. The power vested on the peasant association leaders was so strong that they could allocate, reallocate, divide and subdivide the land of individual peasants every season. Farmers, therefore, were never certain of their land at the end of every harvest.
- Coercive resettlement and villagization programmes destabilized and confused the farmers concerned. From 1985 to 1987 an estimated 30,000 to 40,000 traditional

communities were destroyed and converted into new villages (Clay, 1988). The resettlement programme forced people to settle in areas with different climates and different ecologies with considerable health and psychological impacts on the settlers.

- Prices and the free flow of agricultural commodities were highly restricted by Government rules and regulations.
- By 1984, about 40 per cent of Ethiopia and 30 per cent of the Ethiopian population were within war zones (Clay, 1988).

Even now, the land tenure system is still far from giving farmers land security.

Moreover, the present Government has adopted Structural Adjustment Programmes (SAP). The impact of SAPs in Ethiopia should be carefully examined at this early stage. Studies under the auspices of WWF (1992) on the impacts of SAPs on sustainable development in Cameroon, Mali, the United Republic of Tanzania and Zambia indicate that SAPs have adverse effects in many cases. Studies on SAPs indicate:

- SAPs increase rural poverty and contribute to the lack of off-farm employment opportunities; unclear regulations and management responsibilities for common property resources, poor social services, limited access to safe water in rural areas, to extension services and to research oriented toward low potential rural areas. At the same time SAPs led to a growth in absolute numbers of dismissed civil servants.
- Natural resources that are important for basic subsistence (i.e. soils for agriculture, water for drinking and irrigation, and forests for heating fuel) were being used by an increasing number of people with greater intensity for survival.
- SAPs increased threats to external and internal natural frontiers (marginal lands increasingly cultivated, drought grazing reserves were destroyed, water sheds and wildlife buffer zones were severed).
- SAPs reinforced existing social biases in resource use and consumption.

One cannot see any reason for expecting something different from SAPs in Ethiopia. The likelihood is that SAPs

may render many people helpless and worsen environmental degradation in Ethiopia.

A Ph.D. dissertation on the Climatology of Droughts Over Parts of Ethiopia and their Impacts on Crop Production by K. Abate (1994) also indicated that drought (be it meteorological or agroclimatic) was not a major problem over central, western, southwestern, southern and the highlands of eastern Ethiopia. The dissertation indicated that droughts encountered in those areas (from 1957-1987) were either mild or moderate. The length of the growing season in those areas, according to the dissertation, was well above 120 days and hence capable of allowing the growth of medium and late crop varieties. Moisture analysis within the growing season showed that there was enough moisture over much of the area to allow optimum production of barley and maize. The study, therefore, concluded that attention be given to the amelioration of non-climatic factors that reduce or stagnate crop production.

The best possible measure of mitigating the impacts of droughts is to alleviate poverty. The question of poverty alleviation is a question of sustainable development where the genuine participation of people in the development process is assured. This implies the formulation of favourable policies, designing appropriate implementation mechanisms, synchronized working systems among the various ministries, prevalence of democracy, equitable distribution of benefits from the resources to be conserved, certainty of land ownership, initiating environmental conservation awareness programmes, adopting approaches that will stimulate and inspire conservation interests instead

of using coercive methods and misleading incentives such as the Food for Work Program.

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Rehabilitation and Environmental Protection in the Louga Region of Northern Senegal - A Success Story in Desertification Control¹

Introduction

The Louga region in the north Sahelian zone of Senegal, suffered extensive desertification during the early 1970s largely as a result of drought, demographic changes and modifications to land use practices. The local population is largely made up of subsistence farmers and herders from two major ethnic groups, the Wolof and the Peulh, who have used indigenous agro-forestry techniques for centuries to produce abundant food supplies from sandy dryland soils. Their way of life was severely affected by harsh and prolonged drought that began in 1973, resulting in loss of livestock, enhanced wind erosion of soils, and an increase in male migration to urban centres in search of alternative work, which left women and children to maintain farms and households. This case study outlines a community-based project to rehabilitate the area's ecology and economy.

The effects of drought

Annual precipitation in the Louga region is low and irregular, but the annual average total of 600-800 mm prior to the drought of 1974 has since been sharply reduced. In the period after 1974, rainfall has averaged 200-300 mm a year. Water supply has always been a problem in this dryland area, but the drought made this

perennial resource shortage more acute.

The initial impact of the drought was loss of livestock to dehydration and starvation which, in turn, threatened the long-term food security system of the pastoralist/nomadic population. Farmers lost food, fertilizers from animal dung and a significant source of income. Decreasing rainfall also forced a change in land use. Yields from traditional *tokeur* plots, (small areas of cropland protected by local trees and shrubs), declined with the onset of drought and many were replaced by monoculture cropping of peanuts and millet. Poor yields per hectare of these crops resulted in a reduction in fallow and rotation periods in an effort to boost output. Trees throughout the region were cleared to make way for additional farmland and to meet firewood needs. This led to enhanced wind erosion, which combined with the decline in fallow periods, resulted in accelerated land degradation.

The onset of drought also had a major impact on the demography of the Louga region. Much of the economically active male population left the area in search of work opportunities in the cities or abroad. This migration resulted in an increase in the number of households being headed by single women. At the height of the drought, nearly 60 per cent of the women left behind with children had to assume duties as temporary household heads.

Project background

The environmental restoration and protection project for the Louga region was initiated in 1985 by World Vision International (WVI), a Christian non-governmental organization. The overall objective was the sustainable improvement of living conditions for the rural population of this degraded sylvi-agropastoral environment through water supply, access to back-up services like education, and increased agricultural production through better land use and soil conservation. The approach was based on the principle that a regular supply of basic needs such as water and income-earning opportunities is the basis for household food security, and this basic security is the necessary foundation for any attempts to address the problems of environmental degradation.

Using the Participatory Rural Appraisal Method (W.V.I Report 1995), WVI staff held discussions with villagers in more than 17 villages that served as pilots for the project's development. (Figure 1).

The project adopted a self-centred development approach which aims to help people recognize resources within themselves and their communities. It is deliberately "bottom-up", aiming to stimulate community involvement and support, as well as accountability within

¹ This article was prepared by E. Migongo-Bake, UNEP on the basis of project documents and evaluation mission report.



Figure 1.- WVI meeting in Keur Sidi village

the community. It emphasizes the following:

- A grassroots approach, revitalising and building on existing traditional knowledge;
- Respect for the social context of any intervention, group and individual endeavour;
- Social mobilization and an increase in individual awareness of sustainability;
- Adaptation of innovations to the needs of the population;
- A partnership relationship within communities; and
- Eventual withdrawal of outside advisors, as a means to achieve self-sustainability.

The design of the WVI project is closely in line with national policy on desertification, environmental protection and conservation. The Government of Senegal's VIII Socio-Economic Development Plan (1989-1995) includes the following rural development objectives:

- To achieve food security;
- To promote traditional crops and professionally introduce new ones;
- To combat desertification;
- To encourage environmental protection and soil conservation in order to ensure sustainable management of natural resources; and
- To improve living conditions in rural areas.

Within the framework of its "Plan de Développement Economique et Social" (PDES), the country has launched two important development policy documents: *Une Nouvelle Politique Agricole* (New

Agricultural Policy Document), 1993, and the Forestry Action Plan Document, 1994. Both policy documents advocate an integrated approach towards agricultural and rural development which emphasize:

- Improvement of the institutional framework;
- Sustainable use and management of forestry and other natural resources;
- Restoration and conservation of soil fertility, through the promotion of agro-forestry and sylvi-agropastoral farming systems;
- Training programmes on protection and conservation of the environment;
- Promotion of participatory approaches with beneficiaries using their own know-how;
- Training for improvement of the living conditions of certain groups (e.g. women and youth) through income-generating activities.

National development policies advocate combating desertification in the whole country and in the Sahelian zone in particular. Senegal ratified the Convention to Combat Desertification in June 1994 in Paris and remains an active member of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS). These are strong indications of the country's commitment to combat desertification and to promote environmental protection and conservation.

The WVI project has maintained a close relationship with the Ministry of Water and Forestry, Hydrology Department, the department that surveys all borehole activities, and there has been close collaboration with the Institut Sénégalais de Recherche Agricole (ISRA), the International Institute for Tropical Agriculture (IITA) and the University of California, United States in the introduction of two improved varieties of cowpeas (*Niêbe*).

Project innovations

Water availability

Initial studies showed that the shortage of water was one of the most basic problems in the Louga region villages. In collaboration with the Ministry of Eau et Forêts, Direction de l'Hydraulique, a total of 458 boreholes have been drilled since 1987 and supplied with manual or wind-driven pumps (Figures 2 and 3).



Figure 2.- A water pump at Maho Ly village



Figure 3.- Aeolian water pump at Par Cisse

The wells have been confined to settlements with more than 250 people. Village water committees, comprising both men and women, were first established to raise the necessary funds: 150,000 CFA (US\$ 300). Monitoring of the water table in the region indicates that the new wells are utilising groundwater at a sustainable rate.

Afforestation and natural generation of species

Villagers throughout the project area in the region have successfully revived the old system of "Tokeur", the planting of living fences of *Euphorbiaceae* (known locally as *salans*) to provide zero-grazing enclosures of about 15 m² in which crops are cultivated (Figure 4). The *salans* both protect the *tokeurs* from straying animals and against wind erosion. Planting within the *tokeurs* is carefully planned to rehabilitate the soil. A couple of seasons of manioc, a basic food crop with a low phosphate requirement, are followed by

potatoes and cowpeas. As the soil quality improves, crops such as millet and

tomatoes are planted. This relatively intensive cropping reduces the need for tree clearance on surrounding lands for agricultural extension. Fodder crops are also grown in the *tokeurs*, reducing grazing pressure on surrounding pastures.

