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**ISSUES PAPER**

**Land Degradation and  
Rehabilitation  
Research in Africa 1980-1990:  
Retrospect and prospect**

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# LAND DEGRADATION AND REHABILITATION RESEARCH IN AFRICA 1980-1990: RETROSPECT AND PROSPECT

Michael Stocking

## 1. An Overview of Research to 1990

Africa has a long and illustrious history of research in land degradation and rehabilitation. It is a record influenced by the trends of the time, the nature of the colonial relationship, and the perception of the problem. Influences from anthropology, natural resources survey and agricultural engineering, mingled with the various perceptions of colonial administrators and agricultural officers that Africa was a rich continent being ruined by the natives (e.g. Stockdale, 1937), all contributed to a richness of research unparalleled elsewhere. Hailey's (1938) African Survey had 60 pages on erosion in recognition of the view that it was one of the severest of Africa's problems. Needless to say, much of the research is prejudiced, a product of "scientism", and patchy in its application and appropriateness (Abel and Stocking, 1981). Nevertheless, it provides a necessary learning experience, upon which current research may build and develop.

There are a number of milestones which are worthy of special mention for their influence on research:

- \* *erosion and runoff plots in Tanganyika.* E.H. Harrison, the Director of Agriculture in 1929 introduced soil conservation as a priority in agricultural policy. Plots were set up at Ukiriguru and Lubaga in 1929, and Mpwapwa in 1933, and maintained until 1939 (e.g. Staples, 1939). The detailed records are now lost, but the importance of the maintenance of vegetation cover was established;
- \* *trials on rates of erosion and effectiveness of conservation in the Rhodesias and Nyasaland, 1953-1963* (Hudson, 1957; Elwell, 1971). This programme of the Federal Ministry of Agriculture was the largest single investment in land degradation research in Africa of the period. A data bank of soil loss and runoff rates from some 50 different treatments, representing various conditions of soil, slope and land use, is the largest source of quantitative information on erosion providing the base for

several subsequent studies (e.g. nutrient losses with erosion: Stocking, 1986);

- \* *erosion and rilling studies in French West Africa, 1956-75* (Roose, 1975). This major programme, financed by the French overseas research organisation (ORSTOM), was active in Ivory Coast, Upper Volta (now Burkina Faso), Dahomey (now Benin), Senegal and Niger and collected a large body of data on factors contributing to land degradation (Roose, 1976);
- \* *Inter-Governmental Commission for Technical Cooperation in Africa South of the Sahara (CCTA)*. Following an Inter-African Conference on Soil Conservation at Goma in the Belgian Congo (now Zaire) in 1948, CCTA was set up to organise four regional committees for conservation in east, west, central and southern Africa. In the event, only SARCCUS (Southern African Regional Committee for the Conservation and Utilisation of the Soil) operated effectively, helping to assist international cooperation and to disseminate research results;
- \* *FAO's Land Degradation Methodology (FAO, 1979)*. This 3-year joint project of FAO, UNEP and UNESCO used North Africa as its pilot area for testing the methodology and mapping the results. Four maps were published at 1:5 million giving (a) present soil conditions and rates of soil degradation; and (b) soil degradation risks. For the first time, the different processes of degradation were brought together.

Such major efforts suggest that not only was land degradation seen to be a major threat, but also that there was a core of local scientists and expatriates, national governments and international agencies ready to commit a considerable amount of resources to research. It is interesting to contrast the situation in Africa with that pertaining in Europe. In the latter case, only in the second half of the 1980s has there been any concerted effort to promote research on land degradation and measures of conservation (see Schwertmann et al, 1989, to note the minimal progress in Europe).

As Africa entered the 1980s, there was a comparatively large base of knowledge as to the severity of land degradation, and where the greatest problems would be likely to occur. The most susceptible zones were recognised to be the fragile environments on steep slopes, the seasonal tropical

600- 900 mm mean annual rainfall areas, and certain soils and landscape positions, such as sodic soils and dambo wetlands.

The beginning of the 1980s saw specific trends in research which influenced the type of research promoted in the fields of land degradation and rehabilitation. The late 1970s had seen a spurt of international effort and rhetoric based around a concern for the environment and the need for better information as to land use and man's influence upon the natural resources of soil, vegetation and water. In addition to the land degradation methodology research already mentioned (FAO, 1979), these efforts at quantifying the capability of land to be used safely were typified by the following projects:

- *Agro-ecological Zones Project* (FAO, 1978). This major initiative of FAO, started in September 1976 though based on earlier international projects on soil mapping (UNESCO, 1974) and on "land evaluation" (FAO, 1976). It was a "study of potential land use by agro-ecological zones to obtain a first approximation of the production potential of the world's land resources, and so provide the physical data base necessary for planning future agricultural development" (from Foreword by R. Duda). One of the basic principles of the methodology is that land use must be matched with the land suitability, where "suitability refers to use on a sustained basis". (p.1) Implicit in the analysis is that if land is used more intensively than its suitability rating would suggest, then degradation will occur. This fundamental aspect was developed in the following project:
- *Potential Population Supporting Capacities of Lands in the Developing World* (Higgins et al, 1982). This joint project of FAO with the International Institute for Applied Systems Analysis, Vienna, and the UN Fund for Population Activities, New York, asked the basic questions, "Can the agro-ecological zone crop potential estimates be converted into estimates of potential population supporting capacities? if so, can these population potential estimates be compared with data on present and projected populations to identify critical areas where land resources are insufficient to meet food needs?" (p.5). The research went on to calculate a huge body of data for 117 developing countries. For example, the ratio of estimated population in the year 2000 to projected land potentials at low level of inputs for Africa is 1.6, indicating that in aggregate Africa should be able to meet its food needs easily from its own land resources, and without major investments.

- World Soil Charter (FAO, 1981). This document, endorsed by the 21st Session of the FAO Conference, established a set of principles for the optimum use of the world's land resources and calls for a commitment by governments, agencies and land users "to manage the land for long-term advantage rather than short-term expediency" (FAO, 1983, p.37).

