Implementation of the Plan of Action to Combat Desertification

Progress since UNCOD

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This article makes a detailed examination of progress in implementation of the Plan of Action to Combat Desertification (PACD) since its inception in 1977. It reveals many shortcomings in implementation of the PACD and points out that the rate of desertification is increasing in most parts of the developing world. While the technology to stop desertification is there, the missing ingredient where desertification continues is political will – and the consequent resource allocations. Where governments have shown strong political will to stop desertification, as in the USSR and China, significant successes have been registered.

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The political initiatives that led to the convening of the United Nations Conference on Desertification (UNCOD) in Nairobi, 1977 were initially a response to social and economic crises in the Sahelian countries following several years of severe drought in the southern borderlands of the Sahara. However, the global perspectives of the conference and the worldwide evidence of the reviews, case studies and country reports presented at UNCOD revealed the existence of general and longer-term land degradation which threatened all the world's drylands. This degradation was held to be causally linked with the critical manifestations of poverty and famine and the breakdown of entire systems of livelihood in the more vulnerable countries of the developing world.

This degradation, described as 'desertification', was defined as 'the diminution or destruction of the biological potential of the land', reducing its capacity for plant and animal production and amounting to an extension or intensification of desert-like conditions.[1] Its more visible expressions include the destruction of forest and woodland, the devegetation and mobilization of formerly stable dunes and sand sheets, accelerated soil erosion by gullying, sheet erosion and deflation in croplands, and the waterlogging and salinization of once-productive irrigated lands. However, over large areas desertification advances in a less obvious but insidious fashion through loss of fertility and structure in agricultural soils and the impoverishment of natural pastures. The patterns of its advance left little doubt that the primary causes of desertification lay in human pressure on natural resources and in man's mismanagement of the land, rather than in secular climate change, although the stress of drought had undoubtedly aggravated problems of regional resource management and had triggered or accelerated the processes of degradation.

Studies of desertification prepared for UNCOD focused on the arid and semi-arid zones and on areas of irrigated agriculture in otherwise little-settled, extreme-arid zones, covering a total of 40 million km^2 or

[1]United Nations, *United Nations Conference on Desertification: Round-up, Plan of Action and Resolutions*, United Nations, New York, NY, USA, 1978.

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one-third of the earth's land surface, with a population of more than 600 million. Three-quarters of this area was threatened and in large part already affected by desertification, whilst almost 20% was regarded as severely desertified, putting at serious risk the livelihoods of about 50 million people in less-advantaged areas.[2] It was claimed that the world's 9 million km^2 of man-made desert was being enlarged each year by the loss of almost 6 million ha of productive rangeland, rainfed cropland and irrigated land through desertification, representing an annual capital loss of almost US $13 billion in 1975 values.

The evidence was that desertification had generally progressed most rapidly in developing countries, where its social and economic impacts had also been most severe. This drew attention to the social, economic and political factors in desertification, commonly acting to increase local pressure on land resources and to restrict the options for improved land use and rehabilitation. They include: lack of alternative sources of livelihood; the vicious cycle of poverty contributing to land degradation and so to further increase in poverty; and the social, economic and technical deprivation among the worst-affected communities, which stood in the way of improvement. All too often the dryland sectors within countries and the dryland countries within regions tended to be the marginal areas – geographically, economically and in terms of political influence and claims on investment. Accordingly, programmes to combat desertification would need to address not only its ecological manifestations but also the economic and social ills contributing to the mismanagement of dryland resources.

In many cases, factors of this type contributing to desertification had originated outside the areas directly affected: for instance, national pricing, taxation and investment policies determined outside the drylands within the country concerned, or terms of trade fixed at the international level. Equally, the consequences of desertification – whether environmental, biological or human – were seen to be similarly widely shared.

Objectives and principles of the UN Plan of Action

The Plan of Action to Combat Desertification (PACD) formulated by UNCOD and subsequently endorsed by the UN General Assembly[3] attempted to address the dimensions, complexity and urgency of what was recognized as a global problem through cooperative national, regional and international actions.

Three related and progressively encompassing objectives are identified in its recommendations: to arrest and reverse the environmental processes of desertification; to establish ecologically appropriate, productive and sustainable land uses; and to secure the social and economic advancement of the communities affected. Stress was placed on the integration of measures to reconcile these several aims. The Plan recognized that actions would mainly be undertaken through national programmes based on local priorities and capabilities, hopefully as part of wider plans for economic development and social progress, but it also stressed the need for supportive regional and international actions, partly because desertification processes do not stop at national boundaries, and particularly because of the need for technical and financial assistance, in view of the limited resources of many of the worst-affected nations.

[2]UNCOD Secretariat, *Desertification: Its Causes and Consequences*, Pergamon, Oxford, UK, 1977.
[3]UN, *op cit*, Ref 1.

The technical knowledge for the immediate implementation of the Plan already existed, although it might need to be adapted to differing circumstances; the problem was rather the strengthening of technological resources in developing countries affected by desertification. The Plan set the year 2000 for the attainment of its goal of overcoming the threat of desertification, but identified some measures for priority action, notably the establishment of national coordinating machineries, monitoring the nature, extent, severity and trends of desertification, and formulating plans to combat it.

The extent to which man was the prime agent of desertification was in effect a measure of his capability to combat the problem, and the corrective measures called for under the Plan were grouped under the main forms of land use: rangelands, rainfed cropping and irrigated lands, or in relation to the rehabilitation and conservational management of water and vegetation resources, including forest and woodland.

