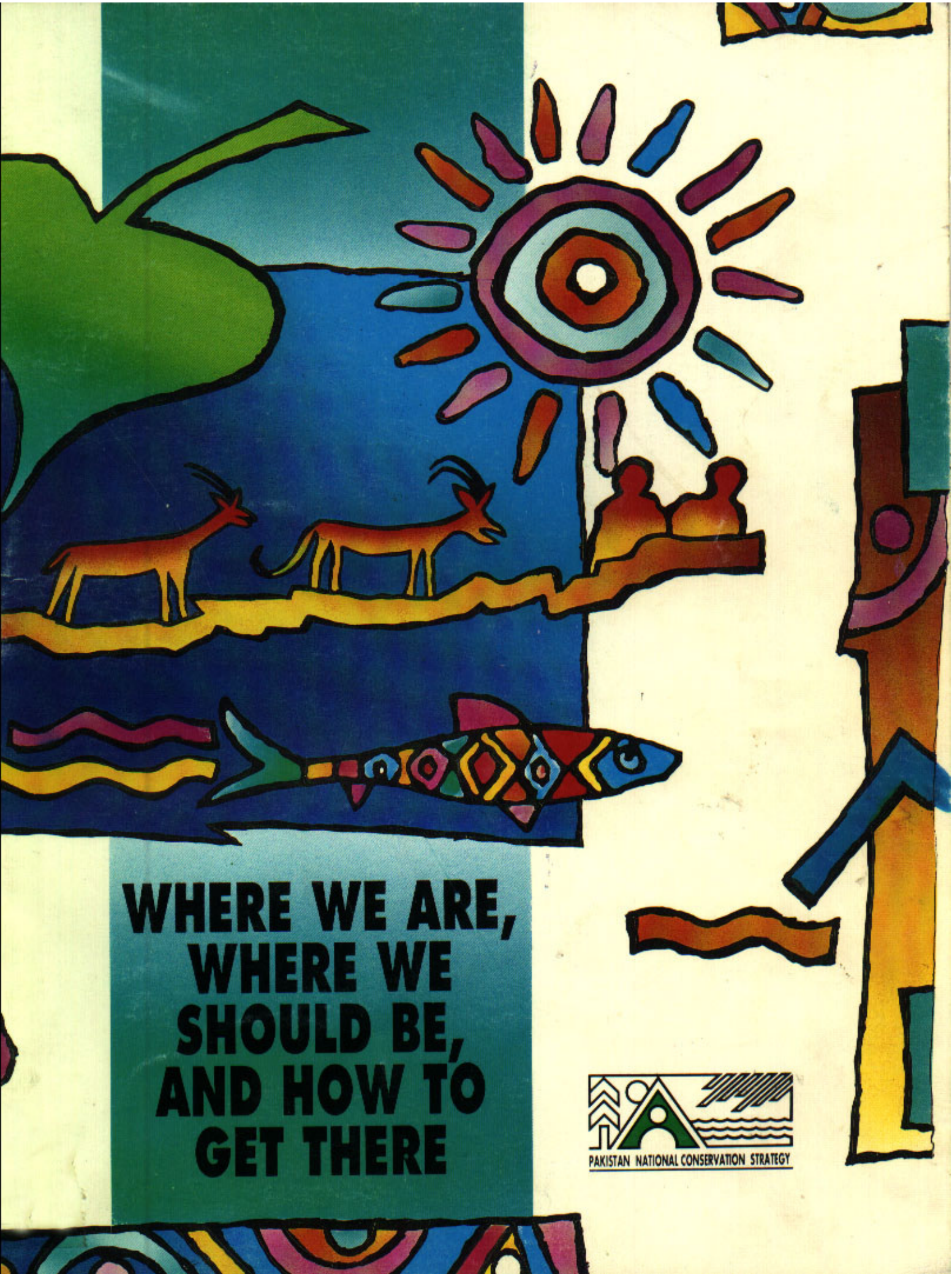


# WHERE WE ARE, WHERE WE SHOULD BE, AND HOW TO GET THERE

PAKISTAN NATIONAL CONSERVATION STRATEGY

# WHERE WE ARE, WHERE WE SHOULD BE, AND HOW TO GET THERE

The Core Programme Areas of the
Pakistan National
Conservation Strategy

Linda Starke

Editor: Linda Starke
Editorial Advisors: Dhunmai Cowasjee & Saneeya Hussain

The Pakistan National Conservation Strategy was prepared by
the Government of Pakistan (Environment and Urban Affairs Division)
in collaboration with IUCN – The World Conservation Union