A vital part of the strategy for soil conservation was the introduction of *kad* trees (*Acacia albida*) and leguminous crops like cowpeas, as well as the revitalization of traditional methods like the euphorbia fencing. As a result of the project's activities, several species have been re-established for the first time in ten years: Kel (*Grewia bicolor*), Baobab (*Andansonia digitata*), Ngigis Mborin (*Philostigma ceticulatum*), Mbep (*Sterculia setigera*), and Bér (*Sclerocarya birréa*). Tree planting and nurseries are managed by women and children and in some cases by school classes. These activities are labour-intensive and do not yield high incomes, but villages now enjoy the benefits of many shade trees.

Throughout the Louga region, the project has led to the establishment of ten village horticultural nurseries, five nurseries for fruit trees, and 133 agro-forestry nurseries. The outcome of the sylvi-agropastoralism and soil conservation activities in a selection of villages is summarized in Table 1.

The overall outcome of the sylvi-



Figure 4. - Making the desert green, through water and tokeur cultivation

Table 1. The success of *tokeurs* in villages in the Louga region

Groups	Villages	No. of Plots	Total area (ha)	No. of <i>Kad</i> trees	Salans fencing length (m)	Manure production (tons)	Fruit trees	Potato production (tons)	Vegetable production (tons)
Par Cissé	Par Cissé plus 5 surr. villages	51	50	1,217	19,625	12.45	796	100	3.2
Keur Sidi Mbengue	Keur Sidi Maica Fall	82	62.5	1,082	21,255	17.5	810	1,150	8
Total		133	112.5	2,999	40,900	29.50	1,200	2,150	11.2

Source: WVI, Senegal (1993)

agropastoralism and soil conservation activities are summarized below.

Cropping outside the *tokeurs*

In the fields surrounding the project villages, a wide range of crops is produced - mainly cowpeas, peanuts, cassava and vegetables (potatoes, tomatoes, egg-plants) - promoting food security and income generation at the village level. Cowpea cultivation has proved to be particularly successful. The crop provides a good ground cover that protects soil against erosion, and high yields have been produced from a newly-introduced, improved variety. Cowpea is now processed into couscous, providing an additional basic food to supplement the traditional staple: millet-based couscous. The possibilities of exporting surplus cowpea production to the Republic of South Africa are also being negotiated with private traders.

Economic empowerment through revolving funds

In 1993, when the above schemes to combat the basic problems of water supply and crop production had been established, a new economic element to the Louga

region project was initiated. A revolving fund scheme was established to enable villagers to run their own income-generating schemes. Loans are made over periods of three to six months to groups who pay interest on the money at three per cent below the actual bank rate. These groups, in turn, repay their loans to other groups or individuals.

The revolving fund scheme has proven to be a great success, with repayment rates to date of 100 per cent. Borrowers have used the funds for a variety of schemes, including zero-grazing fattening of livestock, the provision of food processing equipment for women's groups and the

introduction of more efficient stoves.

Livestock fattening schemes using fodder grown in *tokeurs* have been implemented both collectively and by individuals for young bulls, sheep and goats (Figure 5). Women tend to concentrate on sheep and goat rearing, while men have specialized in bulls. In one example, in the village of Par Cissé, a men's group with 10 bulls made a profit of 150,000 CFA (US\$ 300), or 15,000 CFA (US\$ 30) per person after just four months. This figure included income generated from the sale of 7.5 tons of manure to gardeners and nursery managers.

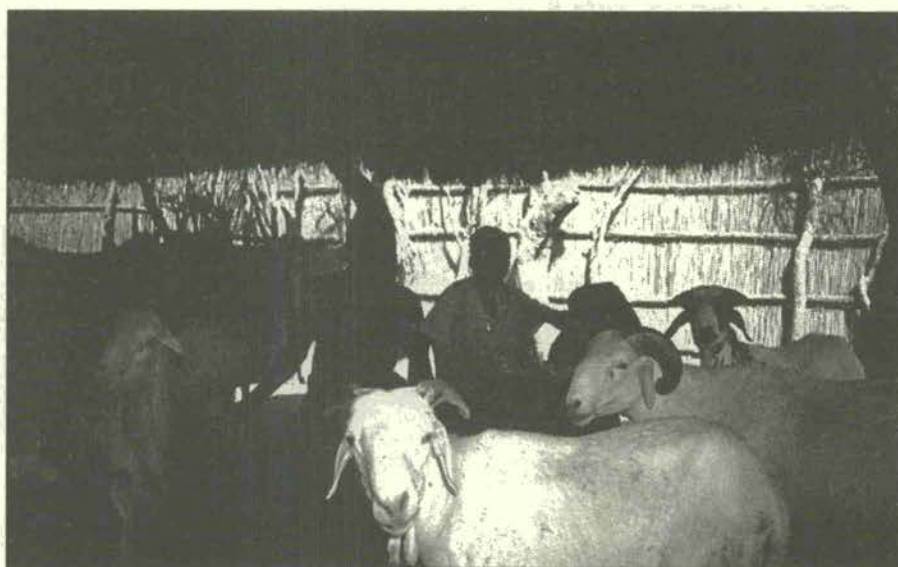


Figure 5. - Zero Grazing, fattening of sheep



Figure 6. - Improved peanut press - a product of women's activity at Keur Sidi village

Millet mills have generated the highest levels of income for groups who have invested in food processing. Table 2 shows the economic results in two villages over the period 1992-1994.

In another food processing scheme, a number of women's associations bought an improved model of a manual peanut press, produced by local village blacksmiths, for 75,000 CFA (Figure 6). Use of these communally-owned presses has yielded high returns. The processing costs are half a franc per litre of oil pressed, while one litre of oil can be sold for 335 CFA and more. The annual salary of a family unit is 70,000 CFA (1992). The average family unit (11 or more members) produces 1,000 kg of peanuts per year at 70 CFA per kg. They consume at least 78 litres of peanut oil, i.e. worth 26,130 CFA. A family unit in this region consists of one male head of household, his wives and the children eating from one cooking pot. The revenue is 43,870 CFA. If all the

harvest is processed into oil, i.e. 242 litres, and the cake and husks are sold or used as animal feed, the net revenue could be 43,870 CFA. The widespread acceptance of the new peanut oil presses, and high demand among women for further supplies of the machines, indicate the project's success in dissemination of appropriate technology.

Figure 7.- Improved energy-saving stove - Women's activity at Keur Sidi village



The improved fuel-saving stoves (Figure 7) are well appreciated by the women, who build them themselves with mud. They claim that they use only 25 per cent of the wood used in previous stoves. However, the design of the new stoves needs further improvement, since most need some form of repair after three to five years, and few women currently bother to carry these out.

Education and training

Several other positive elements of the Louga region project should be mentioned. Foremost among these are training and literacy programmes. Since 1990, 19 education centres have been established and 1,200 children participated in educational courses. The quota of girls participating in school activities is gradually nearing 50 per cent. Of these children, 59 per cent can read and write French and know the basics of mathematics.

Adults have also participated. Seventy-five per cent of the 750 adults who have attended courses can now read and write Wolof and have a notion of book-keeping. Leadership training is

Table 2. Economic proceeds from millet mills in two Louga region villages, 1992-1994

Village	Net income (CFA)	Deposits made at the bank (CFA)
Ngueball Fall	5,020	100,045
Ndame Mor Fadamba	44,770	63,195

Note: 500 CFA = 1 US\$

especially important for the management of the mills, which is entirely in the hands of women. Literacy training has been most successful for women, since unlike the men they do not migrate away from the villages in search of employment.

Women and development

Women's needs have been a special focus for the Louga region project (WVI and WID report 1993). In 1992, for example, WVI opened Women in Development (WID) offices in Mbacke and Thies in 1992 employing eight women professionals as staff. The objective behind this move is to integrate local women more fully into the project's activities and its institutional set-up, hence both responding to the women's needs, and implementing the long-term strategic needs of making women and girls partners in development. The women are given training in a range of skills, including income generation, institution-building, management and leadership, book-keeping and credit. Mothers and daughters are also provided with education in the socio-cultural sphere of family planning.

Prospects for replication and sustainability

There is a general acceptance among the population of the Louga region of the expansion of the *tokeur* plantation system, the natural regeneration of trees, and the planting of multi-purpose trees around the villages, once a water supply is assured. The intensive livestock raising in fenced

fields contributes to the improvement of soil quality, as manure is used as fertilizer. The social group cohesion is encouraged and the villagers consider themselves an integral part of the project activities. In this way, the sustainability of the project activities is almost assured. The project has laid a good foundation for income generation through specific revolving funds and training programmes for the beneficiaries. Under the circumstances, the project provides a good example of a high level of awareness in the population on environmental degradation issues and on ways of tackling them with the full involvement of the population concerned.

Sustainability in the pilot village areas is secured through the use of revolving funds. The mechanisms for accountability are established through community structures for agricultural and livestock activities to promote desertification control. These include nurseries, water maintenance committees, revolving loan committees, mill committees, training committees and many more. The different committees, especially in the pilot villages, have opened bank accounts with the formal Senegalese banking system to assure sustainability. The setting up of WID offices in 1992, with a professional team of eight local women, is another sign of being on the road of sustainability, in a setting where female-headed households are in the majority.

This project has initiated positive steps towards combating and controlling desertification in the semi-arid zone of Louga. The project has created consciousness and raised awareness in the local community of the fact that desertification control is a long-term process and that ultimately it is only themselves who can successfully tackle this task.

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NEWS FROM UNEP

Inter-regional Conference on the Implementation of the United Nations Convention to Combat Desertification (CCD), Tashkent, 10-12 June 1997

The Inter-regional Conference on the Implementation of the United Nations Convention to Combat Desertification, co-organized by the Government of Uzbekistan and the Interim Secretariat of the UNCCD, was attended by about 60 participants from 12 countries of Central Asia and East Europe, NGOs, as well as representatives of UNEP, UNDP/UNSO, FAO and IFAD.