An overview of the desertification problem prepared by the Secretariat of the Conference[4] put the costs of salvaging the 6 million ha of productive lands estimated as becoming significantly more desertified each year at US $400 million (1977 values), and the total gains from reclamation at US $1300 million, claiming net financial benefits of around US $900 million, apart from wider-ranging social benefits. A later study commissioned for the UN General Assembly in 1980 estimated that the implementation of the PACD called for an expenditure of US $4.5 billion a year over a period of 20 years and that the developing countries would need assistance at the level of US $2.4 billion annually for this to be possible.

General assessment of progress

Responsibility for following up and coordinating the PACD was placed with the United Nations Environment Programme (UNEP), including the requirement under the Plan for an assessment of progress in its implementation seven years after its inception. Acccordingly, the Executive Director of UNEP reported on a General Assessment of Progress (GAP) to the Twelfth Session of his Governing Council in May 1984. His report contained three related components: a global summary of the status and trends of desertification; an assessment of progress in implementing the recommendations of the PACD; and an evaluation of the institutional and financial arrangements for that purpose. That report, together with the background studies upon which it was based, is the main source of the present document.

Establishing the machinery

Progress in setting up the machinery, monitoring desertification and drawing up national plans – areas which were emphasized among initial actions called for under the Plan – has generally been disappointing. The PACD had stressed the need for a national body to coordinate actions to control desertification, which should be placed at a high level in the central government. Instead, governments have tended to vest this responsibility either in an existing department with sectoral responsibilities relevant to desertification, such as forestry or soil conservation, or as one of the several concerns of newer organizations set up to deal with environmental management or natural resource

[4]UNCOD, *op cit*, Ref 2.

planning. In some countries this may reflect the shortage of professional skills; in others there are constitutional problems, as in Australia where resource management rests with provincial or state authorities rather than with the central government. It may unfortunately also indicate a low national political priority accorded to combating desertification. Whatever the reason, such arrangements have undoubtedly stood in the way of securing the high-priority, across the board response asked for under the PACD.

The GAP revealed, and was hampered by, a lack of information at country level concerning the extent and nature of desertification, as well as on progress in combating it, which reflected general shortcomings in its assessment and monitoring. Apart from the inadequate institutional arrangements referred to, several factors appear to have contributed to this.

One factor is technological – the lack of the equipment or expertise for surveillance of desertification. Whilst important locally, this can by no means account for the general failure in assessment, since many of the developing countries affected by desertification – including some of the least developed economies – now have receiving stations for satellite scanning imagery or have access to the output, own the equipment for image-analysis and have staff trained to use it. (This is an area of considerable interest for national defence and mapping, and one in which there has been a great deal of international cooperation.)

A second problem is methodological, in particular the continuing absence of standard and easily applied procedures for broad-scale assessment of many aspects of desertification. Whilst the situation is satisfactory in some areas, for example in surveying the *extent* of forests and woodland, the *degradation* of these resources is less readily monitored. There have been significant advances in rangeland assessment using band-ratio techniques, but these still generally remain at the investigation stage and have yet to be harnessed for systematic inventories. The largest problems remain in assessment of the status of rainfed croplands, particularly in those significant stages of soil degeneration which precede the more visible processes of accelerated erosion.

Lack of a central coordinating authority to deal with desertification has undoubtedly also contributed to the lack of integrated national programmes to combat it. It was an awareness of the many-faceted nature of desertification that led to the emphasis in the PACD on the need for this machinery; its absence has meant that focus on desertification control has been lost, and actions have remained uncoordinated and dispersed and to that extent less effective.

Corrective anti-desertification measures

Consistent with the PACD definition of desertification in terms of ecological degradation, and the emphasis placed on man's misuse of land resources as its primary cause, field measures to combat its degradational processes in the framework of various forms of land use and resource management rank first among the executive recommendations in the PACD. Since they concern the most visible manifestations of desertification, they constitute sensitive criteria of progress and are accordingly dealt with in some detail.

Management of water resources

Consistent with the Mar del Plata Action Plan of the UN Water Conference held earlier in 1977, the PACD calls for 'efficient, socially, economically and environmentally sound planning, development and management of water resources' as part of measures to combat desertification. This aspect of desertification control has received widespread attention in most countries, since the view of water as an essential but finite resource is well-entrenched in dryland communities. Most such countries have central or provincial bodies responsible for water resources, and in many the harnessing of these resources in an integral part of national development plans.

Progress under this recommendation has commonly taken one of three forms: extension of irrigation, particularly through damming and diversion of rivers and in some areas by tapping additional reserves of groundwater; improvement of community water supplies; and provision of additional watering points in rangelands, commonly from water bores.

Integrated development based on irrigation has been the key to continuing success in desertification control on piedmont steppes in the Central Asian Republics of the USSR; in Turkmenistan the Karakum Canal has been further extended, whilst in Uzbekistan experience in reclaiming the Golodnaya Steppe is now being mobilized in the Karshi and Djizak Steppes. The effective harnessing of mountain rivers has also supported the rehabilitation of irrigated oases as a main feature of the outstanding anti-desertification achievements in western China.