It was supported by the Canadian International Development Agency

ISBN 969-8141-10-3



IUCN – The World Conservation Union, Pakistan
1 Bath Island Road, Karachi 75530

Design: Creative Unit (Pvt) Ltd
Formatting: Umer Gul Afridi, Journalists' Resource Centre for the Environment
Printed in Pakistan by Nikmat Printers

Support for the production of this popular version of the NCS was also provided by NORAD

# C O N T E N T S

# WHERE WE ARE, WHERE WE SHOULD BE, AND HOW TO GET THERE

When the Cabinet of the Government of Pakistan endorsed the National Conservation Strategy (NCS) in March, 1992, it joined a handful of countries that have pledged to balance their economic development with the conservation and use of their natural resources. This important step came none too soon, as the nation faces numerous environmental problems that constrain its efforts to meet people's needs. Consider, for example, that:

- Less than 20% of Pakistan's land can be intensively farmed, nearly all of which is already cultivated.
- Only half the human wastes in cities are disposed of in sewers, and most of that is then not treated.
- Rangelands are producing at 15-40% of their potential.
- The total fertility rate, which has remained nearly unchanged for decades, is about 6.5 children per woman, putting Pakistan in the group of countries growing fastest in the world.
- Approximately 60% of infant deaths are due to infectious and parasitic diseases, most of which can be traced to polluted water.
- Only 30% of the irrigation water diverted at canal heads reaches crop roots, with the rest being lost during application.
- Pollution of some waterways has reached such a point that fish production in the Ravi River below Lahore has been cut by 5,000 tonnes a year.

The NCS must also be seen in the context of a world that is becoming aware of environmental constraints on growth. The last decade has seen international conventions and treaties on endangered species, hazardous wastes, deterioration of the earth's protective ozone layer, and — at the June 1992 Earth Summit in Rio de Janeiro — climate change and biological diversity. Pakistan thus joins many nations in efforts to respond to the pressures being put on our life-support systems by humanity's consumption patterns and growing numbers.

The strategy has three over-riding objectives: conservation of natural

resources, sustainable development, and improved efficiency in the use and management of resources. Reaching these goals depends in turn on three operating principles — achieving greater public partnership in development and management, merging environment and economics in decision making, and focusing on durable improvements in the quality of life of Pakistanis. The report is pointedly addressed to the people of Pakistan, for without their understanding and help the chance to build a better life and a more secure future for the nation will be lost.

The NCS is both a product and a process. The product — a book of 406 pages, with 95 tables, figures, and maps — brought together national and international experts who produced more than 5,000 pages of reports on how 18 economic sectors affect and in turn are affected by the environment. The process consisted of workshops on these topics, seminars, lectures, and the work of the Journalists' Resource Centre, all of which created a constituency of people more concerned about Pakistan's environment, and more ready to do something about it than ever before. Public hearings were held in three cities and five villages, to listen to the views of local communities. Quotes from those meetings are included throughout this document to give some feeling for Pakistanis' many views about the environment.