Main objectives

- To encourage affected States of the concerned regions to accelerate the process of ratification/accession to the Convention, to achieve progress in National Action Programmes, thereby insuring the effective implementation of the CCD.
- To strengthen linkages between action at the national and international levels by informing participants of steps taken by the international community as the Convention entered into force and reviewing funding options through partnerships arrangements.
- To conduct an exchange of views and share experience on the preparation of national action programmes so as to harmonize action taken to promote sustainable development at the local, national, inter-regional and regional levels.
- To discuss the process of elaboration of an Inter-regional Programme of Action (IRAP) with a view to achieving consensus on programme

development according to the identified priorities and to promote an exchange of views on the existing institutional capacities in the regions that could be called upon to execute elements of the IRAP.

- To conduct an exchange of views and share experience on the cooperation at the local, national, inter-regional and regional levels between the main stakeholders such as governments, scientific institutions, NGOs, and local communities.

The meeting brought together decision makers from governments, non-governmental organizations (NGOs) and international multilateral and bilateral donor Agencies, in order to review progress made in the respective countries and formulate a framework for action to stimulate inter-regional cooperation on the implementation of the CCD between Eastern European, Caucasian and Asian countries.

The Interregional Conference on the Implementation of the United Nations Convention to Combat Desertification made a very positive contribution to the programming process for the sustainable management of natural land based resources in Eastern Europe, the Transcaucasus and Central Asia.

The decisions of the Conference create a solid basis for development of inter-regional cooperation between CIS countries. Concrete measure to stimulate such cooperation were agreed upon. The Secretariat of the Convention is *inter alia*, requested to assist in the preparation of an

Inter-regional Programme of Action (IRAP), that would be implemented through thematic networks relying on existing institutional and scientific capacities in the participating countries. Consequently, a Group of Experts would gather to spell out the terms of reference of the IRAP and assess prospects for partnership arrangements with international donors and financing institutions. UNEP and other concerned multilateral institutions are invited to assist in coordinating the work leading to the establishment of an IRAP.

Participants at the Conference discussed in depth the necessity of preparation and implementation of national action programmes to combat desertification, drought and land degradation. The urgency of preparing such national programmes was unanimously underlined. United Nations bodies and institutions are requested to facilitate the conclusion of partnership arrangements in support of the NAPs.

It was understood that the principal sources of finance of activities aimed at combating desertification should be the countries' internal resources. At the same time, participants at the Conference expressed their understanding that external assistance would also be called for. In this regard they called upon the international donor community to provide necessary resources for the implementation of the Convention at all levels. They also invited the United Nations bodies, including UNEP to lend technical and financial support to the

preparation process of the NAPs and of sub-regional and interregional programmes to combat desertification in the regions covered by the Conference.

The Conference adopted the declaration on the implementation of the United Nations Convention to Combat Desertification and two conclusions prepared by Working Group I and II.

Declaration of the Tashkent Inter-regional Conference on the Implementation of the United Nations Convention to Combat Desertification

Participants from Central Asian, European and Transcaucasus countries which took part in the Interregional Conference

Noting that the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa has entered into force on 26 December 1996;

Welcoming that by 10 June 1997 seventy-six countries became Parties to the Convention;

Bearing in mind that other countries wishing to participate in the first session of the Conference of the Parties as a Party to the Convention have to deposit their instrument of ratification, acceptance, approval or accession with the Secretary-General of the United Nations no later than 29 June 1997;

Mindful that wide participation of countries in this Convention is essential for fruitful international cooperation to combat desertification, and drought and to address the challenges of land degradation and poverty in the drylands at a global level;

Expressing concern over the impact of desertification, drought and land degradation on affected countries in Central Asia, Eastern Europe, and the Transcaucasus;

Acknowledging that desertification, and drought are problems of a

transboundary nature and that joint action of relevant countries is needed to combat desertification, and drought;

Recalling the Resolution adopted in Almaty in June 1995 by the International Conference on Desertification and the Nukus Declaration adopted in September 1995 by the International Conference on Sustainable Development of the Countries of the Aral Sea Basin;

Recognising the essential role that non-governmental organizations are called upon to play in the implementation of the Convention and recalling Declarations of the Conference on NGOs Cooperation and the Implementation of the Convention held in May 1997 in the Republic of Kyrgyzstan;

Have agreed that they shall:

- Urge all States from Central Asia, Eastern Europe and the Transcaucasus that have not yet done so to ratify or to accede to the Convention, as soon as possible, so as to improve the effectiveness and coordination of actions aimed at combating desertification, drought and land degradation;
- Endorse the conclusions prepared by the two Working Groups annexed to this Declaration;
- Invite all governments of countries participating in the Conference to pursue the preparation and/or adjustment of National Action Programmes (NAPs) to combat desertification, drought and land degradation;
- Agree that there is need for joint actions of interested countries in establishing an Inter-regional Programme of Action to combat desertification and drought;
- Invite the United Nations bodies, particularly, UNDP/UNSO, IFAD, UNEP, FAO, WMO to lend technical and financial support to the preparation process of the NAPs and of subregional and inter-regional programmes to combat desertification in the regions covered by the Conference;
- Call upon the international donor community, including multilateral financial institutions such as the World Bank, the European Bank for Reconstruction and Development,

IFAD, the Islamic Development Bank, the European Union and bilateral donor agencies to provide necessary resources for the implementation of the Convention at all levels;

- Express their appreciation to the Government of The Netherlands for the support provided to the Secretariat of the Convention to Combat Desertification in favour of the countries of the regions, including the promotion of national awareness seminars on the CCD and the sponsorship of this Inter-regional Conference;

- Further Express their appreciation to the Government of the Republic of Uzbekistan for the excellent organization of the Interregional Conference and for its hospitality.

Participants to the Conference from all 12 CIS countries agreed that there is a need for joint actions of interested countries in establishing Inter-regional Action Programmes (IRAP) to combat desertification and drought that would be implemented through the existing institutional and scientific capacities in the participating countries.

It is understood that the IRAP would include international cooperation in the field of scientific research, data management and information exchange, transfer of technologies, training, pilot projects and related funding in various fields of activities. Participants to the Conference agreed that eleven areas of cooperation could be considered as priority elements of the IRAP. Work under these areas could be facilitated through thematic networks.

It was agreed that an Expert Group should be established to draft proposals for and to give an impetus to the preparation of the IRAP. The CCD Secretariat was requested by the participants to the Conference to hold information consultations with all countries having expressed interest in the work of the Expert Group in order to prepare necessary terms of reference and documentation for the meeting. The Expert Group would be convened with the assistance of all interested United Nations bodies, no later than the first half of 1998.

UNEP/CIP Project Support of Desertification Control Activities in the Commonwealth of Independent States (CIS)

The majority of countries with economies in transition (Commonwealth of Independent States, CIS) are concerned with the problem of desertification and its control, and have already translated this concern into a variety of measures and activities. However, the priority given and resources allocated to such programmes vary from one country to another but, on the whole, fall short of dealing with the problem with the needed urgency and effectiveness. In all countries gaps exist in research programmes and there is a need for a more consolidated and holistic approach in the identification, formulation, implementation, monitoring and evaluation of research activities.

The arid, semi-arid and dry sub-humid zones occupy a significant part of CIS territory and comprise more than 4.6 million km². Over 70 million people inhabit this territory. A significant part of this territory is subjected to various forms of desertification. The most intensive forms of desertification/land degradation take place in Central Asia.

The dark shadow of desertification has now fallen upon Europe, which once seemed far removed from the problem so prevalent in Africa and Asia. Desertification - processes of degradation of dry farmland - is starting to affect many European countries. Russia, the largest country on the European continent, is no exception; already more than 50 million hectares are either affected by desertification or under threat of it.

Desertification processes are already well under way in the Astrakhan, Volgograd and Rostov regions, the Altai krai and the Republics of Tyva and Dagestan, while parts of the Krasnodar krai and the Stavropol krai have also been affected. Areas under threat include land in the southern part of the steppe zone in the Voronezh, Saratov, Orenburg, Omsk, Chelyabinsk and Chita regions, and in the Republics of Khakasia and Buryatia.

Perhaps the worst situation, however, is to be found in the Kalmuck Republic, the most arid region of the European part of the Russian Federation. Over 80 per cent of its territory is now in the grip of desertification, and almost half is either severely or very severely affected, this is surpassed only by the deserts of Central Asia.

During sandstorms, massive sand tracts have been shifting from the black-earth areas far beyond the limits of the Republic, reaching the borders of Eastern European States. The regular dispersal of particles from the earth's surface has been reaching altitudes of more than 800 metres, polluting the living environment.

The Kalmuck Republic has announced an initiative to set up an Association of Arid Regions of Russia and to establish a Special Federal Programme to protect areas of the Russian Federation from the processes of degradation. The aims are to stimulate action to combat desertification at a Russian level, to improve the effectiveness of measures aimed at agreeing National Action Programmes and to draft recommendations for creating and implementing a sub-regional, regional and joint Action Programme for Russian conditions in line with the United Nations Convention. This idea has been warmly welcomed in the other regions of the Russian Federation.

As land degradation/desertification continues to be a major environmental problem in the CIS region, UNEP has assisted the Kalmuck Republic of the Russian Federation, Turkmenistan and Kazakstan with the preparation of the National Action Programmes to combat desertification as well as holding the first training course "Conservation and Management of Salt-affected Soils" held in Volgograd in 1994 for 26 specialists from 12 republics of the region.

In accordance with the UNEP Corporate Programmes Framework 1996-

1997 and 1998-1999 a joint DEDC-PAC/CIP programme on assessment of desertification, training, awareness raising and support of the UN Convention to combat desertification was approved for implementation.

The following main activities are under implementation in cooperation with national institutions and CIP in the CIS region.

- A sub-regional Action Programme to combat desertification for the south-eastern European part of the Russian Federation.
- The second training course on Reclamation and Management of Eroded soils was held in Volgograd in September-October 1997 for the CIS Region.
- Development and dissemination of information materials on dryland desertification issues.
- Preparation of a case study on population dynamics in the drylands of Central Europe and Asia.
- Production of a video film "Desert reaches Europe."