These efforts certainly raised the profile of land degradation issues at the time. They contributed to a great number of projects, which for FAO alone in 1983 in 13 African countries amounted to over \$20 million on soil conservation (FAO, 1983). Within the various projects, the research results themselves by country and by region produce interesting data, but both their technical accuracy (e.g. the scale problem) and their usefulness must be questioned. The three maps of suspended sediment yield within Africa, so different, yet based on essentially the same data set, are now well known (Walling, 1984; Stocking, 1987) but well worth reproducing (Figure 1) to demonstrate that so-called objective data have different interpretations to different analysts.

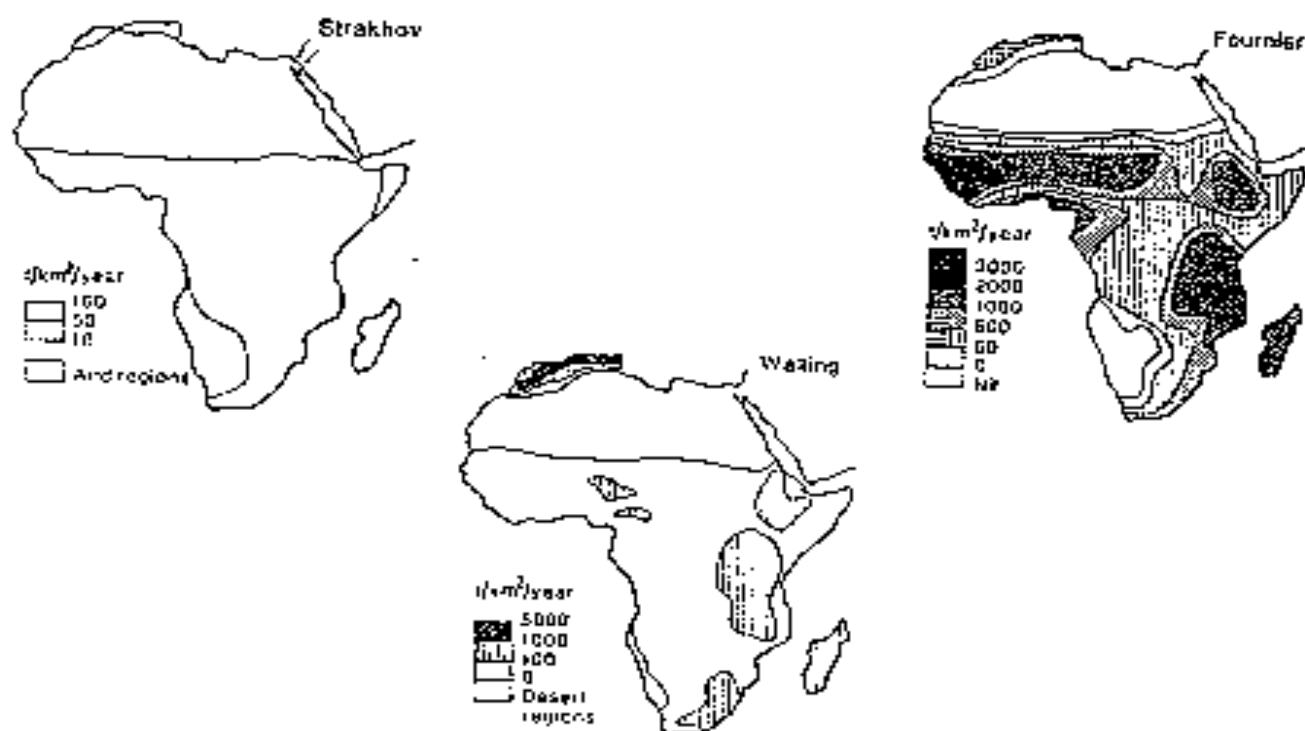


Figure 1. Suspended sediment yield in Africa - comparison of the maps of Strakhov (1967), Fournier (1967) and Walling (1984)

However, it has to be said that there has been much soul-searching as to whether the approach to soil conservation adopted in the 1970s and early 1980s was money well spent: the answer in general has to be "no". The most comprehensive analysis of this is by Hudson (1991). He cites several major surveys to support the general feeling that all is not well with projects in the agricultural sector (p.1):

- an analysis of 994 World Bank projects, 212 of which were in agriculture, implemented between 1973 and 1983, showed failure rates of 14 percent for all sectors combined, but 26 percent in agriculture. Of the agricultural projects, the highest failure rate was in East Africa with 55% (World Bank, 1984);
- an FAO study of 310 projects, between 1982 and 1986, assessed that 63 percent were satisfactory in the definition of objectives, and 52 % were satisfactory overall (FAO, 1987).

Hudson's own analysis of soil conservation projects supports the general feeling that there has been very little input from research or learning from experience. From the main aid donors, he identified 133 projects started in the 1970s and 1980s in the general field of land degradation and rehabilitation, but only 35 of them had enough documentation, monitoring and analysis of results to make a judgment as to success or failure (a statistic which itself suggests the lack of attention to monitoring or research in projects). 21 of these projects were in Africa. From his sample, of those projects started in the 1970s, 25 % were rated successful; in the 1980s, 56 %.

These are discomfoting analyses. They suggest that:

- ♣ the major international research effort has had little impact;
- ♣ the many erosion and runoff plot experiments have not provided data useful for implementing projects;
- ♣ project planning has been woefully inadequate, indicating that planners have had little guidance as to good practice in soil conservation;
- ♣ research has either been ignored, it has been inappropriate, or it has not been done.



Currently, there is scepticism amongst many that large research projects can either produce usable results or encourage action to reverse what everyone agrees is accelerating land degradation. Most major international efforts regrettably have come to nothing. The World Soil Charter is remembered by very few. There have been only a handful of applications of the Soil Degradation Methodology and the Population Supporting Capacities Project: one attempt of the latter for Lesotho showed possibilities at the local scale (Sibolla, 1987), but it really only demonstrated what was already self-evident, that Lesotho will never be able to feed itself from the natural resources within its borders.