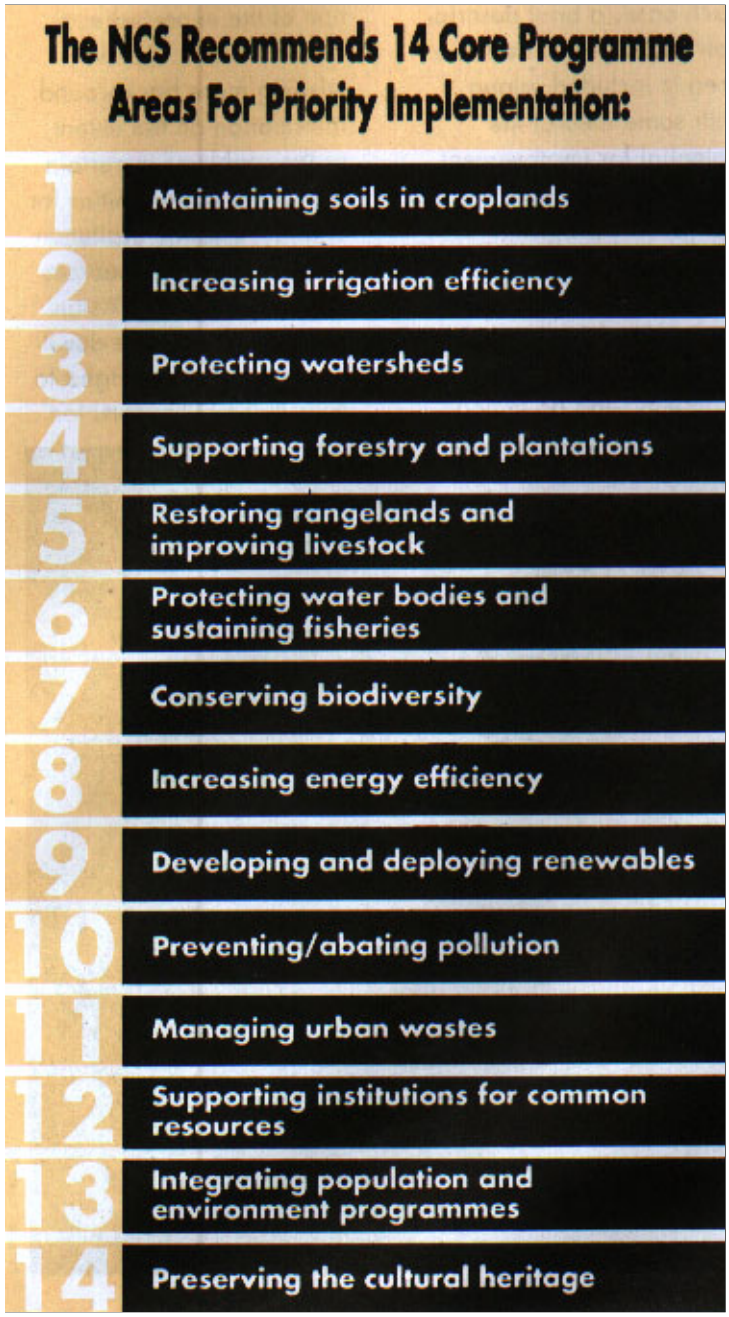
One main focus of the NCS is investment decisions, which are more flexible than consumption patterns. It seeks to identify actions with significant economic and social impacts that would not otherwise happen by themselves because of failures of the marketplace or of society's institutions. A second key finding is the importance of community-based management of resources. From the Aga Khan Rural Support Programme in the Northern Areas to the Orangi Pilot Project in Karachi, participatory organizations have proved to be effective agents of change in society's efforts to move towards sustainable development.

The full report is divided into three parts. The first surveys the state of Pakistan's environment in the largest sense — the quality of its land, water, and air; its use of energy; the health of its people; and the institutions and policies that deal with these concerns. Part 2 provides detailed recommendations for policies and measures in agriculture, forestry, the management of rangelands and livestock, water supplies, marine and coastal resources, wildlife, mining, energy supplies, industrialization, the growth of cities, pollution, tourism, and a host of supporting programme areas such as communication, education and research.