National workshop on sub-regional NAP development for the European part of the Russian Federation.

A workshop on the development of the Sub-regional Action Programme to combat desertification was organized by the all-Russia Scientific Research Institute of Agroforestry Reclamation (VNIALMI) in cooperation with the Centre for International Projects (CIP) in Volgograd in June 1997.

The workshop's aims were:

- Identification of programme elements, approaches and coordinating

mechanisms for preparation and follow-up on the Sub-regional Action Programme;

- To exchange information on programme activities in the region of the Russian Federation in support of the NAP and CCD implementation;
- To discuss coordination and financial mechanisms amongst the regions, government agencies and NGOs on the NAP development and to identify the role of NGOs in supporting the programme;
- To identify practical arrangements or harmonization of various agency activities and to develop a common operational approach and inter-agency strategy to support the national action programme.

The workshop discussed the national issues of desertification, the successful ongoing programme on desertification control in the region as well as an action strategy involving; desertification monitoring, environmental zoning; improvement of the management system; scientifically justified measures on the prevention of further land degradation; improvement of pastures and hay lands; reduction of the socio-economic consequences of desertification and other issues relating to the resolution of the desertification problem.



Photo: L. Kroumkatchev

National Workshop on Sub-regional NAP development.

Over 30 leading scientists, prominent specialists from different ministries, NGOs, agencies and scientific organizations from Volgograd, Saratov, Astrakhan, Dagestan, Kalmykia and UNEP attended the meeting. The participants made a deep analysis of the factors contributing to desertification and practical measures necessary to combat it and other issues related to the resolution

of the desertification problem in the European part of the Russian Federation. As an outcome of the meeting, the outlines of a sub-regional NAP for the south-eastern European part of the Russian Federation was discussed and drafted and a working group on NAP development was established as well as a Coordination Committee.

National Action Programme in the Republic of Uzbekistan

The United Nations Convention to Combat Desertification (CCD) is to be implemented through National Action Programmes supplemented by regional and sub-regional ones. Effective action to combat desertification has to be carried out locally and must be adapted to local circumstances and conditions. But it must also be integrated into national and regional strategies to ensure that it gets adequate priority, that duplication is avoided and that resources are used as well as possible.

National Action Programmes form the very core of the treaty. The programmes are to identify the factors contributing to

desertification, and to propose practical measures necessary to combat it and to mitigate the effects of drought. And they should specify the respective roles of government, local communities and land users and what resources are needed, and which are available.

Within the CCD and UNEP 1996-1997 work programme, DEDC/PAC assisted the governments of the Republic of Uzbekistan to elaborate National Action Programme to Combat Desertification (NAPCD). The Action programme in Uzbekistan is undertaken by the Main Administration of Hydrometeorology (Glavgidromet) with UNEP financial and

technical assistance. In September 1997, a two-day meeting was organized by Glavgidromet on NAP development. Leading scientists and experts from different ministries, agencies and NGOs attended the meeting. The participants made a deep analysis of the factors contributing to desertification, and practical measures necessary to resolve desertification problems in the country. As an outcome of the meeting, the outlines of the NAP were discussed and drafted. A working group on NAP development and a coordinating team were established.

The Second Training Course on the Reclamation and Management of Eroded Soils for the Commonwealth of Independent States (CIS)

The second training course on the Reclamation and Management of Eroded Soils for the Commonwealth of Independent States (CIS) was held in Volgograd, Russia from 15 September to 5 October 1997. It was organized by UNEP in cooperation with the Centre for International Projects (CIP) and the All-Russia Scientific Research Institute of Agroforestry Amelioration (VNIALMI).

The overall objective of the training course was to address the issues of desertification/land degradation in arid and semi-arid ecosystems with a special focus on:

- i Facilitating the extensive use of the application of proper methods of conservation, reclamation and management of salt affected agricultural lands;
- ii Promoting development of internationally acceptable methodologies and techniques for desertification control;
- iii Strengthening regional and international cooperation in anti-desertification activities; and
- iv Improving the capacity of countries concerned in the CIS region to deal with desertification issues through exchange of information, experience and training.

In all, 28 participants from twelve



Participants observe the influence of field protective shelter belts on reclaimed eroded soils in Volgograd region. Photo: L. Kroumkatchev, UNEP

CIS countries (Armenia, Azerbaijan, Belarus, Georgia, Kazakstan, Kyrgyzstan, Moldova, the Russia Federation, Tajikistan, Turkmenistan, Uzbekistan and Ukraine) attended the course which was both practical and theoretical and incorporated lectures, seminars, discussions, the exchange of national experiences, field studies and study tours.

More than 30 prominent scholars

and experts from leading research institutions and universities from the Russian Federation were invited to share their knowledge and experience. Twenty reports were presented by participants on the major desertification/land degradation problems in their republics.

On completion of the training programme, an evaluation meeting was organized and all trainees were presented with certificates.

Rangeland Desertification: International Workshop - Iceland, 16 - 19 September 1997

Workshop Report

Prepared by Halldor Thorgeirsson, chairman of the ad hoc committee

Over 80 experts from 30 countries in all continents gathered to discuss

desertification of rangelands at a workshop in Iceland in late September. The workshop was hosted by the Icelandic government and co-sponsored by the European Union. The participants represented diverse disciplines such as range ecology, agronomy, soil science, geography, remote sensing, policymaking

and law. The secretariat of the CCD was also represented and INC chair Bo Kjellén addressed the opening session.

The location of this workshop has surprised many. After an excursion through Iceland including the barren deserts the participants agreed that the setting was highly relevant to the topic of

the workshop. The case histories of rangeland desertification in climatically diverse regions of the globe presented at the workshop revealed striking similarities, Iceland, with its severe desertification, being no exception.

Highlights of issues discussed

Below are highlights of the discussion at a summing-up session prepared by an *ad hoc* group. The scientific papers will be published by Kluwer Academic

Publishers. Please note that the meeting was not an intergovernmental meeting and the participants attended in their personal capacity.

The context

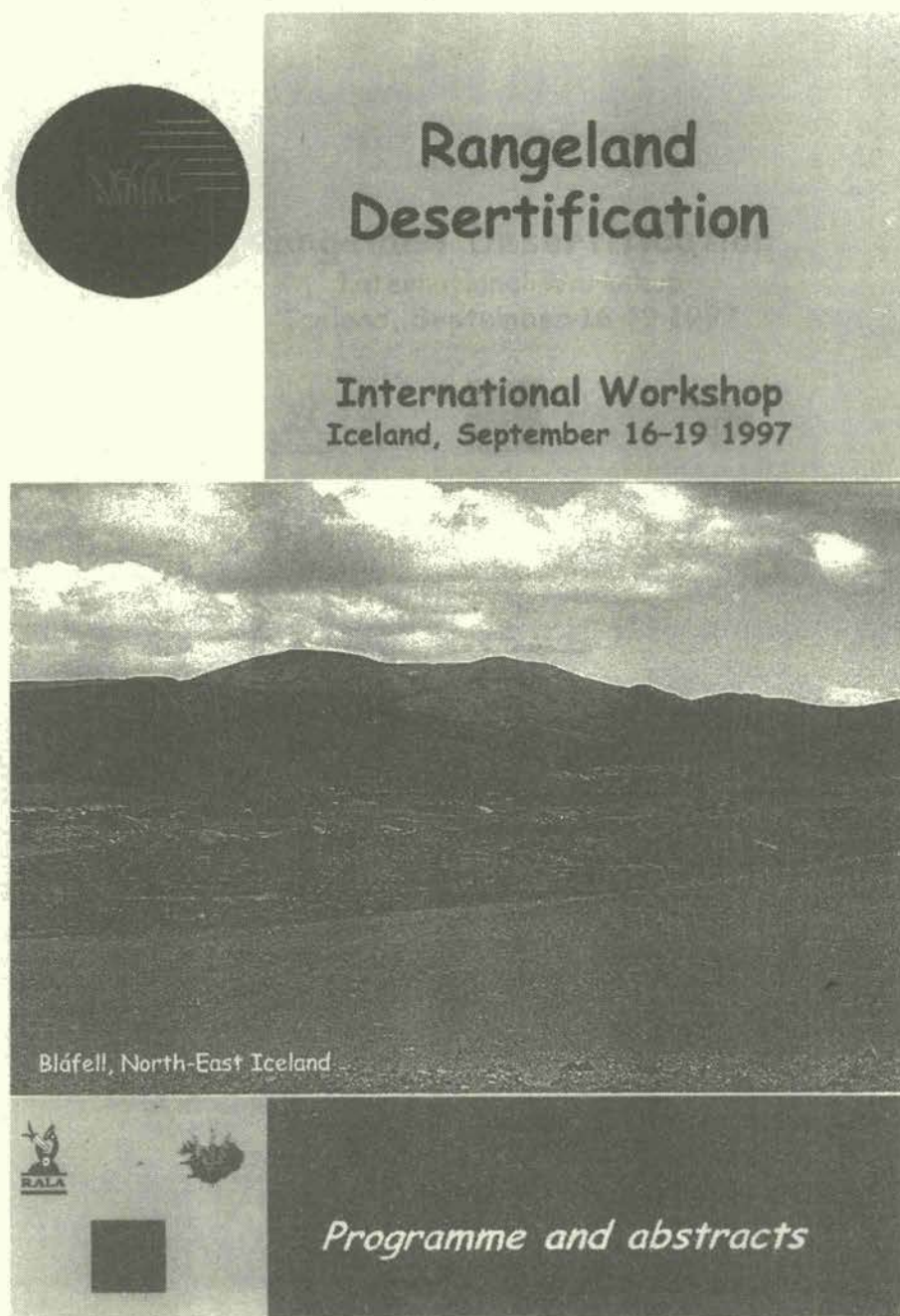
1. Rangelands are of key importance in the context of desertification globally both in terms of extent and socio-economic impact.
2. Demographic pressures on rangelands will continue to increase. Desertification is not just an African problem; it is a global issue.