In some other areas, however, extension of irrigation has brought further environmental and socioeconomic problems. In Nigeria, for example, the introduction of large projects in areas of established rainfed cropping has caused disruption of the traditional farming systems without bringing compensatory benefits to the displaced peasant farmers.

Improved efficiency in water use, stressed in the PACD, is an important feature of many projects for controlling waterlogging and salinity in irrigated lands, but the changes so far effected have been mainly in the engineering domain. Improvements at the farm level have commonly been opposed by traditional systems of water rights or by water-pricing policies, lack of money or credit, inadequate extension services and farmer education, and by failure to provide incentives for better water use. Comparable problems have been met in areas of rainfed cropping, despite considerable advances at the research station level in water harvesting, methods of planting and tillage and in the use of mulches and barriers to reduce water loss from the soil. In many rangelands the provision of additional permanent stock waters has not been supported by appropriate livestock and pasture management, thus contributing to rather than alleviating the risk of desertification.

Weather forecasting and hydrological monitoring in support of surface water management have been improved in many countries, often with international support as in the Sahelian region. In contrast, there has been a general failure to develop and manage groundwater reserves on a conservational basis with due regard to recharge and transmission; overpumping and uncontrolled sinking of wells have gone on as before, water tables have continued to fall and supplies to diminish, with the attendant risks of salinization in dependent irrigation areas, and of salt-water incursion in coastal tracts. With few exceptions,

projects have concentrated on the discovery of new reserves and the establishment of additional wells, but groundwater exploration has rarely been accompanied by determinations of safe yield. In the absence of controls, competition between agricultural and urban users for scarce groundwater resources has increased the risk of desertification in many closer-settled arid areas.

The consequences of desertification can be widely transmitted through the hydrological cycle, whether by siltation, flooding, salinization or deterioration in quality of irrigation or drinking water. For this reason, water management is often the key to many aspects of desertification control. This has been exemplified in Bangladesh which was faced with a complex of water-related problems linked with salt-water incursion in its south-western areas. Bangladesh has addressed them through a master plan for the development of its regional water resources, taking account of ecological and environmental aspects although placing immediate emphasis on increasing agricultural production. The first phase has now been carried through. Control of groundwater regimes and flooding has restricted the incursion of saline waters and has allowed significant extension of irrigation and improvements in navigation and fisheries.

In some cases, as with the Ganges and Colorado Rivers, hydrological problems extend across national frontiers and their solution calls for international cooperation, as may also be desirable in the management of large groundwater basins. Several problems of this type recognized at UNCOD remain outstanding.

Reclamation of desertified rangelands

There has been little progress in combating this type of desertification, which the Nairobi Conference identified as the most extensive form, affecting most of the arid lands as well as those semi-arid and sub-humid areas where cropping is impracticable. These are mainly areas of low productivity, often restricted to seasonal usage, while all are subject to periodic drought. Intensive reclamation methods such as seeding, replanting or soil treatments have limited application, while the natural rehabilitation of pastures under controlled grazing is commonly very slow and dependent on rainfall. Some arid rangelands degraded many decades ago have shown negligible recovery where left unprotected, while – at present costs – fencing for range management is impracticable.

Range improvements have been achieved in some environmentally favoured, commercial rangelands, as in the montane states of the southern USA where progress in sagebrush control and pasture improvement is reported. The main successes, however, have been through large-scale government intervention, eg in the central Asian sand deserts of the USSR, assisted by rational development of groundwater and aerial reseeding, and in semi-arid sandy areas in China through labour-intensive methods, including planting and reseeding. Otherwise the main emphasis has been on animal improvement, as shown by a review of international aid projects made for the GAP.

In the traditional – commonly nomadic or transhumant – systems of pastoralism, desertification has generally continued to advance. Customary practices and safeguards which may in the past have maintained an ecological balance are proving increasingly inadequate to cope with new pressures, particularly from increasing livestock numbers in

response to population growth, and an increasing demand for meat, particularly from growing urban markets. The settling of nomads, and permanent borehole waters provided to assist it, have also increased local grazing pressure on the rangelands, as have political restrictions on the seasonal movements of animals and herders. There have been some successes in the past decade, for example the *hema* range management, forage cropping and sheep fattening schemes in Syria, but these represent only a minor impact at the regional scale of the problem. Generally the traditional rangelands have remained neglected by governments, with investment going to more productive sectors.

The situation is perhaps most critical in Southern Africa, South Asia and Andean Latin America on pastures used by closely-settled, mixed-farming people. These are mainly sub-humid areas with intense summer rainfall, in which the rangelands commonly occupy the watersheds and are liable to severe erosion. Accelerating desertification of these rangelands, exacerbated by further droughts since UNCOD, is linked with a continuing rise in livestock numbers related to growth of rural populations, difficulties of management of communal range, and loss of pastures through extension of cropping in circumstances of acute land hunger. The risk of very severe desertification is probably greater here than in the sparsely settled more arid rangelands, but these areas have attracted even less attention.

Soil and water conservation in areas of rainfed cropping

The rainfed croplands, which provide subsistence for more than 250 million people in the semi-arid and sub-humid zones, must count as the type of land use worst threatened by desertification in terms of its potential human impact, but in those developing countries most affected little has been done to arrest the process. The high levels of out-migration from these communities reflect the low returns from farming, both a cause and consequence of the degraded state of the land, further disadvantaged through national cheap-food policies in face of rising costs of inputs.