Only one major international investigation project on degradation has arisen during the 1980s. This is GLASOD, the Global Assessment of Soil Degradation project, financed by UNEP and executed by the International Soil Reference and Information Centre with the cooperation of FAO, International Society of Soil Science and the International Institute for Aerospace Survey and Earth Sciences. From 1987, GLASOD has produced general guidelines for the assessment of human-induced soil degradation (ISRIC, 1988) and three maps at a scale of 1:10 million to show the status of degradation (Oldeman et al, 1990), prepared, it is stated, with the cooperation of more than 250 scientists worldwide. The objective of GLASOD is "to strengthen the awareness of policy-makers and decision-makers of the dangers resulting from inappropriate land and soil management, and leading to a basis for the establishment of priorities for action programmes" (p.2, 1990 Explanatory Note). Africa appears on Sheet 2, along with Europe and Western Asia. Although the methodology is somewhat simplified from the earlier FAO efforts, it is difficult to see any material advantage in the approach. Because the data are to be linked with a World Soils and Terrain Digital Database, there will be a great opportunity for the presentation of statistics on type, degree and extent of degradation problems for various geographical areas. But as GLASOD itself points out, "this global map will not in itself solve the problem of soil degradation" (p.21)

The 1980s have, therefore, seen a significant increase in awareness of the degradation problem. They have also seen a shift away from large global projects, dealing mainly with physical and chemical aspects of degradation, towards a more diverse set of research activities. The main purpose of this paper is to make a preliminary inventory of not only the research, but also the changes of emphasis in the research, on land degradation and rehabilitation in Africa over the last decade; to assess the importance of the changes of emphasis; and to examine the major issues for the forthcoming agenda.

## 2. A Caricature of Pre-1980 Approaches to Soil Conservation

To illustrate the major shift in approaches to land degradation over the 1980s, two papers have recently drawn caricatures - deliberately exaggerated - to illustrate the typical pre-1980 approach to soil conservation which imbued both research and implementation (Sanders, 1988; Stocking, 1988). The following is an abbreviated account from the second paper:

"In his youth Watch Mafuta worked at the mines. Now, at age 40, he is tired, and his yearning for his communal ancestral home has brought him back to the family "shamba" or farm..... Watch cultivates cotton and maize on an extensive plot allocated by the chief..... Declining yields force him to plow more land each year. Weeding is a real problem.....

An unremarkable family, the Mafutas. No one is starving. Because basic educational provision is now greatly improved, the three children even go to school. Life for the household is, however, a single treadmill; the next bowl of maize-meal porridge the dominant thought or, when times are better, such as after a good harvest, the walk to the forest reserve under cover of darkness to spirit out a tree or two for charcoal to sell, perhaps to buy a battery for the now-silent but cherished family transistor radio.

Concerned because of reports about land degradation, the government agricultural officer, a local extension assistant, and a foreign aid worker call on the Mafutas. They take the classic three-step approach to soil conservation:

1. *Identification of the problem:* These technicians see the degrading arable land, the overgrazed range, the poor crop stands, no fertilizer use, and not a single measure they could call 'conservation'. If the visitors bother to ask, they may even identify some critical constraints in the farming system, such as late-planting because of lack of animal traction for plowing or of labour demand during land preparation and weeding. The analysis concludes: Erosion is confirmed as serious; soil conservation and land reclamation are urgently needed.

So, the alarm is sounded; and pointedly the finger of accusation is directed at the land user. What next?

"2. *Planning of control measures:* Soil loss rates are calculated and packages of remedial measures designed to reduce degradation. Technically good, these measures will work, the experts argue. "We only need cooperation from the community," they say."

This is the "technical-fix approach" which identifies a physical problem and prescribes a physical solution. The logic appears to be inescapable; but is it?

"3. *Implementation of the plan:* The plan is explained to the Mafutas. Encouragement and persuasion, even subtle threats, are employed. Typically, the household is shown photographs of eroded land, statistics on soil loss, and embellished descriptions of the dire consequences of allowing erosion to continue. Appeals based on patriotism, their custody of the land for future generations, and the security of the state are launched. Demonstration plots and field days show what can be done. Hoe in hand, the Mafutas set to.

The farmer and local administrators, inarticulate in the face of such an onslaught, can rarely muster convincing arguments against such plans. Nods of agreement, smiles, and handshakes follow. The experts' plans are accepted. Implementation proceeds.

Successive stages in this scenario could be summarized by these headlines: "Soil conservation project hits teething problems," "Targets not met in conservation plan," "Government minister urges unity to fight menace of erosion," "Heavy rains destroy contour terraces," "Lazy farmers blamed for soil erosion," "Aid agency pulls out." (p.381)

It is a depressingly familiar story. The innocent - the technical experts, professionals, aid agency - are cleared of blame. The guilty, are revealed: degraders of the land, and ignorant peasants.

This is a caricature of the old approach. Like all caricatures, it contains enough truth to be uncomfortable. The largely technical approach to research gave a solid grounding for such views, which saw "human irrationality" merely as complicating factors in the battle against land degradation. The warning signs, even from physical scientists, were, however, already there: Young and Goldsmith (1977), for example, working in Malawi, found "management issues" far more influential in determining crop yield than the intrinsic quality of the soil. That being true, it might have been only a short step to recognising that socio-economic, cultural and political factors are at the core of any analysis

of the causes of land degradation and, therefore, need to be uppermost in any design for rehabilitation. Natural scientists took most of the decade to convert to the new views: Many scientists who had made important contributions to African research, such as E. Rouse, came slowly to realise the importance of non-technical factors in the 1980s. Land husbandry, co-authored by five leading scientists and conservation practitioners, says this: "While conservation is essential, ..... it is a secondary and complementary objective that must be integrated with production practices" (Shaxson et al, 1989). This small book shows how far, the views of scientists had at last changed.