Particularly vulnerable groups have to be identified and catered to. The demands put on rangelands by society are not limited to food and fibre, rangeland management needs to meet multiple demands simultaneously including outdoor recreation, hunting, water supply, conservation etc.

3. There is a need to act in spite of uncertainty. The CCD needs to be founded on sound science, however. Leadership and deeper political commitment is needed from affected as well as unaffected countries.
4. Interaction between the scientific community and the decision-makers needs to be strengthened. Stakeholders need to play an integral part in the planning, implementation and evaluation of desertification control actions. A sense of ownership in the solution should be strengthened. Empowerment of stakeholders and capacity building at all levels needs special attention.
5. Guiding principles for desertification control need to be elaborated taking notice of socio-economic consideration, ethical issues, ecosystem dynamics and external driving forces. National strategies and programmes are critical.
6. The context provided by the Icelandic rangelands which have undergone catastrophic desertification helped to underline the sense of urgency.

The science

7. Specific case histories demonstrated that rangeland systems in climatically diverse regions have more in common than what separates them. The desertification in Iceland is an excellent example of desertification and can provide insights applicable to other parts of the world.
8. The degradation of rangelands needs to be evaluated based on their ecological properties, and methods designed for croplands are generally not applicable. Understanding the ecosystem function is vital, for assessment, management objectives and counter measures. Management of rangelands needs to be based on understanding of ecosystem (plant,



soil, and animal) function and the role external driving forces have in dictating ecosystem behavior.

9. Some ecosystem processes are event-driven and the ecosystem response to extreme events can be more important than the mean conditions in determining the long-term trend. Their response to stress is commonly non-linear due to positive feedback loops. There may exist ecological thresholds beyond which degradation may accelerate and become irreversible. These thresholds have not been clearly identified, however.
10. There was a general consensus that the desertification concept needs to be reevaluated as knowledge about the processes and mechanisms increases worldwide. Functional analysis of rangeland ecosystems has developed to the point that we can move from the mere description of superficial phenomena to a working understanding of rangeland function. This understanding can be distilled into functionally relevant indicators. These indicators can be used for early warning purposes. There are still important gaps in our understanding of rangeland function, however.
11. Indicators functionally relevant at one level can lose their meaning when upscaled to larger areas. When rangeland systems are analyzed at the landscape level, individual patches are found to be spatially interconnected with significant fluxes of matter from one landscape unit to the next.
12. Rangelands are degraded when the functional integrity of the system is

damaged thus leading to a reduced productive capacity and loss of resiliency. Rangeland degradation represents a continuum of system states with desertification as the end point. Productive capacity of rangelands will fluctuate due to external driving forces. These fluctuations need to be separated from long-term trends.

13. The best management of rangelands can only be devised in the context of the management objectives of the stakeholders. The needs of stakeholders can only be met within the limits posed by the supply capacity of the soil-plant system, however.
14. The current level of understanding of rangeland function has been gained from long-term studies using broad-based ecological approaches (including the soil system). These studies need to be continued.
15. There is a need for issue-driven research programmes combining several scientific disciplines aimed and finding solutions applicable to desertification control.

Implications for the Convention to Combat Desertification

16. The workshop participants welcome strengthened cooperation among climatically different regions under the Convention. They also agreed that the evolution of the Convention could be enhanced through broad-based scientific input. The interaction across the science-policy interface needs to be enhanced.
17. The scientific community needs to

recognize the importance of the development of indicators (impact indicators and implementation indicators) and benchmarks for these indicators under the CCD/Committee on Science and Technology.

18. The social science disciplines need to promote and research the participatory approaches advocated by the Convention. People's participation and NGO involvement are of key importance.
19. Adoption of appropriate technology needs to be enhanced at the local level through technology transfer.
20. The science input for the benefit of rangelands and the people depending on rangelands for their livelihood can be significantly enhanced through efficient networking across and within climatic regions, between scientific disciplines and across sectors of activity relevant for combating desertification. The CCD has a role to play in networking and in mobilizing partnership arrangements.
21. There is a need for an early warning network based on coordinated databases.

Further information:

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BOOK REVIEW

World Atlas of Desertification

Second Edition

United Nations Environment Programme
Co-ordinating editors:
N. Middleton, University of Oxford and
D. Thomas, University of Sheffield, United
Kingdom

The *World Atlas of Desertification* summarises the state of scientific knowledge on the drylands of the globe. Representing in graphic form the current state of our understanding of desertification, as well as its extent and possible solutions, it contains an extraordinary amount of information of value to students and experts alike. The Atlas clearly shows that desertification is one of the world's most pressing environmental problems, and that it is a global issue which is accelerating.

Since the publication of the first edition in 1992, over 100 countries have ratified the United Nations Convention to Combat Desertification. This second edition reflects major advances in our understanding of desertification over the past few years and has been thoroughly revised and expanded to almost twice its original size. Because combating desertification involves all aspects of environmental issues, this edition covers a broader range of topics, including concerns surrounding poverty and food security, biodiversity, climate change and the availability of water. Social and economic conditions also have a major impact on the progress and control of desertification and this edition contains the latest information on population movements which result from, and lead to desertification.



The Executive Director of UNEP, Elizabeth Dowdeswell, presenting a copy of the Second Edition of the World Atlas of Desertification to Mr Mahmoud Ould El Ghaovth, vice President, COP-1 and Chairman of the Committee as a whole.

- Double the length of the 1st edition and fully referenced throughout;
- Uses state-of-the-art digitised maps;
- Thoroughly revised to reflect recent advances in the study of desertification;
- Includes a wide range of case studies;
- Essential reading for everyone concerned with drylands and their people.

Contents

Introduction/Section One: Global

Climate surfaces and designation of aridity zones/ Climatic variability and change in drylands/ Soil degradation in drylands/ Soil erosion/ Soil deterioration/ Causes of soil degradation/ Soil degradation and vegetation/ **Section two: Africa** - Introduction GLASOD/ Soil degradation/ Soil erosion/ Soil deterioration/ Causes of soil degradation/ Vegetation/ **Section Three: South and Southeast Asia** - Soil degradation:

The ASSOD survey/ Soil degradation/ Water and wind erosion/ Soil deterioration/ Causes of soil degradation/

Section Four: Desertification studies and issues - Desertification assessment and mapping the Aral Sea Region/ Population and desertification/ Developing the capacity for national desertification assessments: a Kenyan study/ Water erosion risk in Kenya: a survey using the SOTOR methodology/ WOCAT: Regional example of Eastern and Southern Africa/ Using digital mapping of water resources to support conflict resolution in the middle East/ Desertification and land use in Mediterranean Europe/ Biological diversity in the susceptible drylands/ Dryland plants and their use/ Carbon sequestration in drylands/ Saline soils in the drylands: extent of the problems and prospects for utilization/ The North American dust bowl and desertification:

economic and environmental interactions/ Poverty and degradation/Desertification and migration in Mexico/Integrated whole farm -whole landscape planning in Southwestern Australia/Culturing Tamarix shrubs in sandy and saline soils in Northwestern China using summer floods/Restoration and environmental protection in the Longa region of Senegal.

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Agroforestry for Sustained Productivity in Arid Regions

Edited by

J. P. Gupta and
B. M. Sharma

Agroforestry is an integrated land use system combining trees, crops and/or animals for sustained production of grains, fuel wood, fodder and other products of economic value. This system has been *in vogue* in arid areas since time immemorial possibly for efficient utilization of meagre and off season rainfall, nutrients and also for providing economic security and environment protection. In recent years, arid regions have registered an alarming increase in population of human beings and livestock. This has put tremendous pressure on agricultural lands, forest lands and grazing lands. As a result of this, even the marginal and submarginal lands are put under cultivation. There is deforestation and degradation of grazing lands to meet fuel wood and fodder needs. The net result is degradation and desertification. These processes need to be halted and reversed. To achieve this objective, the Central Arid Zone Research

Institute (CAZRI), Jodhpur initiated work on the development of different agroforestry systems for different land types and agro-ecological sub-regions. A lot of valuable information has been obtained on various aspects of agroforestry systems, improved genotypes of trees and grasses, soil and water conservation, nutrient-dynamics, socio-economic conditions and the transfer of technology. This information has been compiled in the form of this publication. It is hoped that the information contained in this volume will be valuable to researchers, extension workers and all others engaged in development of the arid regions.

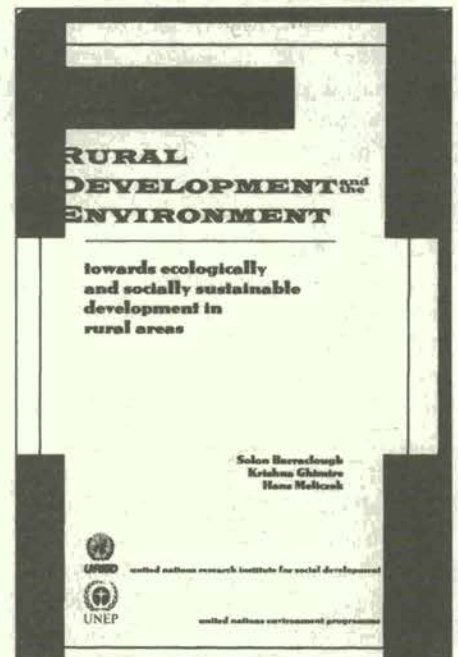
Rural Development and the Environment

By

Solon Barraclough
Krishna Ghimire
Hans Meliczek

The original study was undertaken in response to a request from the ACC Task Force on Rural Development for an analysis of the current state of knowledge on the intricate linkages between rural development and environmental issues. It was carried out with support from and in close consultation with many UN agencies, especially FAO. The United Nations Research Institute for Social Development and the United Nations Environment Programme would like to express their appreciation to these agencies as well as to other members of the Task Force for their support and critical comments on an earlier draft.