There have been considerable technical advances in methods of planting and tillage to conserve water, as well as in cropping systems to enrich and stabilize the soil – eg in India by the Central Arid Zone Research Institute (CAZRI), and by a number of agencies in the Sahelian countries – but these have generally not been adopted by farmers, in part because of resistance to change but also because of lack of incentives in the face of obstacles such as unsatisfactory conditions of land tenure, shortage or unreliable supply of inputs and inadequate credit facilities and support services.

In the Mediterranean lands of West Asia and North Africa and the dry monsoonal areas of South Asia, where traditional crop–fallow systems have been pushed to the climatic limits of cultivation, yields remain unsatisfactory on soils low in nutrients and with little organic matter, and a vicious cycle of poverty and further desertification continues. Rising food requirements have been met by extension of cropping on marginal lands rather than through agricultural improvements. In Western Asia and the Mediterranean areas this has been assisted by an increased use of tractors and heavy farm machinery which has contributed to increased soil erosion. The mixed farming and arboriculture stressed in the PACD have made some headway as commercial enterprises by the wealthier farmers on the better lands, as

in southern Tunisia, but otherwise there have been few improvements since 1977.

In tropical summer-rainfall areas there has been a dearth of desertification-control projects, as shown by a recent African survey.[5] The situation is most acute where farming populations are concentrated in uplands, as in much of Southern and East Africa and in Latin America. The climate and soils make these lands particularly vulnerable to erosion, together with demographic and socioeconomic conditions which could well make these the crisis areas of the future.

Some progress has been made in areas of higher rainfall through the introduction of alley cropping and other forms of agroforestry, eg in Kenya, Sri Lanka and north-eastern Thailand where governments are involved in land reclamation projects in partnership with donor countries and agencies. Future success will depend on the extent to which such land developments can cope with rapidly growing, still largely agricultural populations, and provide the infrastructure and market incentives for farmers.

The temperate areas of commercial grain farming in the USA and Australia experienced severe wind erosion and sand drifting in the 1930s, bringing a first realization that these land resources were finite and destructible. Soil conservation activities were inaugurated then and, assisted by better weather, economic recovery and some restructuring of agriculture, the situation was considered to have been stabilized. This complacency was shaken in the drought years of the 1970s and 1980s, when major dust storms carried to political centres downwind. Recognition of the harmful effects of exploitive commercial monocropping with heavy machinery and repeated clean tillage in crop–fallow systems is now growing and the public costs of desertification are beginning to be counted; in Australia at least, the view that soil must be treated as a non-renewable resource is also gaining ground. Effecting change in heavily capitalized, market oriented, private-enterprise freehold systems currently under a cost-price squeeze in highly competitive export markets is not easy, however. The main gains since 1977 have been in the wider recognition of the problem by the public at large, if not on the farm. Fortunately, desertification status is still generally moderate compared with that in the drylands of the developing world. Complacency is perhaps the main danger.

A relatively new and growing problem has arisen in these extensive croplands in the form of dryland salting, where clearing of perennial native vegetation for annual crops has reduced evapotranspiration, allowing a rise in saline watertables. The areas affected are not large, but include valuable footslopes and valley flats whilst, as in Western Australia, salinization may extend to streamflows, threatening urban and irrigation supplies. Measures to restrict clearing of watersheds, combined with revegetation, are already in place in several Australian states.

Combating waterlogging and salinization in irrigated lands

Here desertification threatens maximum losses in production and investment, and the number of livelihoods placed at risk is exceeded only in the rainfed croplands. In countries such as Egypt, Pakistan and Iraq where irrigation dominates agricultural production, the economy as a whole may be threatened by waterlogging and salinization.

Generally, in modern irrigation systems the dimensions of the

[5]UNEP, *Desertification Control in Africa: Actions and Directory of Institutions, Vol 1 Actions*, UNEP, Nairobi, 1985.

problems are known and the solutions understood, at least in engineering terms. In Pakistan, for example, salinity control and reclamation projects were begun in 1958 and accelerated in a major programme with World Bank support in 1973. Case studies of successes in such projects were presented to the Nairobi Conference by China, Iraq, Pakistan and USSR. A decade after the inauguration of the PACD, however, the proportion of irrigated lands affected by water-logging or salinization is still around 30%, with perhaps 20% at least moderately desertified and incurring significant losses in production. This is despite considerable successes in Asiatic USSR and China and the achievements in Pakistan and elsewhere.

Causes of the continuing problems include faulty design aspects, such as unlined distribution canals and inadequate land drainage (often an attempt to reduce costs in the initial development phase of a scheme); poor quality irrigation water; extension of irrigation on unsuitable terrain and soils; and poor water management at the application stage, including over-irrigation due to bad scheduling or unskilled farming, or conversely, incomplete soil leaching where irrigation is inadequate. Even where the engineering remedies are straightforward, the work required is often costly, involving major government commitments; but in fact they are rarely straightforward, for example the disposal of saline groundwater can involve conflicts of interest, even on an international scale. Where water storages have diminished through siltation, large-scale watershed rehabilitation may be required, again possibly extending beyond the national territory.

Remedies at the farm end may call for long-term programmes in farmer education, development of infrastructure, and above all the provision of economic incentives through marketing policies. The social and economic problems are generally even more complex and demanding than the engineering ones.