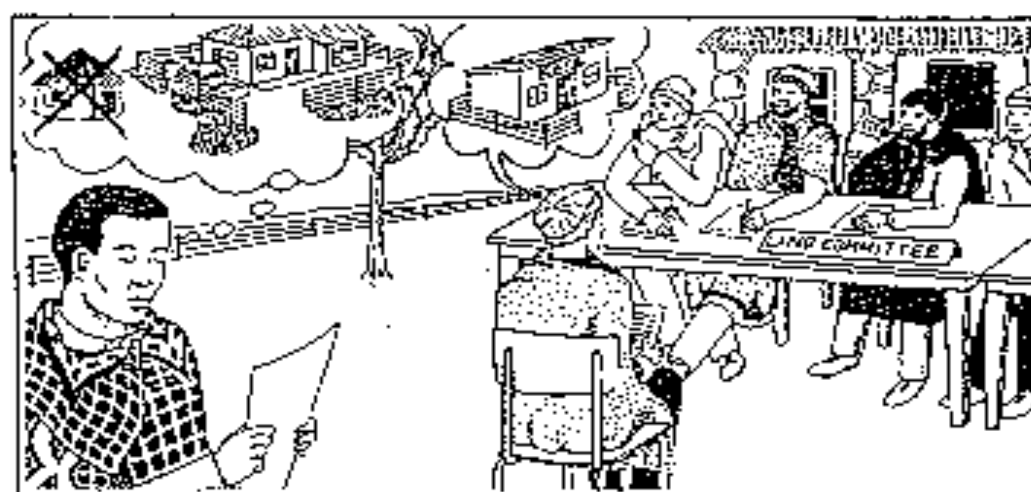


Figure 2 Illustrating some of the conflicts in community land use planning - an extract from a Bulletin for farmers (by permission of the Institute of Land Use Planning, Lesotho)

Today, it seems remarkable that the emphasis has changed so much. A cartoon, such as that in Figure 2 taken from a 1989 Bulletin of the Institute of Land Use Planning, Lesotho, for staff and farmers, showing some of the conflicts which may arise in community land use allocation, would never have appeared in that forum even five years earlier. Indeed, this same Institute had earlier been trying to produce FAO-type physical land evaluation and soil maps as its contribution to land use planning. Now it is promoting community-based, participatory, plans with innovations such as contractual agreements as to what government agents will supply and the community will accept (Stocking, 1989). The change is fundamental. Researchers may not have led the change, but they are certainly now following new approaches as the section below shows.

### 3. An Inventory of Major Research Efforts in the Decade in Africa

This section attempts to give a "flavour" of the type of research carried out in Africa between 1980 and 1990 focussing on various aspects of land degradation and rehabilitation. The research emanates from many sources and academic disciplines; the terms used range widely through "conservation", "desertification", "drought-control", "agroforestry", "sustainable agriculture", "farming systems research (and extension)", "on-farm adaptive research", and so on. The research has been done by agriculturalists, foresters, climate and soil scientists, geographers, and a few economists, sociologists and anthropologists.

Table 1 gives a very partial view of research initiatives in the decade, starting with the international cooperative efforts, regional networks and continuing with country-specific research projects. Not mentioned are research projects of individuals, often university or government researchers - of which there are many - and the work of researchers from outside Africa. Many anthropological studies are still in this latter category. The human and financial resources devoted to land degradation and rehabilitation are considerable.

**Table 1.** Major research efforts to study and combat land degradation in Africa, 1980-1990. (various sources, including UNEP (1985), CDCS (1986), Milner & Douglas (1989), Kerkhof (1990), unpublished FAO records, personal experience)

Area/Country	Title	Observations
Africa	UNEP's Plan of Action to Combat Desertification, 1977-84	Attempts to measure the extent and severity of degradation and design ameliorative measures; targets originally set have not been met
Africa	UN Sudano-Sahelian Office, UNSO	Works in 19 African countries; mainly planning and programming; but also research support
Africa	UNESCO/MAB (Man and the Biosphere Programme); projects in most African countries	14 major research themes including: impact of human activities and land use practices on grazing lands; dynamics of arid and semi-arid ecosystems
Africa	FAO Programme of Action for Africa, 1986-	Targets: soil conservation techniques; communal grazing; fuelwood problems; irrigation at village level; people's participation; conservation-based resource development.
Africa	Comite Interetats pour la Lutte contre la Secheresse au Sahel, CILSS	drought control; promotion of research and cooperation amongst Sahelian countries

Area/Country	Title	Observations
Africa	International Fund for Agricultural Development, IFAD - Special Programme for Sub-Saharan Africa	Important study on "Issues and Options" for soil and water conservation; including survey of for indigenous practices (CDCS, 1986)
Africa	International Council for Research on Agroforestry (ICRAF), Kenya - including AFRENA for most agro-ecological zones	Promotes collaborative research on agroforestry for soil fertility, conservation, social and objectives. AFRENA is a network of in-country researchers. Major publications come from ICRAF: e.g. Huxley, 1983; Nair, 1989; Young, 1989
Humid/sub-humid Africa	International Institute of Tropical Agriculture (IITA), Nigeria - Farming Systems Programme	Major experimental programme; including soil and nutrient losses, alternatives to shifting cultivation, intercropping, alley cropping, tillage, mulching etc.
Arid Africa	International Centre for Agricultural Research in the Dry Areas, (ICARDA), Syria	Includes farming systems research; variety trials etc
Semi-arid Africa	International Crop Research Institute for the Semi-Arid Tropics, Sahelian Centre, Sahelian Centre, Niger, and Farming Systems Programme	Based in India but with centres in four African countries, including: millet intercropping with cowpea, existing farming systems (e.g. small farmer minimisation of risk objectives), tied ridging
East Africa	Permanent Inter-governmental Authority on Drought & Development in East Africa, (IGADD), Djibouti	coordination of research, groundwater studies, livestock development
Southern Africa	SADCC Coordination Unit for Soil and Water Conservation and Land Utilisation, based in Lesotho	For the 10 SADCC countries; cooperative including, economics, design of soil conservation, people's participation, erosion hazard mapping etc.
Algeria	Barrère Verte (Green Dam Programme, 1971- )	Research into species for dry areas; socio-economic investigation to improvement of grazing
Botswana	Dryland Farming Research Project	Major constraints to crop production; minimum till.
Botswana	Arid Lands Development Programme, 1980-90	Includes research on communal farming systems.
Burkina Faso	Sambouai Project (UNESCO/MAB)	People's perception of drought; response and adaptation to change
Burkina Faso	Proj. Combat Desertification in Tropical Zones, 1976-85	Research on ecological and socio-economic conditions in Sahel. Station at Mare d'Oursi
Burkina Faso/ Mali	Projet Bois de Villages, 1977-. Now in Now in Phase V. Uses local research institution.	Social research component to investigate extension systems (GRAAP), pioneer of "flannelographs"