The final section of the NCS looks at the arrangements for implementation of

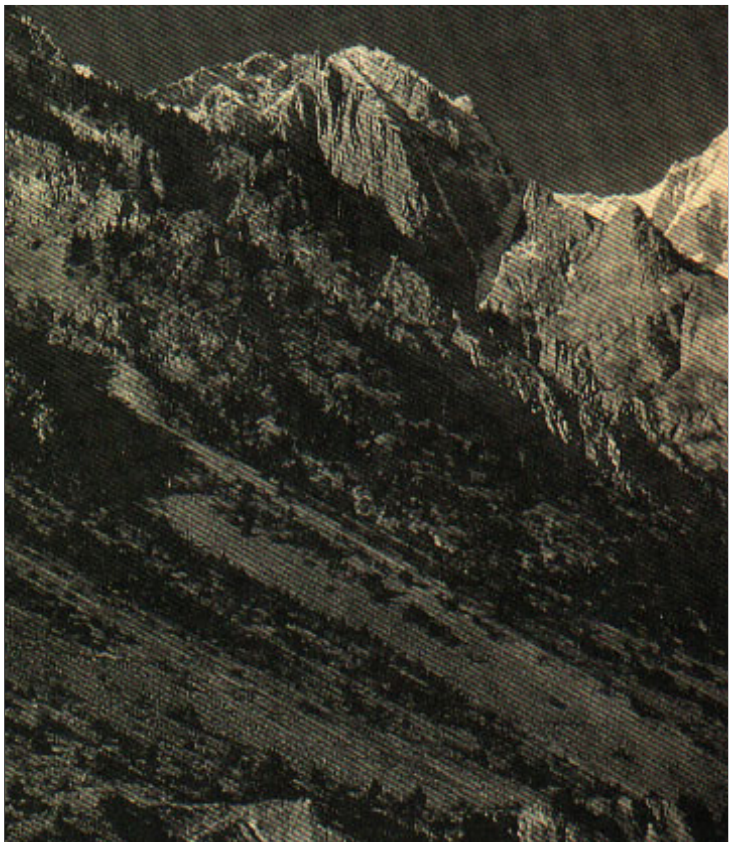
all the recommendations in Part 2. A total of 68 specific programmes are identified in 14 core areas, each with a long-term goal and with expected results and resource investments within the next decade. The total investment recommended for 1992-2001 is Rs. 150.7 billion, with Rs. 61.6 billion to be made available from revamping current government projects. Of the additional funds needed, Rs. 52 billion (59%) is expected to come from the private sector, encouraged and stimulated by the government. When combined with government commitments already made under the Seventh Five-Year Plan, the NCS is expected to generate approximately 800,000 jobs during the next decade.

This summary of the NCS is organized around the 14 core areas identified in the report, with a final section on the programmes needed across the board to support the changes called for. In




The NCS is organized around the 14 core areas identified in the report, with a final section on the programmes needed across the board to support the changes called for.

each case, a brief description of the problems in the area is included, along with some idea of the potential for improvement. This is followed by a list of the specific programmes and investments recommended in the NCS, some examples of the components of these programmes, and an indication of the expected economic benefits. Readers wishing more background information on the extent of the problems in certain areas, the opportunities for change, and the institutional and financial resources needed to move Pakistan towards sustainable development are encouraged to consult the full report.



Ameneh Azam Ali

Although the NCS recommendations are organized in 14 sections of key areas, one of its most important messages is the inter-connected nature of sustainable development problems and of their solutions. Efforts to protect watersheds, for example, can reduce flooding and thus improve agricultural productivity in downstream areas. Increasing energy efficiency and developing renewable energy sources can lower the nation's dependence on fossil fuels and thus help with its air pollution problems. And protecting forests for the wood and ecological services they provide can also conserve the nation's biological diversity. This tendency for changes in key areas of resource management and environmental health to be mutually reinforcing should be kept in mind when reading this summary — and when seeking to apply the lessons of the NCS at the local, provincial, and national levels.

Efforts to protect watersheds can reduce flooding and improve agricultural productivity in downstream areas.

# C R O P L A N D S

As noted in the opening section, less than 20% of the 88 million hectares in Pakistan is suitable for intensive agricultural use. This is nearly matched by the amount of land already being cultivated, so Pakistan has little room on which to expand farming. But there is considerable room for getting more out of the land that is already cultivated.

First, if sufficient irrigation water becomes available, some 12 million hectares could support two crops a year, nearly three times the amount that is currently double-cropped. Second, Pakistan has one of the lowest levels of output per hectare in the world, so the productivity of the land can be greatly improved. These two problems — low intensity of land use and poor output per hectare — have a number of sources: the nation's system of absentee landlords, the breakup of landholdings into fragments, the reduction in farm size from one generation to the next, poor access to capital for expansion and improvement, inadequate transfer of new technology to farmers, and lack of advice on the use and timing of such aids as fertilizers and pesticides.