In some cases, lack of progress with this recommendation has resulted less from technological shortcomings *per se* than from an inability to muster the necessary large-scale engineering forces, as employed for example in successful projects in the USSR. In the developing countries particularly, changes in established farming methods are unlikely to be effected rapidly. In developed countries such as Australia and the USA, the environmental problems of irrigated farming are linked with highly contentious issues concerning wider environmental impacts or the extent of governmental support, bringing them into the political arena.

The position is even less satisfactory where irrigation is dependent on groundwater, which has traditionally been developed without regard to natural limitations set by aquifer storage, transmissivity and recharge. Falling watertables, rising pumping costs and decline in water yield and quality have been commonplace in the absence of restrictions on the exploitation of reserves. The PACD has brought little change in attitudes; emphasis in project investment has been on the discovery of additional resources rather than on the conservational management of those already in use. Salinization continues on oasis perimeters, which tend to be most vulnerable to lowered watertables, and in the lowermost parts of irrigated depressions where the consequences of excessive irrigation are compounded by natural difficulties in the disposal of saline drainage waters. Incursion of sea water is an on-going problem in overexploited coastal aquifers. Where groundwater has been mined rather than used as a finite renewable resource, conflicts between uses

and users have inevitably arisen, as between urban or industrial consumption and farm use in the south-western USA, with prospects of further desertification where cropland has to be abandoned.

The Plan of Action stressed the potential for irrigation developments to control desertification and increase productivity in the drylands, but experience since Nairobi shows that it is not an automatic sovereign remedy. The finding of the GAP was that, for the next two decades, slight overall gains could be expected at best, with sucesses in some areas being largely offset by losses elsewhere. At this rate, and given the many problems raised by the introduction of large schemes in developing countries, irrigation developments will not make their hoped-for major contribution to desertification control.

Restoring and maintaining vegetation cover

Some conspicuous successes have been recorded in this area, notably in dune stabilization and in reafforestation, both in technology development and in field projects. Monitoring the destruction of tree cover is a relatively straightforward application of remote sensing and the dimensions of this aspect of desertification are better known than most others, although the extent and degree of the large area of *degradation* of forest and woodland are less certain. Government involvement in forest management is widespread and of long standing, and the institutional and technological bases for combative actions commonly exist. Tree planting has an immediate visible impact that has assisted its adoption into popular programmes; it can be effective in informal, village-scale projects, where it meets perceived needs, particularly for fuelwood; and it improves the environment.

The GAP showed afforestation projects to be by far the most common among activities by donor countries and international aid agencies in support of the PACD, with a particularly important share taken by NGOs. With help from UNESCO and FAO, there have been significant gains in the knowledge and use of tree species suited to dry areas, and in agroforestry and silvipastoralism. Indeed, a view that combating desertification is merely reafforestation under a new name has become so widespread in some quarters that it may unfortunately mask the complexity of the problem and its causes.

These many projects have had varying success. For example, an analysis of USAID afforestation projects in West Africa showed that many of the larger government schemes had not been effective, largely because of administrative costs and poor management. In strong contrast, the smaller projects conducted by NGOs with community involvement had proved successful on both counts, and in meeting shortages of fuelwood and forage, thus generating additional income and improving the living environment. Similar successes are reported from northern India. On the other hand, China has an impressive record of government-sponsored afforestation in a wide range of environments and involving the local community in various ways.

Nevertheless, in large areas of the drylands, and especially in the non-oil-producing countries, forests and woodland have continued to diminish in the last decade, mainly in face of the demand for fuelwood. The situation is at its worst in those semi-arid areas where growing urban populations have accelerated the demand but where regrowth is nevertheless limited by low rainfall and human pressure on the land; eg on the savanna border of the Sahel, where depredation of woodland is

occurring over ever-increasing supply areas about the towns, far outstripping any benefits from new plantings. Agricultural clearing, firing and browsing by livestock also continue to aggravate the problem. The situation in such areas calls for large-scale government intervention but most efforts at that scale have been disappointing; eg the projected establishment of green belts to the north and south of the Sahara failed as transnational enterprises under the PACD, although individual national successes – as in Libya – have shown what can be done, given the political will.

The problem is also being attacked through reducing fuelwood consumption by using more fuel-efficient stoves. Here the efforts of NGOs in West Africa and India have met with local success. Other alternatives are biogas generators and solar heaters. Small biogas generators are being widely used in China, but costs and customs have impeded their adoption in India, where it had been hoped to replace the use of animal dung as fuel.

In higher rainfall areas in South and South-east Asia, it is a question of restoring the balance between forest exploitation and planting in the interests of environmental stability. Governments have taken steps to control commercial logging, and forest reserves have been established in most countries of the regions, but where – as in Indonesia – receipts from forestry are an essential part of national revenues, limitation faces difficulties. Deforestation has also arisen from clearing cultivation by upland farmers and from agricultural colonization from densely populated lowlands. Despitc counter measures – such as reafforestation, the resettlement of upland farmers and agroforestry projects – the rate of forest destruction in South and South-east Asia is still almost five times as great as the rate of afforestation. Nevertheless there have been substantial regional successes, notably in south-east China and the Republic of Korea, and a significant ingredient in these has been the enlistment of villagers, eg in small forest farms in China, in village forests in Nepal, and in agroforestry schemes involving partnership between farmers and forestry organizations as in Indonesia.