Area/Country	Title	Observations
Cameroon	Promotion of adapted farming systems based on animal traction (PAFSAT), 1984-	On-farm research to support and develop innovations, including contour ridges, ox-ploughing, intercrope
Cameroon	Operation Green Sahel	Environmental rehabilitation, Maroua
Chad	CARB Chad's <u>Acacia Albida</u> Project	Research to exploit this remarkable tree (and others)
Djibouti	Restoration of the Dry Forest	Resource inventory, ecological studies, rangeland
Egypt	Desert Development Demonstration & Training Prog., 1979-	Alternative integrated approaches to arid land agricultural and community development
Egypt	Regional Environmental Management of Mediterranean Desert Ecosystems, 1979-	Evaluation of impact of different land-use types on environment; provision of research results for decision-makers.
Ethiopia	Land Use Planning Project, Min. of Agriculture, 1978-	Inventory resources, mapping, erosion hazard
Ethiopia	Soil Conservation Research Project, Ministry of Agriculture; with University of Bern, Switzerland	Network of seven experimental stations; wide range of research on soil loss, productivity, rehabilitation design of appropriate conservation systems - see important publication, CFS/CDD (1986)
Gambia	Gambia Soil & Water Management 1978-88	Creation of soil conservation service along US lines; some research monitoring
Kenya	Soil & Water Management Research Programme, KARI, 1985-	Comprehensive programme of research, including soil productivity, cover crops, farming systems analysis etc. (little progress because of staff shortages)
Kenya	Kenya Woodfuel Development Prog. 1983-	Baseline surveys of existing resources; development of technical packages, on-farm trials
Kenya	East Pokot Agricultural Proj., 78-	Experiments in range management, controlled grazing
Kenya	Baringo Pilot Semi-Arid Areas 1983-	Test improved soil and water conservation practices.
Lesotho	Farming Systems Res. Proj. 79-84	On-farm and on-station trials; arable & grazing land
Lesotho	Farin Improvement with Soil Conservation Project, 1985-	Farming systems research; introduction trials of soil conservation
Malawi	Land Husbandry Branch, Ministry of Agriculture, 1969-	Promotion of more integrated methods of soil conservation and land use planning. Little direct research, but an important influence in region

Area/Country	Title	Observations
Mauritania	Nouakchott Greenbelt Project, 75-	Dune stabilisation, research on <i>Prosopis</i>
Niger	Majita Valley Windbreak Project, 1975-. Part of Management of Semi-arid Lands & Natural Forests Programme	Design of shelterbelts, crop yields, social and economic impact on farming systems
Nigeria	Arid Zone Afforestation Programme	Community and private woodlots, people's participation
Rwanda	Projet Agropastoral de Nyabiziudu 1979-87	Large agroforestry research component; shrubs on conservation strips
Senegal	Agro-sylvo-pastoral land use Models in the Fight Against Desertification N. Senegal, 1975-	Originally to investigate afforestation around wells. Major social research in 1985 found that relations between project and local people very poor
Somalia	Northern Rangeland Development Project	Range management, grazing reserves, herbarium
Somalia	N.W. Region Agricultural Development Project, 1979-89	Soil & water conservation; improved cropping practice; research monitoring
Sudan	W. Sudan Agricultural Research Proj.	Development of sustainable agricultural systems
Sudan	Land Reclamation Project, N. Sudan	Economics of land reclamation
Tanzania	East Usambaras Agricultural Development Environmental Conservation Project, 1985-	Promotion of forest protection & biological diversity through development initiatives, soil conservation, etc. Research monitoring (see Stoking & Perkin, 1991).
Tanzania	Hifadhi Ardhi Dodoma (HADO), 1973	Pioneering social and physical experiments on total destocking. Famous in the literature (e.g. Ostberg 86)
Tunisia	Institut National de Recherche Forestiere, INRF	Species selection, with preparation and afforestation
Zambia	Luangwa Integrated Resource Development Project, E. Province, 1986	Protection of resources of Luangwa Valley, incl. wildlife, soils, forests, by channelling revenues to local people. Substantial research monitoring.
Zambia	Soil Conservation & Agroforestry Project, S. Province, 1986-	Research trials on species; diagnostic surveys.
Zimbabwe	Institute of Agricultural Engineering CONEX - soil erosion experimental sites, Hatcliffe and Domoshawa	Experiments on soil erodibility, tillage, tied ridging, organic matter, conservation systems; now moving into small-farm agricultural systems on the sandy soils of communal areas
Zimbabwe	Dryzone Afforestation Project - research component of Rural Afforestation Proj., Forestry Comm.	Screening and provenance trials, species experiments, monitoring and evaluation



What, then, are the principal features of the research efforts through the decade? Clearly, there was an important transition in both types of research and subjects of study.