But the problem of poor productivity can also be tied to the health of the land itself, and the pressures that are being put on it. Some 17% of the land used for farming, forestry, or ranching is affected by water erosion, particularly in the Northern Areas and the NWFP, with more than half of that being severely or very severely affected. Nearly 8% of the country suffers from wind erosion, especially in arid and sandy desert areas, which is reducing land productivity by 1.5-7.5% a year; almost one-fifth of the province of the Punjab is affected by this. Productivity is reduced on nearly 9% of Pakistan's land, primarily in Sindh and the Punjab, through problems of salinity (the buildup of salt in the soils of irrigated land) and sodicity (the presence of many types of salts in the soil, which eventually makes it difficult for air and water to reach lower sections of the soil and support growth. Flooding is an additional problem in the Punjab, and waterlogging of soils occurs everywhere irrigated agriculture is found. A last major problem, affecting fully 96% of

the soils that could support farming in Pakistan, is a low level of the all-important organic matter in soil that both helps it retain moisture and nutrients and enables plants to use those nutrients.

Substantial opportunities exist to improve the productivity in rainfed agricultural regions by introducing permanent vegetative cover in high-risk erosion areas and by promoting cropping systems that will complement each other in their demands on the environment. Projects and practices that conserve soil and water also need to be introduced, backed up by specific conservation plans for each sub-catchment area.

In areas that rely on irrigation, waterlogging can be eased through the planting of phreatophytes, deep-rooted plants that can pull water from the soil. And the buildup of salt in the soil can be lessened by providing farmers with gypsum, which when applied breaks down the alkaline content of the soil in a chemical reaction that has the beneficial side-effect of producing potassium, which the soil needs. The construction of open farm drainage systems can be encouraged, and shallow tube-wells or tile drains can be installed to ease waterlogging where appropriate. In some areas, the land can be levelled to increase water-use efficiency. Fish ponds may be appropriate in certain low-lying areas, to take advantage of land too waterlogged to be brought back into crop production.

Apparent wasteland can be better used by planting salt-tolerant grasses and shrubs in areas with saline groundwater. In mountain areas, high-risk erosion areas should be identified, integrated crop and livestock production systems can be adopted, local economic activities can be diversified by combining appropriate-scale agriculture with timber-based industries, and community purchasing and marketing groups can be developed.

Overall, agricultural intensification on the best lands can occur through the promotion of organic matter recycling and integrated pest management,

## RECOMMENDATIONS

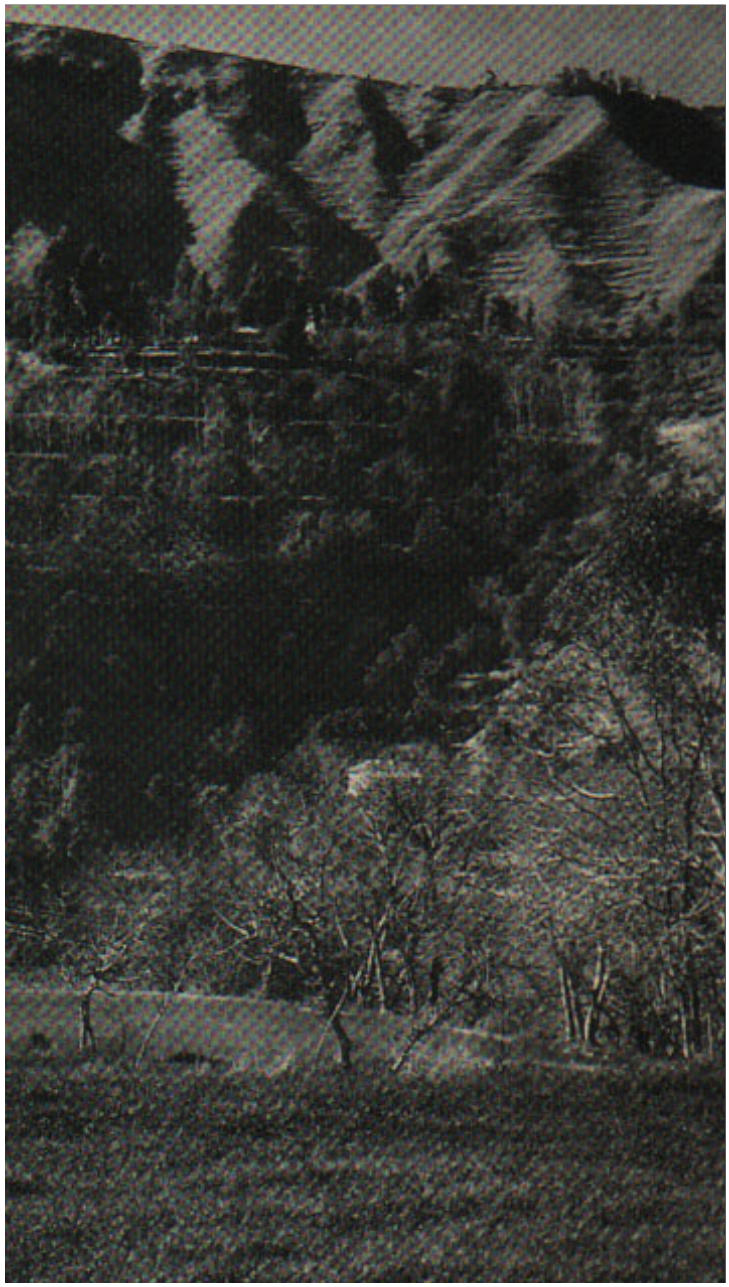
Seven programmes and an investment of Rs. 28 billion — the largest in any one programme area in the NCS — are suggested for the next decade to maintain soils in croplands:

- biological pumpage by phreatophytes, and field surface drainage,
- gypsum application on sodic soils,
- increased organic manure application,
- saline agriculture,
- green manuring by leguminous crops,
- direct or indirect return to the soil of crop residues, and
- soil conservation works in rainfed croplands.

which reduces farmers' dependence on expensive and environmentally damaging pesticides. Federal and provincial programmes in education, economic development, and local infrastructure (markets, roads, and transport) can encourage farmers to stay in these areas, where the greatest potential lies for raising Pakistan's agricultural productivity.

Some of the specific inputs this will entail include planting 732 million trees or shrubs on cultivable waste to improve the soil, and a further 513 million trees along field borders to lessen wind erosion and provide leaves that can add organic matter to the soil. Two million hectares of sodic soils can be improved by providing gypsum, to be applied at 10 tonnes per hectare. Following research, demonstration, and extension programmes on organic agriculture, it is expected that farmers will construct 4 million compost pits.

Studies on saline agri-



Saneeya Hussain

"Balance between the amount of land reserved for agriculture, for trees and for grazing is very important. If any one of these becomes too much the others are going to suffer."

From the field, Giddary, Mardan.

## It pays to practise organic farming

Mitho Khan is 70 years old and a crusader. For most of his life he has opposed the use of pesticides and chemical fertilizers in agriculture, refusing to use them on his land in his native Ali Khan Sirewal village near Hyderabad, Sindh. Instead he practises organic farming and the results speak for themselves. His 12 acres of land are in far better condition than other holdings in the village. Organic farming has not compromised his yield either; in fact his yield is considerably higher than his fellow farmers who use chemical fertilizers and pesticides. In 1994 when most of the village's farmers produced 640 kg of wheat per acre, Mitho Khan harvested 2,800 kg per acre and the size of grain harvested by him was much larger and heavier than the grains grown with chemical fertilizer on adjacent land.

So what is the secret of Mitho Khan's success? What is he using that makes his land so much more productive? And how does he manage to protect his crops without the regular application of pesticides?

The answer is simple: farm yard manure. Not only does it provide his crops with essential nutrients, but it also offers a number of advantages over chemical fertilizers.

First, it saves money on land development. Whereas chemical fertilizers create a hard pan over the soil which makes it virtually impossible to plough without using a tractor, farm yard manure maintains the original, softer, texture of the soil which can be ploughed by the less expensive method of a local Sindhi plough pulled by two bullocks.

Second, farm yard manure helps to conserve water. Last year Mitho Khan was unable to irrigate his cotton field because of a shortage of water. But inspite of the fact that his crop received only two heavy soakings he still achieved a yield of approximately 880 kg of cotton per acre. This was due to the fact that farm yard manure has greater water retention properties than soil alone. During the initial soakings the manure in the soil absorbed the water, retained it, and then released it into the root zone of the cotton plant in response to osmotic pressure.

And third, in Mitho Khan's experience, manure seems to do away with the need to use pesticides. While there is often no need to protect wheat crops, cotton nearly always requires protection from pests. Surprisingly, Mitho Khan's crop didn't. On inspection the leaves, as well as other parts of the organically grown cotton plant, proved to be coarser than those of chemically fertilized plants. While the tender and juicy leaves of the latter invited pest attacks, Mitho Khan's tougher plants proved less attractive. Thus, Mitho Khan didn't need to spend a penny on pest control.