The revegetation and stabilization of sand dunes mobilized by desertification is another aspect of this recommendation where existing technology has been proved adequate in a number of successful projects. The Chinese have used shelter belts combined with revegetation or mulching on windward slopes to protect oasis perimeters from moving sands; bituminous mulches have assisted the planting and seeding of dunes in Iran, Libya and USSR; chequer-board planting of shrubs protected by planted grasses, mulches or palisades of dead shrubs has been successfully employed in many smaller Indian projects. The Chinese and USSR projects in particular have been supported by irrigation, and these and others have included the reshaping of dunes on aerodynamic principles, by heavy machinery and locally by the use of water jets or floodwaters. Aerial reseeding has also been carried out on dunefields in the USSR.

Such projects are straightforward to the extent that technological interventions are carried out at government cost under specialist direction in little-used areas of moving sand bordering settlements, oases and communications. The eventual test of success is whether the revegetated areas can be protected and eventually managed for grazing, forage or fuelwood production, particularly with the cooperation of local land users. This is a feature of the Chinese achievements.

The revegetation of watersheds, mentioned under this recommendation, is relevant to the entire group of corrective measures. Watershed degradation lies at the core of many forms of desertification because the consequences of devegetation and soil loss are transmitted widely through surface runoff. It is occurring under many forms of land use: in drier areas it is mainly linked with overgrazing, fuelwood collection and firing; in wetter regions also with exploitive upland cropping or logging. Emphasis in the PACD on an integrative approach to desertification control partly relates to the need to treat drainage catchments as wholes, and this has become increasingly accepted, at national and international levels. The numerous projects to stabilize watersheds now being undertaken in Nepal are of concern to Bangladesh and India, for example. Among regional bodies established to secure such integration is the Interim Committee for Coordination of Investigations of the Lower Mekong Basin based in Bangkok, with its own Environmental Unit.

Watershed management is an element of many projects for the improvement of upland agriculture in tropical sub-humid to semi-arid areas, as in north-east Thailand and similar drier parts of continental and insular South-east Asia; pressure for cropland and timber production, however, combined with high natural erosion rates constitutes a continuing threat and there is urgent need of wider action. In comparable areas in Latin America equally serious problems still remain to be addressed.

In the temperate drylands there has been a notable afforestation of watersheds in Mediterranean Europe where upland grazing has diminished or has been restricted, but the situation remains unsatisfactory in North Africa and in similar environments of Western and South Asia, to the detriment of water supplies and irrigation works in adjoining lowlands.

Conservation of plants and animals

This recommendation acknowledges the valuable genetic resources of the drylands and our obligation to conserve them. Many countries have responded through legislation to protect flora and fauna by establishing parks and reserves, and many are signatories to international conventions aimed at protecting endangered species and their habitats. Policing the reserves still presents problems however, for example poaching continues in many African game parks, and there is little report of progress in monitoring these habitats, as required under the PACD.

Combating social and economic dimensions of desertification

The PACD states 'the implementation of this Plan implies more than a campaign against desertification; it is an essential part of the broad process of development and the provision of basic human needs'. This is not merely a question of social justice as the end of human endeavour, but a recognition that desertification arises in large part from social and economic inequity, including poverty and the struggle for subsistence. The commitment under this section of the PACD is vast, for it embraces almost any measure to improve the human condition in the drylands and to provide the infrastructure for economic and social development.

Despite problems set by remoteness and by scattered, partly nomadic

populations, there has been considerable progress in the last decade in improving social welfare in developing countries in the drylands, for example in providing health and education services, village water supplies and improved housing. By far the larger part of aid spending in the drylands in the period under review has been on projects in this general category – perhaps, it has been suggested, to the detriment of progress with field measures to halt the physical and biological processes of desertification. But it is neither practicable nor meaningful to see the social and environmental aspects of desertification control as separate problems and alternative priorities. To the extent that excessive human pressure on land resources has arisen from poverty, ignorance or lack of the facilities to bring about change, environmental improvements independent of action in the social and economic sector can have only short-term prospects of success. This is also implicit in the emphasis given in the PACD on the need to integrate control measures.

The sheer magnitude of these tasks is such that progress can only be very slow, however, and in many parts of the Third World the problems have continued to grow in the last decade, for example those connected with growing migration from rural areas to the towns and the need for urban housing, and those associated with the resettlement of refugees, whether from drought-stricken areas or from the turbulence of civil strife.

Measures to reduce the risk and effects of droughts

A great deal has been learned in the past decade about the causes and patterns of drought, notably about global-scale controls such as oscillations in major atmospheric pressure systems and related changes in sea temperatures and oceanic circulation (eg relationships between the Southern Oscillation and the El Nino phenomenon or the South Asiatic monsoon). This has brought an understanding of the nature and impacts of climatic fluctuations with a periodicity of a century or so, which might for example explain an increase in drought risk in the tropical drylands from the 1960s onwards and which could in turn lead to more realistic estimates of the likelihood of severe drought in coming decades.

At the other end of the scale, the development of weather satellites has given improved weather forecasting for periods of a few days ahead, the benefits of which will accrue to the drylands as their sparse networks of meteorological stations are strengthened. In this respect improvements in the Sahelian countries under the AGROHYMRET project are noteworthy. However, prospects for seasonal forecasts from one to six months ahead are still remote, while rainfall enhancement through cloud seeding seems likely to remain of localized value only. Accordingly, measures to reduce drought impact in the PACD remain as relevant now as in 1977.