- ♣ *runoff/erosion experimental plots*: the emphasis on these declined. Many countries of Africa maintained them throughout the period (e.g. Nigeria, Zimbabwe), but elsewhere they fell into disrepair (e.g. ORSTOM trials in West Africa). Individual researchers took them up in some instances (e.g. Rwanda, Kenya), but no longer were these plots the automatic choice for erosion research;
- ♣ *development of predictive models*: in the 1970s, Africa had developed the only real challenger to the supremacy of the US-derived "Universal Soil Loss Equation": it was called SLEMSA, the Soil Loss Estimator for Southern Africa (Elwell & Stocking, 1982). In line with the decreasing emphasis on plot experiments, the use of predictive models for assessing degradation also declined in the 1980s.
- ♣ *"Land Husbandry" approach*: this commenced in Malawi in 1969 with the creation of the Land Husbandry Branch which took over all the functions of the former Conservation Branch, and provided services in land use capability assessment, land use planning and environmental conservation (Shaxson et al, 1977). Although based largely on physical planning, the approach broke new ground in involving aspects such as financial analysis and farmer preference. It can rightfully be seen as the precursor to more farmer-centred approaches of conservation. Its influence on research is indirect but powerful - see, for example, Mwakalagho & Mulenga (1990);
- ♣ *small-farm and subsistence conditions*: far more research is now aimed at the small farm sector. Concepts such as risk-minimisation, gender divisions of labour, farmer-first approaches, rapid rural appraisal, all developed during the decade and became features in at least some of the newly-started research;
- ♣ *emphasis on production and household economics*: there was very little of this for degraded lands. Only a handful of projects (e.g. SADCC's economics programme) attempted to look at the local-level costs and benefits of rehabilitating and conserving lands. Initial results do not look promising: it would seem that small farmers would require very high

returns from soil conservation to make it an attractive proposition (Bojo, 1987);

- ▲ *integrated management and use of resources*: during the decade a number of projects started in Africa which might loosely be called "conservation-with-development" (Stocking & Perkin, 1991). Examples include Ngorongoro Conservation and Development Project which seeks to protect wildlife while providing a living for Masai pastoralists; Korup in the Cameroon; the Usambaras Project in Tanzania (see Table 1). They are a response to the lobbying of environmentalists, and the growing pessimism of standard project approaches to protection of natural resources;

These trends have changed the kind of research pursued in the 1990s. The following section summarises the principal emphases now in research in land degradation and rehabilitation.

#### 4. The Major Emphases in Research Now

A major change has been away from large, multi-site erosion research projects (e.g. ORSTOM in West Africa) towards more specific, focussed trials with well-defined and sometimes quite modest objectives. No doubt this is a change partly forced upon researchers by funding constraints. Nevertheless, it is a trend which recognises the very site-specific nature of resource management in Africa, where (a) the environmental conditions provide a unique set of opportunities and constraints, and (b) the social, economic and political circumstances of local people, local leaders and decision-makers combine to ensure that no universal solutions can operate. A good example of the type of project now being supported is the 1990 winner of the "Innovations for Development Association Award (IDEA)", a prize of one million Kroner (c \$180,000) given by Sweden for innovative projects in rural development which help solve technical, economic, social and environmental problems "in disadvantaged areas of the world". The winner was a project based on developing flexible management systems for a dry area, the Guesselbodi Forest, near Niamey in Niger (Fries, 1990). The project has focussed on:

- the value to the population of the products from the natural forests such as wood for fuel, construction etc.;

- management methods and how to influence the output of these various products;
- factors influencing seed production etc., and the how to improve forest cover and composition by means of direct seeding and planting;
- the importance of forest fires and the how to manage these;
- prices and marketing;
- legal and tenure problems concerning the rights by people to trees and forest products.

In short, the emphasis now is far more on production possibilities, the social, legal, institutional and economic constraints, and specific technical research such as, in this case, techniques of direct seeding. It makes for an interesting mix of subjects and specialities, all within a single research project.

The above example presents a change from a large, single-sector project undertaken at several different sites to multi-sector, single-site project, and demonstrates another important change which has become apparent: research tests solutions, rather than analysing the problem. In a way, there is "problem fatigue"; planners no longer wish to know that there is a problem; the problem is probably self-evident. The fatigue demonstrates that problem-oriented research had little direct application to conservation and land rehabilitation. The research takes up "best-bet" solutions and, in effect, monitors their success or failure. An example of this is the soil and water conservation research in the semi-arid highlands of Kenya (Liniger, 1989). This measures soil loss and runoff on a selection of local, ridging and mulching methods of land preparation, and then relates the results to a development strategy for this difficult zone. Similarly, elsewhere in Africa, there are large numbers of trials on agroforestry, improved cultivation, water harvesting and so on. The Projet Lutte Anti-Erosive in Southern Mali has introduced since its start in 1986 the concept of village land use management, planned and coordinated by village associations; it has pioneered the "GRAAP" method (Groupe de Recherche et d'Appui pour l'Autopromotion Paysanne), an interactive form of education; and it is monitoring yields and benefits (Rochette, 1989; Critchley & Graham, 1991). Such trials are truly "applied research", where the researcher explicitly draws out the implications of research results and their application to development. Contrast this with the erosion/runoff plots in the Rhodesias, where the results were left to stand for themselves as evident demonstration of

the effects of different factors in erosion. It was left to the planner to read, interpret and incorporate the research results into development proposals - actions rarely done.

A further development is the major increase in networks, and the linking of researchers to inform, disseminate results, channel funds and provide encouragement to small groups who might otherwise feel somewhat isolated. The size, complexity and degree of control exercised by networks varies greatly, but examples include:

- ◆ **FTPP (Forests, Trees and People Programme) Network** - in November 1991 it had more than 2,000 researchers throughout the world, a significant proportion of which are in Africa. It links with a Newsletter and exchange of publications. It has also expedited funding for several projects.
- ◆ **ODI Social Forestry Network**; 1500 members in 109 countries, with 70 percent resident in developing countries, many in Africa. Publishes a Newsletter and regular "network papers". [ODI also coordinates other networks]
- ◆ **AFRENA (Agroforestry Research Networks for Africa)**, based at ICRAF, Nairobi, it supports agro-ecological zone groupings of in-country scientists through workshops, publications, training and access to funding. The current AFRENA networks are: Unimodal Upland Plateau of Southern Africa; Bimodal Highlands of E. & C. Africa; Humid Lowlands of W.Africa; Semi-arid Lowlands of W.Africa. Publishes Agroforestry Today.
- ◆ **Erosion-productivity Research Network**, funded by FAO, SIDA and national governments, is based around a standardised research design to quantify the link between land degradation and crop yields. Research plots in Ethiopia (2), Tanzania, Botswana, Lesotho, Mozambique and Kenya.