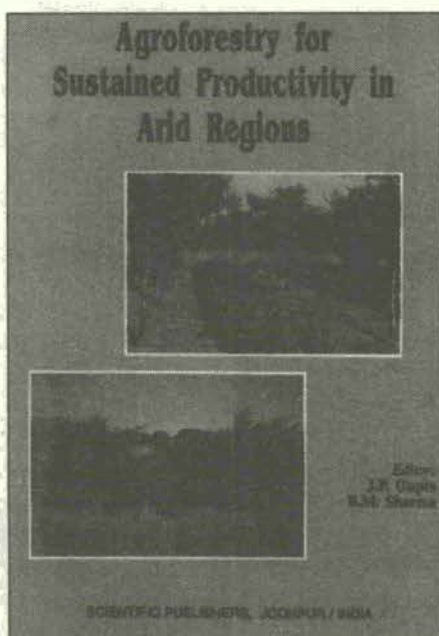
Despite the existence of vast literature on rural development and on environment, it is not easy task to establish a relationship between them. One of the virtues of this monograph is its emphasis on the complexity of the relationship and its delineation of a vast array of intermediate factors that affect that relationship. The study attempts a systematic and coherent analysis of a wide diversity of institutions and policies operating at the local, national and international levels and determines the outcome of the interaction between



rural development and environment. At the local level, the monograph highlights the importance of production patterns, technologies and farm systems as well as of population dynamics, social forces and land tenures. At the national and international levels, they consider the impact of market forces, development strategies and policies, patterns of production and consumption and forces of globalization.

Thus any approach to promote production, reduce poverty and improve the environment has to take account of an extremely complex set of interacting forces and institutions. The monograph states: "...the processes generating rural poverty and environmental degradation are extremely varied. Many are closely linked with transnationalization of the world economy, while others are only affected indirectly by globalization. Their social and environmental impacts depend largely on policy and institutional contexts.

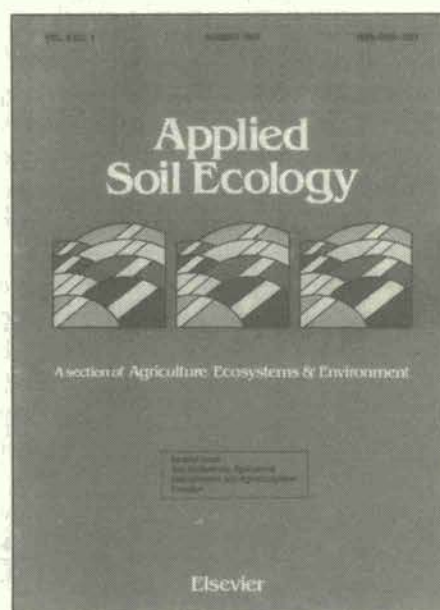
In the concluding chapter they emphasize the importance of action in some key areas to generate a process of rural development linking poverty reduction with environmental regeneration. These include the development of accountable and democratic rural institutions, equitable and efficient land reforms, popularly based national development strategies and



a series of reforms at the international level relating to debt policies, codes of conduct for transnational enterprises, resource mobilization and internalization of environmental costs.

Applied Soil Ecology¹

Special Issue: Agricultural Intensification, Soil Biodiversity and Agroecosystem Function in the tropics: Vol. 1



The seven papers in this Special Issue are the product of a workshop funded by UNEP and convened by the Tropical Soil Biology and Fertility Programme which was held at the ICRISAT Centre, Hyderabad, India, in January 1995. The purpose of the workshop was to explore the implications of soil biodiversity loss for small-scale agricultural systems in the tropics and to evaluate the potential for improving sustainable agricultural production by management of the soil biota.

The papers published here to seek to evaluate the evidence for the basic hypothesis of the importance of the soil biota to sustainable agriculture and also to explore the steps necessary to bring this assertion to a more practicable application. The first paper, by Giller *et al.*, contains in its final table one of the

main outputs of the workshop - a set of research questions hypotheses intended to provoke the research community into action to provide better basis for the management of the soil biota in tropical agroecosystems. The paper also considers a number of basic issues relating to biodiversity which arose during the workshop discussions. These include the different ways in which the relationship between diversity and function can be structured and the variation in 'value' accorded to biodiversity by farmers, scientists and other members of society.

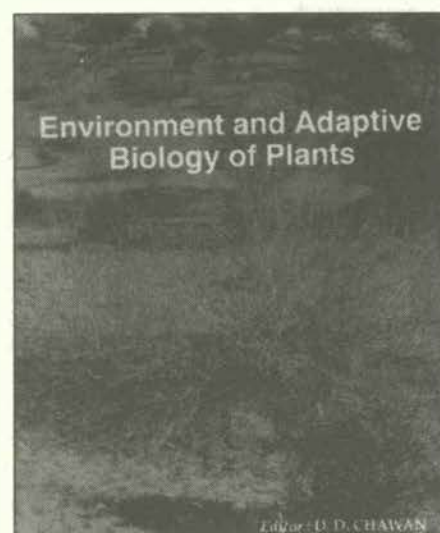
The second paper, by Beare *et al.*, takes up the first of these issues in detail to review the current state of knowledge of the relationship between soil biotic diversity and ecosystem function with a particular emphasis on the processes of decomposition. This is followed by four papers which review this relationship for key groups of the tropical soil biota: the nitrogen-fixing bacteria (Kahindi *et al.*), the mycorrhizal fungi (Munyanziza *et al.*), the termites (Bläck and Okwakol) and the earthworms (Fragoso *et al.*)

The final conclusion of the workshop was agreement among the participants to collaborate in research on the role of the soil biota in sustainable agricultural development in the tropics. It is our hope that the papers in this volume will stimulate others to join us.

Environment and Adaptive Biology of Plants

Environment and Adaptive Biology of Plants - by Prof. David N. Sen (Commemoration Volume) deals with the most bewildering themes in various aspects of ecology and environmental biology. All the chapters are on specialized themes emanating from different schools of thought by the subject experts.

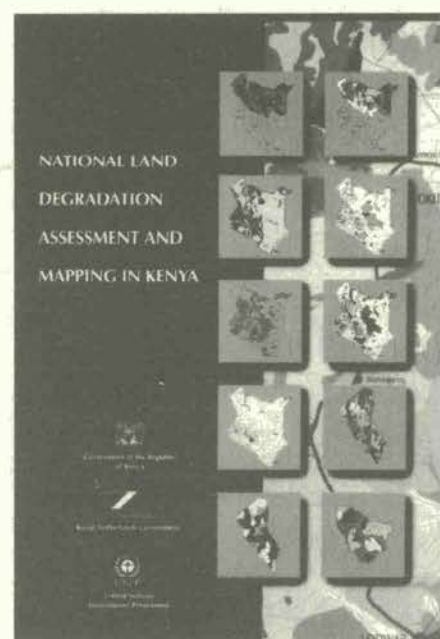
This Volume includes 28 research-cum-review chapters, and have been classified into six parts. The various parts includes (I) Ecology and Environment Management, (II) Adaptive Biology, (III) Biology of Saline Plants, (IV) Weed Biology, Weed Management and



Allelopathy, (V) Desertification and Agroforestry and (VI) Environmental Pollution.

This Volume appears to be a meeting ground of different views on the Environment and Adaptive Biology of Plants. Besides it being a very useful source of information for researchers and students engaged in studying ecology and environment in research institutes and universities all over India, it will also serve as a useful reference for botanists in general.

National Land Degradation and Assessment in Kenya



¹ Mike Swift, Tropical Soil Biology and Fertility Programme, PO Box 30592, Nairobi, Kenya

Kenya is an agricultural country and depends almost entirely on land productivity for subsistence and socio-economic development. However, about two-thirds of Kenya is semi-arid to arid and rain-fed agriculture is confined to the remaining one-third of the country. The pressure exerted on the fragile ecosystems that characterise these semi-arid and arid lands by the large and rapidly increasing human population is at the heart of the desertification that is taking place.

Nevertheless, it is important to recognize that although desertification is mainly a problem of semi-arid and arid lands, land degradation is also becoming a serious problem in semi-humid and humid environments (also referred to in Kenya as medium- and high-potential lands, respectively), especially where cultivation has been extended to steep slopes without adequate soil conservation measures. On the less steep lands, land degradation is usually less visible but is already affecting crop yields through reduction in soil organic matter and increase in soil acidity.

The National Land Degradation Assessment and Mapping (NLDAM) project was initiated before the United Nations Conference on Environment and Development (UNCED) and the formulation of the International Convention to Combat Desertification. The Kenya Government has since formulated and launched a National Environment Action Plan (NEAP) which includes elaborate proposals for controlling land degradation and desertification. An important requirement for the implementation of such a plan is, however, well-documented information on the actual and potential pressures on land resources, the current state of such resources and their resilience, and the positive or negative responses of those affected.

NLDAM was conceived and implemented as a collaborative activity involving the government of Kenya, the Royal Netherlands Government (ref KE006202) and UNEP (ref FP/KL/0323-94-95). The latter was designated as the implementing agency and allocated the task of project coordination and financial management under the Desertification Control Programme as part of the sub-

programme on desertification assessment. Although the project activities were confined to Kenya, the results and experience gained are expected to benefit other countries in terms of further developing and testing of land degradation assessment methodologies as well as the possibility and techniques of establishing a well co-ordinated national database through inter-institutional collaboration.

Combating global climate change by combating land degradation — Proceedings of a Workshop held in Nairobi, Kenya, 4–8 September 1995

The document is the proceedings of an international workshop held to consider land degradation in drylands and its management, particularly as it relates to carbon management as a means to combat global warming. Twenty specialists from nine countries met in Nairobi for five days in September 1995 to discuss:

- Dryland resources — their extent and condition
- Management options for drylands
- Linking drylands and their management in global climate particularly as related to carbon emissions and storage in drylands; and
- The question of whether burners of fossil fuels would be interested in implementing biotic offset programmes in dryland management/anti-desertification measures.