Most traditional dryland societies had evolved strategies to deal with drought, whether through methods of land use to minimize losses or though societal arrangements to spread their impact. Nevertheless, extreme drought has always brought severe suffering which is unacceptable by modern standards. Factors operating both within and outside these societies have now tended to make them even more economically vulnerable to drought. Although government and international relief and the establishment of food stores, assisted by improved communica-

tions and water supplies, may alleviate the level of human disaster, little has been done to strengthen the ability of farmers at risk to cope more effectively with future droughts. Some areas have been helped through the extension of irrigation, but there has been little progress in the introduction of water harvesting or improved methods of water use into rainfed cropping. Additional stock waters and improved roads have brought little-watered or inaccessible rangelands into use, but the maintenance of drought-forage reserves has proved difficult under communal range use, whilst minimal – if any – insurance against stock losses is available in traditional pastoral communities.

Commercial farming systems in the drylands of developed countries already enjoy considerable government support through drought insurance, subsidies in transporting stock or forage, price equalization schemes, and direct grants or low-interest loans where losses have been severe. The primary producer has grown to expect disaster relief during drought, but is generally less willing to cooperate in stabilization schemes which set aside part of the profits from better years or to accept the need for investment in restructuring operations to lessen the impact of drought.

Strengthening science and technology at national levels

The adequacy of national science and technology to serve desertification control programmes still varies greatly between countries, as does expertise in dealing with differing aspects of the problem. Most developed countries have the necessary infrastructure and trained staff; some large developing countries such as India and China have a network of research institutions but have still to satisfy their enormous requirement for lower professional and technical staff, particularly for extension work with farmers. Many of the poorer developing nations still lack institutional resources and trained staff at all levels.

This situation calls for international aid, and one-third of all World Bank, USAID and FAO anti-desertification projects in the past decade have had a significant science and technology component, generally in the field of resource management. Practically every nation has established or strengthened universities, agricultural colleges or research institutes in relevant fields. Nevertheless, a good deal remains to be done, particularly in building downwards from the research level to provide trained personnel who will carry the benefits of research into practice.

Creating public awareness and securing participation

This can imply several levels of action, each with its conceptual motivation. The first is broadly educational – creating an awareness of the significance of desertification, of the potential benefits of controlling it, and of the costs of doing nothing about it. Most countries have responded to some extent at this level, aided by developments in communications technology and media services, but a great deal remains to be done to ensure the effectiveness of these efforts.

A second level envisages the recruitment of the local community and its traditional skills as essential resources for desertification control. Respect for traditional skills has grown over the last decade, reinforced by some unfortunate experiences of wholesale and injudicious innova-

tion, and with it has grown an acceptance of the need for evolutionary change in resource use and the need to adapt introduced technologies to local environmental and cultural requirements.

A third level recognizes the human right of the community to be involved in planning and implementing desertification control programmes, as the arbiter of its own living conditions. The importance of 'bottom-up' and 'self-help' approaches in desertification control has been demonstrated by the relative success of the generally small projects carried through by NGOs with the close involvement of community leaders, and attention is being given to embodying these elements in government programmes.

Last is the need to identify the goal of desertification control with the advancement of the local community by linking it with the creation of employment, raising of incomes and improvement of living conditions. This has become a central theme of non-governmental programmes among the poorest communities, as in India, but it has also been successful in securing partnership between the community and government administration, as in social forestry and agroforestry projects in South and South-east Asia. It emphasizes the need to interpret desertification problems in terms of their social, economic and political ingredients and to target these in the proposed control measures. It involves all the conceptual elements mentioned above, as well as the development of community organizations and local leadership, the creation of linkages between the community and the administration and the devolution of decision making, including financial decisions.

Regional support for the PACD

While the implementation of the PACD is mainly the domain of national governments acting according to their own priorities, the Plan itself recognized the need at regional levels to support and coordinate national responses through the UN regional commissions and other regional organizations. Six transnational projects were endorsed as evidence of regional cooperation.

Desertification does not stop at national frontiers and the regional framework is an appropriate one for pooling experience, as shown, for example, by the important role of the regional commissions in the GAP. Developing countries also need to pool their scarce financial and technical resources, and this is attested by the establishment of a number of regional bodies such as the United Nations Sudano–Sahelian Office (UNSO), the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS), the Southern African Development Coordination Conference (SADCC) and the Andean Pact.

The most successful regional actions so far have been in the field of information exchange, seminars and workshops. UNSO, the most effective of the regional bodies on account of its high political profile and clear charter in the field of desertification control, has gone further by helping with desertification assessment, establishing scientific institutions and assisting countries to secure external funds.

So far there have been few cooperative regional actions to combat desertification; of the six transnational projects under the PACD there has been activity only in two, and that at a limited level. Nevertheless, enough has been done to establish the potential value of regional action. It now remains for national governments to avail themselves of the

opportunity, and this must depend on recognition of an overriding need as in the successful cooperation in desert locust control.

Actions by the UN family

Recommendation 23 of the PACD asks for a wide range of actions by UN agencies in fields such as assessment and monitoring, research, training and the provision of technical assistance. The agencies have responded by attempting to give desertification control an important place in their programmes, for example UNESCO in the Man and Biosphere Programme, WMO in the World Climate and Global Atmospheric Research Programmes, and FAO towards developing a methodology of assessing and mapping desertification. Within budgetary limits, the agencies have also attempted to respond to requests from governments for consulting services and technical assistance. The United Nations University has conducted a programme on problems in applying existing knowledge for desertification control.