In line with these major changes in how research is organised, there has also been a shift in technical emphasis, away from exclusively physical processes, towards what has been called the land husbandry approach (Shaxson et al, 1977; 1989). This is a research perspective based upon strategies for increased production through better management of natural resources. The technical emphasis is very much on the role of vegetation as the provider of organic

matter for soil improvement and the canopy interception of rainfall. This is much the same as "conservation tillage" (Mannering & Fenster, 1983), which has largely revolutionised the approach to conservation on commercial land in North America. The main factor in land husbandry approaches is the socio-economic emphasis on the design of measures which will be acceptable to land users. Shaxson (1988) has gone further to call it "conservation-by-stealth", meaning the achievement of conservation objectives by targeting production increases and farmer benefits. This is a case where implementation of land rehabilitation is in advance of research. Such an indirect approach to conservation has much to commend it, but it is not yet specifically a major focus of research. This will surely change.

A further marked change is the recognition and valuing of "indigenous technical knowledge" in soil conservation and land management. Although this is a belated revival of research in some African colonies in the 1920s to 40s (e.g. Tanganyika: Rounce, 1949), the number of studies of the effectiveness of local practices in adapting to ecological changes has increased dramatically (see Richards, 1985, with regard to shifting cultivation in West Africa; and the review of sub-Saharan Africa in CDCS, 1986). Research is also being done on environmental perceptions of local people, acknowledging that land users often have a very clear idea of what is happening to their environment. Western & Dunne's (1979) study of Maasai pastoralists identifies a well-developed and acutely sensitive decision-making rationale in range management. Similarly, Showers and Malahleha (see Appendix D), working in Lesotho, have uncovered very definite attitudes and perceptions towards the environment which has conditioned local people not to accept imposed conservation practices.

Such fundamental changes in the content, direction and organisation of research are likely to stay with us for the next decade. What are likely to be the main directions of research? The final section is again a personal one: the issues and themes this writer feels are important for research in land degradation and rehabilitation to pick up.

##### 5. The Prospect: Major Issues for the Next Decade

This section is built around the statements in FAO's Framework for Action, a plan put to United Nations member governments in 1990 to combat the grave threat of land degradation in Africa (FAO, 1990). It was based on the analysis in African Agriculture: the next 25 years (FAO, 1986). I have added my comments on how research could help to meet the objectives in the Framework.

The Framework is ostensibly designed to "outline some of the steps that must be taken to put land conservation on a sound national footing" (FAO, 1990, p.21). It therefore tends to concentrate on what African governments can do to fight land degradation, in close cooperation with NGOs, development agencies and donors.

## A. NATIONAL LEVEL

### Improving Land Use

1. *Evaluating land resources*: there is still obviously a need for information on land resources. But that information must be specific and not attempt to recreate the Land Resource Surveys, common through the 1960s and 1970s, which collected large volumes of data with little apparent use in mind. Research topics include:

- rapid (and farmer-participatory) rural appraisal;
- integration of social, economic and technical data;
- development of land resource models, useful to further analysis and decision-making: e.g. Cost-Benefit approaches, Productivity models, Soil Life.

2. *Identifying the causes of misuse*: the question "how do land users degrade their land?" has given way to "why?" Causes may be identified, ranging from farmer-specific reasons such as poor practices to macro-economic influences such as crop pricing. The critical research need here is:

- the development of explanatory models;
- the development of analytical tools for such issues as gender, land tenure, economic disincentives, preference effects, professional and local bias.

3. *Implementing the improvements*: this involves a wide range of trials, from experiments on new technologies (e.g. *Vetiveria zizanoides*) to land tenure considerations and on to indirect strategies such as the diversification of rural incomes. In this sub-category a large number of issues suggest themselves for research, including:

- low-cost intervention packages;
- many, small interventions, or a few, large ones?
- appropriate monitoring and evaluation systems;
- design of flexible responses to changing needs and realisations;
- attention to soil moisture, not soil loss;
- emphasis on plant production and yield;
- risk minimisation.

### Encouraging Participation

1. *Developing short-term benefits:* research needs to look at the way short-term needs expressed by land users can be attached to longer-term sustainability issues. There may be contradictions between the two objectives.

Research may include:

- OFCOR - On-Farm Client-Oriented Research (Biggs, 1989);
- mutually compatible on-station and on-farm trials;
- emphasis on production benefits of conservation.

2. *Technical advice and training:* research in skills training, education, development of appropriate techniques still need advancement. Recent manuals on techniques include: design of physical soil conservation structures for Ethiopian climatic zones (CFSCDD, 1986); water harvesting for plant production (Critchley & Siebert, 1991). More are indicated for local use, and they will need good research and monitoring back-up.

### Developing national institutions

1. *The advisory commission:* FAO cite the Permanent Presidential Commission on Soil Conservation and Afforestation in Kenya, established in 1981. Research in public awareness, education programmes, institutional cooperation is indicated.

2. *Strengthening government services:* in most African countries, the research institutions are woefully inadequate for the diversity of problems and range of skills needed. Research capacity within Africa needs strengthening, and the particular challenge of training for cross-disciplinary analyses needs to be addressed. Research could look at:

- analyses of training requirements for strategists and decision-makers;
- good models for the provision of government services in conservation, social and agro-forestry, rangeland etc.

3. *The work of NGOs:* with the number of projects increasing and their scale diminishing, local and national NGOs are becoming more important in implementation. Research needs include:

- how to build a research, monitoring and learning capability within NGOs;
- developing links with government departments.

4. *Developing conservation programmes:* research needs to focus on the development of conservation strategies, rather than on techniques. How can programmes be more exactly tailored to local community needs? And in

collaboration with the community? There have been several implementation efforts (e.g. Lesotho Village Land Use Plans) but little research on alternative models and analysis of existing experience.