The major conclusions of the workshop were:

- Drylands have the potential to reach an annual carbon sequestration rate of 1.0 giga tonnes/yr. This is the figure cited as the minimum value to be considered as relevant in the efforts to mitigate the build-up of atmospheric carbon.
- It has been verified that drylands have a significant carbon sequestration and reduction potential but there are high risks. The risks arise because of the small differentials between degraded and rehabilitated land, and because of the vagaries of the climate. Carbon is easily gained but just as easily lost.
- The land area required to make a significant difference to the global carbon balance is quite large. About 2–5 billion hectares of land will be required to absorb just 25 per cent of the carbon dioxide emissions.
- The risks associated with carbon sequestration projects will increase along the aridity gradient. Carbon stores are less secure in drier regions because drylands are characterised by vagaries of climate and because of the complex land tenure and community structures.
- There is a synergy between global environmental problems and local aspirations. "Bottom-up" efforts are the key to successful implementation of any anti-desertification and/or carbon offset programmes.
- In forging a link between global climate change, fossil fuel burning and anti-desertification measures, it should be remembered that anti-desertification measures benefit carbon sequestration and that carbon sequestration per se benefits anti-desertification efforts.



NEWS OF INTEREST

Request for Articles and Photographs

The editorial board of the *Desertification Control Bulletin* is seeking photographs and articles for publication in the magazine. In particular, the editorial board is interested in receiving articles describing success stories in controlling dryland degradation and desertification, follow-up in the implementation of the United Nations Convention to Combat Desertification and NGO activities in the field of desertification control in all regions of the world, particularly Africa.

The technical advisor is also seeking photographic submissions for use on the cover of the *Bulletin*. Photographs should be colour transparencies of subjects related to desertification, land degradation, humans, animals, structure affected by desertification, reclamation of degraded lands, etc. Please include a brief caption giving a description of the subject, place and country name, date of photograph and name of the photographer.

All contributions should be sent to:

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For information regarding manuscripts preparation, please see page ii of this issue of the *Bulletin*.

1998 International Fertilizer Award Open

Nominations are invited for the 1998 International Fertilizer Award, for research which has led to a significant advance in the efficiency of mineral fertilizer use in developed countries. Candidates for the Award of \$10,000 should be nominated by an IFA (International Fertilizer Industry Association) member company by 20 February 1998.

The Award is offered to individual agronomists, crop or soil scientists, from the public or private sector, from the

fertilizer industry or a research institute, on the basis of originality of the research and its practical application. Preference is given to an approach which takes account of relevant factors, such as soil fertility, crop management, the use of other inputs, etc, leading to improvements in fertilizer use efficiency. The quality and communication of the research results, the attention paid to environmental issues and the international relevance of the work are also assessed by an independent international panel of scientists.

The successful nominee will be invited to receive the Award at the IFA Annual Conference in Toronto, Canada, from 11 to 14 May 1998. For full details and nomination brochure, including a list of IFA members in the relevant country, please contact:

Jack Whelan, External Relations, IFA, 28 rue Marbeuf, Paris 75008, France.
Tel: +33 153 930 500 Fax: +33 153 930 545/6/7 Email: ifamail@worldnet.fr
Web: www.fertilizer.org

National Arid Zone Information Centre (NARZIC) Established

The Indian Council of Agricultural Research (ICAR) Delhi has approved the establishment a National Arid Zone Information Centre (NARZIC), the first of its kind in the country at the Dr. Raheja Library, Central Arid Zone Research Institute, Jodhpur.

Dr. A. S. Faroda, Director of the institute says the centre will create various extensive databases on all aspects of 'arid zone' research and will be linked up with various national and international net-

working systems. The proposed centre will liaise with similar international centres such as ICRAF, FAO, AGRIS, ICRISAT, CABI, UNESCO, the World Bank, Arizona University as well as SAARC countries.

Dr. D. C. Ojha, Project Leader and Senior Librarian of the institute states that the centre is being established on the recommendations of an international conference held at CARZI in 1989, and that it will be equipped with the latest

hardware and software required for the purpose. In its first phase the centre will utilise existing resources including four regional stations located at Pali, Bikaner, Jaisalmer and Bhuj. The primary object of the centre is to provide information support to scientists engaged in field/farm research and to disseminate information to farmers for the overall development of arid zone agriculture.

New Forests Project World Seed Programme 1997

The New Forests Project provides packets of tree seeds, technical information and training materials free of charge to groups worldwide who are interested in starting reforestation projects with fast-growing, nitrogen-fixing trees. Available for immediate distribution are high quality seeds of *Leucaena leucocephala* (ipil-ipil), *Prosopis juliflora* (mesquite), *Gliricidia sepium* (madre de cacao), *Cajanus cajan* (pigeon pea), *Acacia nilotica* (Etyptian thorn), *Cassia siamea* (yellow cassia), *Acacia auriculiformis*, *Acacia mearnsii* (black wattle), *Acacia tortillis* (umbrella thorn), *Albizia lebbeck* (East Indian walnut), *Dalbergia sissoo* (yette), *Robinia pseudocacia* (black locust) and *Gleditsia triacanthos* (honey locust).

For more information or to receive a reforestation packet, write to:

Fecilia Ruiz
Coordinator, World Seed Program
The New Forests Project
731 Eighth Street, SE
Washington, DC 20003
USA
Phone (202) 547-3800, Fax (202) 546-4784

Please provide an invironmental description of your area, including elevation, average annual rainfall, length of rainy and dry seasons, high and low temperatures, soil characteristics and how you intend to use the trees (fuelwood, lumber, forage, soil conservation, soil enhancement, etc).

New Forests Project¹

The New Forests Project (NFP) is a people-to-people, direct-action programme established in 1982 by the International Center in an effort to curb deforestation in developing countries. Since its inception, the New Forests Project has worked to educate communities threatened by deforestation about the importance of forests and natural resource protection. Over the last fifteen years, NFP has helped farmers begin tree-planting projects in more than 3,500 villages in over 100 developing countries. Utilizing a number of strategies, NFP seeks to provide self-help tools for individuals or communities to produce forest products necessary for their survival.

Through the World Seed Program, NFP promotes the planting of fast-growing, nitrogen fixing tree species like *Leucaena*, *Gliricidia* and *Cajanus*. In conjunction with tree seeds, NFP distributes technical assistance, training aids, and educational materials. With proper management, these trees can sustainably produce fuelwood, animal forage, organic fertilizer and building materials while regenerating degraded soils. In addition to being excellent species for soil rehabilitation and erosion control, these leguminous trees have a proven ability to increase agricultural yields.

In recent years, NFP has been working with local, non-governmental organizations in developing countries to initiate reforestation projects and training programmes that promote agroforestry, sustainable resource management and environmental conservation. In 1990, NFP and ANACAMPRO (National Association of Peasant Farmers for Land) established 'a Regional Agroforestry Training Centre in Nueva Concepción, Guatemala. The Centre was completed in 1992 and now brings hands-on training in agroforestry and appropriate technology

¹ 731 Eighth Street, S.E., Washington, D.C 20003, Telephone: (202) 547-3800 Fax: (202) 546-4784, E-mail: ic-nfp@clark.net

to local farmers, community promoters and extension agents.

In 1993, the New Forests Project, in association with the Centre for Education and Rural Development (CEDRO), began a reforestation project on the Guazapa Volcano in El Salvador. NFP and CEDRO have begun the construction of an agroforestry training centre at the base of the volcano. This centre will work to reforest and protect the soils and the ecological integrity of the Guazapa watershed and will initiate agroforestry and environmental training.

In 1994, NFP started community agroforestry projects in Ethiopia, Honduras, Haiti and the Phillippines. In Ethiopia, NFP is assisting the Tigray Development Association with reforestation projects, fuelwood plantations and training programmes. More than 400 people have been trained in seedling production and more than 45 tree nurseries have been established.

New Forsts Project, in concert with two Haitian NGOs, has started to provide fast-growing, nitrogen-fixing forest trees and fruit trees directly to local farmers

through community nurseries. NFP has already provided one million tree seeds of *Leucaena* and *Gliricidia* which are being distributed for planting this year in over 100 communities. We plan to expand the project to more communities and start producing fruit trees for planting. In addition to our seed distribution, reforestation and training projects, we are also actively involved in the promotion and development of solar box cookers. These cookers can be simple, yet powerful tools to slow the cutting of native forests for cooking fuel.

If you are interested in learning more about the New Forests Project please contact: Stuart Conway, Director or Felicia Ruiz, Coordinator World Seed Program.

Tree species available from the New Forests Project

- *Leucaena leucocephala* (ipil-ipil, leadtree)

- *Prosopis juliflora* (mesquite)
- *Gliricidia sepium* (Madre de cacao)
- *Cajanus cajan* (pigeon pea, gandul)
- *Acacia nilotica* (Egyptian thorn, red-heat, barbar)
- *Cassia siamea* (Bombay blackwood, yellow cassia)
- *Acacia auriculiformis*
- *Acacia mearnsii* (Black wattle, tan wattle)
- *Acacia tortilis* (Umbrella thorn, Israeli babool, seyal)
- *Albizia lebbek* (East Indian walnut, kokko, woman's tongue)
- *Dalbergia sissoo* (sisu, nelkar, shewa, yette)
- *Gleditsia triacanthos inermis* (honey locust)
- *Robinia pseudoacacia* (black locust)

Seeds of these species are available now. If you are interested in planting any of these tree species, contact us and we will send you instructional materials and enough seed to get you started. All seed and materials are distributed free of charge.

IGU Commission on Land Degradation and Desertification (COMLAND)

International Meeting, Perth, Western Australia — 20-28 September 1999

First Circular and Call for Expressions of Interest and Papers

The sixth meeting of COMLAND will be held at the University of Western Australia in September 1999. We are asking now for expressions of interest and offers of papers. The second circular with further details of the programme and costs will be produced early in 1998 and forwarded to all those who respond to this circular. The language of the meeting will be English; regrettably, translation facilities will not be available.