UNEP, as the UN body entrusted with coordination and follow-up of the PACD, has sponsored training programmes and assisted with the publication of handbooks on several aspects of desertification control. Its Desertification Branch, later the Desertification Control PAC, has assisted governments in drawing up national plans or project proposals on request. Through its publication of the *Desertification Control Bulletin* it has provided a valuable international forum, while within its limited resources it has served as a repository of information on desertification. Its developing GEMS (Global Environmental Monitoring System) and GRID (Geographical Resource and Inventory Data) projects are particularly relevant to assessing and monitoring desertification at global levels. Through IAWGD (the Inter-Agency Working Group for Desertification Control) it has helped to coordinate the efforts of the UN family to combat desertification and through DESCON (the Consultative Group for Desertification Control) it has brought donors into contact with those needing assistance. Finally, by undertaking the GAP it has provided a compelling reminder of the need for further commitment under the PACD.

Intergovernmental and non-governmental organizations such as the International Union for the Conservation of Nature and Natural Resources and the International Geographical Union have organized conferences on desertification, commonly with the support of UN agencies, which have advantageously strengthened the interlocking network of professional and non-professional people involved with the problem.

Evaluation

A review of achievements under the PACD makes for generally disappointing reading, but how can the inadequacy of that response be judged? A measure adopted by the Executive Director of UNEP in his report on the GAP was the level of financial commitment made in comparison with what was thought to be needed. An expert study reporting to the General Assembly in 1980 estimated, for example, that the developing countries would require an average annual expenditure of US $2.4 billion over a 20 year period, whereas the present resources available – including external assistance – were around US $600 million.

Clearly the funds available have been grossly inadequate, but it should not be assumed that this was the only, or even the main constraint on progress.

Another possible measure of the adequacy of the achievements is their impact on the problem. Here the findings of a global assessment of the status and trends of desertification as part of the GAP are illuminating. Trends towards improved conditions were found in a few areas only, for instance in irrigated lands in USSR and China and to a lesser degree in the USA, in the extent of forest in Southern Europe, USSR, China and the US, in rangelands in USSR and China and locally in the USA. The developed countries were mainly shown as areas of slight decline or of relatively stable condition, but the developing world, in Africa, Asia and Latin America, was without exception undergoing accelerating desertification.

Furthermore the problem has been shown to be more widespread than envisaged at UNCOD, with large parts of the sub-humid tropics now recognized as being under serious threat. The rural population at risk is now put at 135 million compared with the estimate of 80 million in 1977. Not only have we fallen behind, but more is required of us than was at first thought. With present trends, perhaps with the sole exception of the irrigated lands, the situation will be significantly worse in the year 2000, the date set for achievement of the PACD, than in the year of its inception.

Constraints on progress

Only 25 countries responded to a request for information on what were seen as the principal constraints in the implementation of the PACD. Environmental factors ranked high among the answers, as did financial constraints and organizational constraints. Others listed included lack of information based on assessment, lack of trained manpower and lack of public awareness. Lack of political will was not mentioned, although the United Nations Administrative Committee on Coordination had it ranked as one of two constraints, along with financial limitations.

Some doubt has been expressed as to how important the shortage of financial resources has been. If more aid funds had been available, would they have been directed to anti-desertification projects? If more funds had gone to anti-desertification projects, would they have gone to field control measures as distinct from spending on general infrastructure? If funds had gone to control measures, could they have been spent effectively given the shortage of trained manpower in many developing countries, the lack of assessment of the problem and the failure to draw up national plans?

Chief among the environmental constraints listed is the recurrence of droughts in the years since the UNCOD, particularly in Southern Africa but also in other parts of the world. This has certainly hampered progress of existing projects and perhaps more importantly has commonly exacerbated the social and economic conditions which contribute to desertification. But it has also raised again the question put tentatively in 1977, as to whether large parts of the drylands have not entered a period of more variable and possibly lower rainfall. It is now suggested, for example, that West African farmers would be judicious in anticipating a continuance of unfavourable rainfall conditions for at least the next few decades.

Another constraint has been the poor economic climate, particularly for primary producers in the drylands, resulting from the fall in commodity prices in the last few years. This is made worse in the developing countries – the worst affected by desertification – as north–south trade terms have turned against them and as the costs of debt-servicing have risen. In difficult times, moreover, the drylands – as marginal areas geographically, climatically, economically and politically – tend to suffer most.

In many areas political instability has also threatened long-term programmes of desertification control, and civil disturbance has worsened the problem through the displacement of populations and abandonment of lands.

The PACD was formulated at Nairobi in an atmosphere of crisis engendered by the Sahelian drought, and it seems – if the attendance of DESCON meetings is any indication – that interest in desertification subsided as the sense of crisis dissipated. Long-term ecological degradation is less newsworthy and attracts less political notice. It has been suggested that the presentation of desertification in terms of land degradation may have contributed to the lack of continuing political commitment to the PACD, and that the problem should be formulated in terms of social costs together with the benefits of control measures, so bringing it within the arena of public policy-making as a high priority in the allocation of scarce resources. Whatever the reason, it is difficult to escape the conclusion that the essential ingredient of success so far has been the political will to combat desertification.