## B. REGIONAL LEVEL

### Catalysing Regional Programmes

1. *Training for conservation*: research in training needs and opportunities is vital at all levels: postgraduate research, Masters level, degree programmes, in-service training, refresher courses, research-extension training links, field worker training, farmer training.

2. *Research on land degradation* (at regional level): most African countries do not have the resources for multi-disciplinary research institutes addressing land degradation. Because many past mistakes derive from unsuitable transfer of technology, the research capability regionally and cooperatively needs to be strengthened.

## C. INTERNATIONAL LEVEL

### Coordinating International Action

Most of the research on land degradation and rehabilitation in Africa has been done by non-Africans and non-residents. The balance is slowly being redressed, but access to resources, training and materials for African researchers still militates against faster progress. International action is still required. An analysis of the role of CGIAR (agricultural research) institutions, four of whom are especially active in Africa (ICARDA, ICRISAT, ICRAF, ILCA), is long overdue. Research methodologies need to be reappraised, particularly in the light of new trends in farming systems research and on-farm research.

The FAO Framework is clearly designed to foster greater activity in conservation and rehabilitation in Africa, and, naturally, it is keen to involve the international community. Other agendas worth reading and comparing are included in IUCN (1989) and Reij (1989). These last two focus on the most intractable and difficult parts of Africa: the drylands. Research is crucial here,



but it is by no means certain that answers can be achieved. The higher potential areas also require research to maintain levels of productivity in the face of increasing populations. Indeed, it has been argued that it is more urgent to keep existing good areas productive than to try to rehabilitate degraded lands. The reasoning is that degraded lands take huge resources and great lengths of time to come back into production, whereas present good land can easily lose its productive capability with disastrous declines in yield. Of course, this ignores the social and political needs of dry, degraded areas: do we sacrifice the poor to concentrate on the rich? I think not. And research in the next decade will, I am sure, continue to reflect the diversity of approaches, opinions and techniques that have characterised research in the 1980s - only more so.

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**Appendix I: Themes and issues on land degradation and rehabilitation research in Africa as demonstrated by projects supported by the Project on African Agriculture, Social Science Research Council, New York. Work by in-country researchers only.**

Only those themes and issues which show change in emphasis between pre-1980 and post-1990 are highlighted.

Author(s)/Date	Country	Title	Themes and Issues
EDOH, E.C., OBIASI, I.N. & UGURU, M.I. 1990	Nigeria	Land Use Pressure and Sustainable Agriculture: A Multidisciplinary Framework of Analysis	Argues that sustainability of agriculture is predicated on agricultural methods to raise yields and conserve soils.
FARAH, K.O. & HAJI, A.J. 1990	Kenya	African Pastoral Nomadism in Transition: the Case of N.R. Kenya.	Emphasises the rationality and adaptiveness of pastoral nomads to changing environmental circumstances. The study concludes that there is a need to recreate traditional authority structures for grazing control and allocation of water resources.
KASANGA, J.K. 1990	Ghana	Agricultural Land Administration and social differentiation	Presents a theoretical model of integrated land management, with emphasis on institutional and legal provisions. Argues that failure in the appropriateness of such provisions is a prime cause of failure in modernising agriculture, and, implicitly, in protecting the soil resource.
MUSTAPHA, A.K. 1990	Nigeria	Social Stratification, Land Use Changes, and Micro-Ecology in Rural Kano, 1948-90	Examines a range of political, social and economic factors and their relation to spreading deserts, environmental perception and sustainability. Speculates on the effects of structural adjustment of Nigerian economy on local society.
NSAHIMANA, TITARCISSE 1990	Burundi	Marshland Cultivation and Water Management in Burundi	Emphasises the delicacy and sensitivity of landscape components the wetlands - to exploitation. Blanket bans on their use, as in the colonial era, are no longer enforceable. Example of focussed study on specific problem of resource management.
OKAFOR, F.C. 1990	Nigeria	Population Pressure, Agricultural Change and Environmental Consequences in Southeastern Nigeria	This study takes an interesting dynamic perspective on the inter-relationships between land use and population factors and environmental change. From the stance of a standard survey of physical problems such as gullying (typical of pre-1980's survey), he uses participatory observation to examine labour issues, from which he concludes that the agricultural environment is dynamic. Agricultural change is then viewed, in turn, in its consequences on the environment. Good example of cross-sectoral studies now being pursued by African scientists.
OLOKESUN, A., ADEYEYE, V. & GBADGESIN, A. 1990	Nigeria	The Appropriateness and Impact of River Bank Erosion Control Strategies on Agriculture in Rivers State.	Mid-term report. Intention is to assess the socio-economic impact of a technical set of measures for river bank erosion control.
SHOWERS, K.B. & MALAHLEHA, G.M. 1990	Lesotho	Pilot Study for the Development of Methodology to be Used for an Historical Environmental Impact Assessment of Colonial Soil Conservation Schemes in Lesotho, Southern Africa	Using oral histories, this is a fascinating account of local people's experiences during the colonial era with introduced methods of soil conservation. Adds emphasis to unwise transfer technology and the erroneous assumption that local farmers cannot see what is going on in their own fields. A clear example of change in emphasis in research towards social analysis of the effect of technical interventions.

(continued)

[Appendix I: continued]

Author(s)/Date	Country	Title	Themes and Issues
TUKAHIIRWA, J. 1990	Uganda	Factors Associated with Rural Small-scale Farmers' Adoption of Soil Conservation Practices in a Tropical Mountain Ecosystem, Uganda	A mid-term report only. Approaches adopted: soil loss estimation model, adapted to make it more deterministic; a resource-access model to analyse the links between agrarian political economy and physical environment; rapid rural appraisal, a short cut survey approach. An example of multi-factor research.
UZOIGWE, J. 1990	Nigeria	Analysing Change in Productive Relations in African Agrarian Systems - A Literature Review	This brief analysis brings out several key themes important in today's research on land degradation: the issue of labour, especially gender divisions and access to labour; access to land; need to study interrelations (empirical research) before propounding theories. This is very much the anthropological perspective, but valuable in that it analyses root causes of land degradation.



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