According to Mitho Khan, each acre of land needs at least one good dose of manure every three years. At the moment he is able to supply a quarter of his needs from his own livestock: three buffaloes, two cows and two calves. The remainder comes from *warri*, a local practice whereby one farmer rears livestock for another farmer in return for the manure.

If Mitho Khan were to meet all of his manure needs from his own livestock, he would need to invest a further Rs. 300,000. While this is clearly beyond the means of a small farmer, the initial purchase costs need to be considered in the context of the additional income that could be generated from live-

stock rearing.

Mitho Khan spends comparatively negligible amounts of money on land development, mainly because he uses farm yard manure and the local Sindhi plough. This implement, with its narrow and sharp blade, penetrates deep down into the soil and according to Mitho Khan prepares the land better than a tractor. The superiority of the plough, together with the softer texture of the manure-fertilized soil, meant that in the past year Mitho Khan only needed to plough his land twice, spending the equivalent of two tractor hours on each acre. Furthermore he did not need to spend time levelling his land. As a result his costs were a mere Rs. 200 per acre.

In comparison, the conventional farmers spent Rs. 1850 on preparing their land for wheat and Rs. 2450 on preparing their land for cotton and protecting it from pests. In other words, conventional farmers spent nine times more than Mitho Khan on preparing their land.

At this year's market rate, Mitho Khan averaged a gross income of Rs. 11,200 per acre of wheat. Minus the amount spent on land development, his real income per acre was Rs. 11,000. The gross income from wheat for the other farmers came to Rs. 3,200. With an expenditure of Rs. 1,850 on land development and fertilizer they were left with just Rs. 1,360 per acre. Mitho Khan made seven times more than the other farmers from the village! And if the marginal opportunity cost of land and the milk and meat yields of livestock are taken into account, Mitho Khan's benefits would be even higher, both economically and environmentally, than the chemical fertilizer and pesticide-using farmers of the village.

So why haven't other farmers in Ali Khan Sirewal village switched to organic farming? The answer is that there is a lack of government support for organic farming. The government's agricultural policies have put an end to traditional farming practices. In the mid 1960s chemical fertilizer was introduced to Pakistan for the first time — with a 100% subsidy. The subsidy continued in varying degrees to the late 1980s and had a devastating effect both on traditional farming practices and on the quality of soil. Since the land was already quite fertile, initial applications of subsidized fertilizers increased crop yield dramatically. Convinced of the superiority of chemical fertilizers over manure, and encouraged by the subsidies, farmers switched to chemical fertilizers.

Livestock rearing for manure production became redundant. Farmers all over the country began reducing their livestock numbers. It took farmers a long time to realize that the bounty was shortlived and that though the new practices initially produced amazing results, they were harmful in the long run.

For the farmers of Ali Khan Sirewal there is another discouraging policy to prevent them from reaping the benefits of organic farming. Farmers can obtain credit from agricultural development banks as well as regular banks for chemical fertilizer and pesticides but there is no credit support for purchasing manure or livestock. Having disposed of most of their livestock, they are caught in a vicious circle. Though they are keen to follow the example set by Mitho Khan, they cannot afford to do so. Not until there is governmental support for the revival of traditional, environment-friendly farming practices.

— Aijaz Nizamani

S.M. Shahid

culture will lead to 1 million hectares of moderately and severely saline tracts being brought under plant cover, while research and demonstration on green manuring could mean soils on 15-20% of the nation's cropland have a natural, and better, source of nitrogen. And 25% of rainfed croplands should have effective soil conservation coverage by the year 2001.

By following this programme, Pakistan can expect to register a sustained increase of 10-25% in crop yields from soils that have insufficient organic matter, a problem that affects so much of the nation's cropland. And an expected decline in crop yields of 25-50% on soils affected by waterlogging, salinity, sodicity, and erosion can be prevented or reversed. An additional economic benefit of these efforts to maintain soils in croplands is a 10-30% increase in biomass for livestock feed and other uses.

Some of the specific inputs include planting 732 million trees or shrubs on cultivable waste to improve the soil, lessen wind erosion and provide leaves that can add organic matter to the soil.