Theme of the meeting: *Agriculture, Land Degradation and Desertification*

Papers are invited on any aspect of the theme, with particular interest in:

- All aspects of soil erosion and degradation
- Secondary salinisation of soil and water
- Ecological consequences of land degradation and desertification
- Social and economic consequences of land degradation and desertification
- Technical remedial measures
- Structural (agency) solutions
- Social, economic and political solutions

In brief, the organizers are interested in all aspects of the effects of agriculture on land degradation and desertification, anywhere in the world: the nature and extent of the problems; specific and underlying causes; the biophysical and socio-economic consequences of the problems, and the range of solutions - from specific remedial measures through to policy aspects. Papers which provide case studies of successful solutions will be particularly welcome.

Structure of the meeting

At this early stage it is envisaged that there will be:

1. Up to three days of paper presentations in Perth
2. A one-day field excursion, examining a transect from the coast across the urbanised, sandy/aeolianite coastal plain to the Darling scarp and its valleys, deep weathered 'lateritic' soils, granite landforms, complex vegetation associations and land-use

conflicts, and degradation associated with fire and disease

3. A three-day post-meeting field trip in the southwest of the State, looking at soils, vegetation and landforms with an emphasis on the impact of dryland agriculture on the environment. The field trip will be run in conjunction with Agriculture Western Australia (the State's agricultural agency) and will include examination of sites where personnel from the agency have conducted detailed research into groundwater hydrology in relation to the salinisation of streams and soils.

We also hope to visit sites where various solutions such as pumping, revegetation and integrated catchment techniques are being trialled and/or implemented. Numbers on this field trip will be limited on a first paid/first served basis to a maximum of 40 due to transport and accommodation constraints

Expression of interest (this is not a commitment but will be helpful to the organizers; and you will receive the second circular)

I will/hope to participate in the Perth meeting of COMLAND:

Family Name and Title (PLEASE PRINT) _____

First Name _____

Affiliation _____

Mailing Address _____

Phone _____ Fax _____

E-mail. _____

Separately, please provide the names and addresses of any other persons or organizations to whom copies of this circular should be sent.

Offer of a paper

Offers of papers **must** include the following information:

Name(s), title(s) and affiliation(s) of all author(s) _____

Affiliation, address, fax, phone and e-mail of person to whom correspondence should be addressed *if different from that under 'Expression of Interest' above* (please include with the paper's summary)

Title of paper. _____

Oral presentation? (PLEASE CIRCLE ONE) or Poster presentation?

Please attach a 300 word summary of the paper, stating its objectives, methods and main findings

Offers of papers will be reviewed by members of COMLAND and presenters whose details are given above will be advised of acceptance as soon as possible.

Mail or fax to:

Dr. Arthur Conacher
Department of Geography
University of Western Australia
Nedlands, WA 6907, Australia
phone 61 (0)8 9380 2705
fax 61 (0)8 9380 1054
e-mail: ajconach@gis.uwa.edu.au

How to Motivate Youngsters to Combat Desertification

Combating desertification is not only a task for present-day of decision makers it is one of the most urgent objectives for

the generations to come. It is therefore extremely important to motivate young people in the fight against desertification.

Stimulated by very positive discussions at the International Symposium, in Tuscon, Arizona, United States (May 1997), entitled "Combating Desertification: Connecting Science with Community Action", we decided to confront a small group of youngsters in Belgium with the difficult daily life of the population in Burkina Faso, a country in which we had a sustainable development project. This project, on reforestation and soil conditioning began in 1988 sponsored by a Committee of the City of Maastricht, The Netherlands.

Financial support for this new initiative came from: a bank (BBL), a textile holding company (C&A), a transport company (CMB-T), a general warehouse (GB-INNO-BM), a car manufacturer (Peugeot), a shade net manufacturer (Ridobel), a publisher (Roularta), the Belgian airline Sabena and TERRACOTTEM, a company producing soil conditioner.

During the period 10 to 21 August 1997 a group of seven young people (three girls and three boys from Belgium, one boy from Maastricht) aged between 15 and 18 years, visited the Department of Niou (northern part of Burkina Faso), accompanied by a representative of the Belgian Development Cooperation Agency, a teacher from Maastricht and a University professor. The general objective of the project was to offer these youngsters the chance to learn about the harsh conditions existing in a Sahelian country.

First, the group was confronted by the difficult circumstances faced by some schools, where 60 to 70 pupils are educated

in hot classrooms with little teaching materials. The youngsters' reaction was very positive: they intend to set up a regular collection of books, notebooks, pencils, pens, etc., and to send this material to all schools of the Niou department.

Visits to the local hospital and maternity homes provoked a similar reaction: awareness of the urgent need to send elementary instruments, all kinds of elementary medicine and disinfection products. The young people could not believe that effective health care was possible in such poor conditions.

In order to let them experience how hard daily life in the dry regions really is, the youngsters were invited to work together with the rural population in the fields. A lot of weeds have to be dug out to give millet and corn the best possible chance to grow during the rainy season. Needless to say, after a dynamic demonstration by the local people, mostly women, our Western youngsters got work but were exhausted after 10-15 minutes, sweating and breathing heavily. This convinced them that there is an urgent need for the alleviation of such difficult conditions in desertified areas.

The young people enthusiastically participated in reforestation activities. Special attention was given to a new method of planting, using a large plastic sheet to collect and to drain rain water to the plant pit, in which the water and fertilizer stocking soil conditioner TerraCottem was used. Gum arabic trees (*Acacia senegal L.*) were planted at the local Women's Association Centre "Gueswende" and at the Youth Centre. Teams were formed, each consisting of an African boy and a Western boy or girl, which created a special link between the Western group and the local population.

This form of participation was highly appreciated.

Through positive reactions on the spot and through a number of interesting comments in personal reports, the group of youngsters confirmed the success of this new initiative. It was clearly shown in Burkina Faso that direct confrontation and first hand experience with the problems of desertification and poverty contributes in a very effective manner to awareness raising of the next generation. These delighted youngsters from Belgium and The Netherlands have called themselves "Young Ambassadors of the Convention to Combat Desertification", and will participate in an information campaign, giving talks, slide and video-film shows in a number of schools and youth centres.

From 22 July until 6 August 1998 we will offer a new group of young volunteers from Belgium the chance to participate in a similar project with rural people in Inner-Mongolia. Looking at the extraordinarily positive effect of such a youth project we are now suggesting that possibilities should be created to repeat this initiative in different OECD-countries, or look for ways to form international groups of youngsters. Investing in young people and thereby taking care of awareness raising for the next generation can be extremely rewarding. Who wants to contribute? Don't hesitate, let us know!

Prof. Dr. Willem Van Cotthem
President TC Dialogue Foundation
Beeweg 36 - B9080
Zaffelare (Belgium)
Tel/Fax +329 356 7285

AGROENVIRON98: International Symposium on "Agro-environmental issues and future strategies: Towards the 21st Century" 25 - 30 May , 1998, at the University of Agriculture, Faisalabad, Pakistan

This Symposium is being organized by the Department of Structures and Environmental Engineering, University of Agriculture, Faisalabad, Pakistan in collaboration with AKRSP (Pakistan/Sweden), CIRDAP (Bangladesh), CIGR (Belgium), IEF (Canada), NRC (Egypt), PNAM (Thailand), PEA (Palestine), WAITRO (Denmark), AARI, CEWRE, DRIP, EPA, IEP, IWASRI, PCRWR, PSF, PSAE, UGC, WRI, WWF, (Pakistan).

"AGROENVIRON98" will highlight agro-environmental issues and facilitate the exchange of scientific information. It will help policy makers recognize the impact of agricultural practices on agro-ecosystems. It will also suggest agro-environmental abatement strategies. Papers on the following topics are requested: agro-chemicals and groundwater contamination; agricultural machinery-related noise pollution, soil compaction, erosion etc; agro-industrial pollution and control; acid rain and air pollution; agro-environmental impact assessment and legislation; industrial/

sewage irrigation and soil pollution; modelling agro-environmental systems; farm wastes, recycling and energy generation; mountainous deforestation and management; and any other.

Contributors are invited to submit three camera-ready copies. Type within 8.5" x 11" (standard A4 paper) with 1" margins on all four sides. Paper format is: title (capitalised), author's name, address, abstract, introduction, methodology, results and discussion, conclusions, recommendations and references. Centre all the titles and do not indent. The text should be single spaced with double spacing between paragraphs and headings. Use 11 point Times or equivalent font size for text and 13 point bold Times for the titles. The graphs and figures may be drawn using any graphic packages available and included in the text as appropriate. However, graphs or figures drawn by hand (using black ink), should be submitted in original form along with their Xerox copies at respective places in the hard copy. The captions of figures and

tables should be numbered in Arabic numerals. The length of the paper should not exceed six pages. Please include an IBM compatible disk (3.5") with the paper using WORDPERFECT or MS WORD or an ASCII file.

Papers sent before **15 MARCH 1998** will be published in the "Agroenviron 98" proceedings.

Send your paper before 15 March 1998 to:

Engr. Sajid Mahmood, Lecturer/
Symposium Secretary
AGROENVIRON Secretariat
Department of Structures and
Environmental Engineering
Faculty of Agricultural Engineering and
Technology
University of Agriculture, Faisalabad,
Pakistan
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Desertification is land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climatic variations and human activities. This latest, internationally negotiated definition of **desertification** was adapted by the United Nations Conference on Environment and Development (UNCED), Rio de Janeiro, Brazil, in June 1992.

The United Nations Conventions to Combat Desertification was formally adopted on 17 June 1994 and opened for signature in Paris on 14 October 1994. This Convention is notable for its innovative approach in recognizing the physical, biological and socio-economic aspects of desertification; the importance of redirecting technology transfer so that it is demand driven; and the involvement of local populations in the development of national action programmes. The Convention has 115 signatories and came into force on 26 December 1996.