# I R R I G A T I O N

Pakistan relies on irrigation for more than 90% of its food and fibre production; since 1960-61 the irrigation water available per irrigated acre has gone up by 35%. Yet, as noted earlier, water-use efficiency levels are low: although the availability and use of water rose 42% from 1971-76 to 1981-86, water-use productivity increased just 7.8%.

Only 30% of the water tapped in the Indus Basin and intended for crops really reaches their roots. The bulk of it is lost in canals and watercourses or when it is being applied to the fields. Groundwater is another source for irrigation, but nearly 90% of the annual recharge of groundwater is already drawn up by tube-wells and used. One problem with relying on groundwater is that it contains much more salt than canal water; evaporation from fields that have been irrigated with groundwater from tube-wells can leave a damaging level of salts in the soil, increasing salinity and sodicity problems and thus lowering its productivity.

One reason water productivity is so low is that farmers are generally not able to supply water to plants when they most need it. The farmers' turn for water supplies is based on a rotational system developed by the managers of the canal irrigation network. The gap between their turns may be one week or it may be two weeks; whichever it is, it does not usually coincide with the critical stages of plant growth. When water is available to farmers on demand rather than on a fixed-supply basis, yields improve dramatically. Thus the single largest opportunity for increasing efficiency lies in changing over to a demand-orientated water supply system.

Efficiencies can be

## R E C O M M E N D A T I O N S

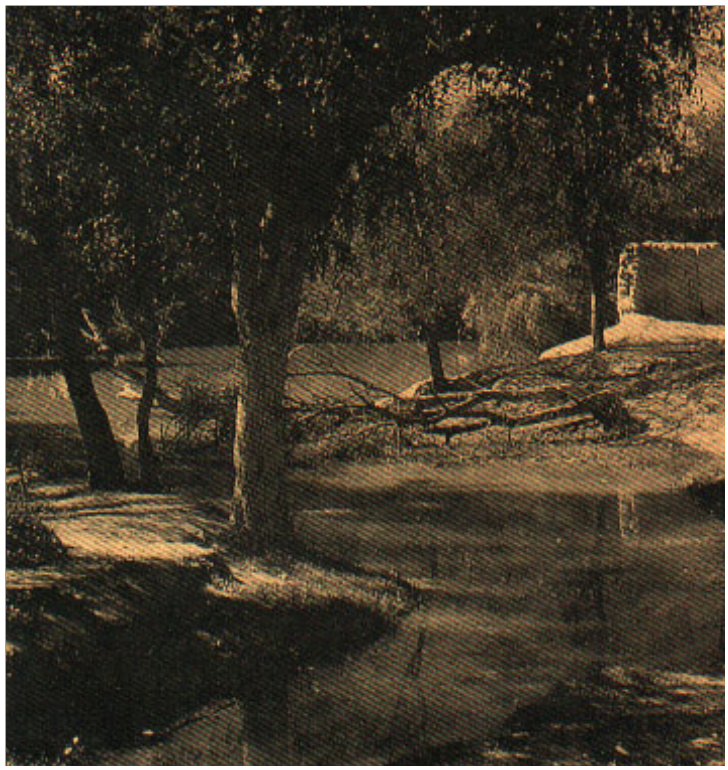
To increase irrigation efficiency, an investment of Rs. 18.5 billion is suggested in four programmes:

- irrigation system rehabilitation,
- command water management,
- on-farm water management, and
- improved water harvesting in torrent-irrigated areas.

improved by supporting and funding an on-farm water management programme that puts control of watercourses in the hands of village communities. Similarly, local control is needed for a successful demand-based system, so water users' associations need to be supported. Research is needed on biological as well as engineering solutions to salinity, sodicity, and waterlogging problems throughout the Indus Basin. For all these initiatives to reach their goals, the price of irrigation water must reflect operation and management costs, and eventually also the capital and environmental costs.

Specifically, 17,000 kilometres of the canal system needs to be rehabilitated in the next five years, and 900 kilometres needs to be excavated and remodeled. Expansion of the on-farm water management project and reactivation of water users' associations will result in 39,000 watercourses being improved and lined to reduce loss of water during transmission. Priority in this project should be given to saline groundwater zones. The amount of water reaching the root zone of crops on at least 60,000 hectares will be improved through precision land levelling and the addition of appropriate sprinkler and drip irrigation systems.

Among the economic benefits of increasing irrigation efficiency are up to 15% higher crop yields from reduced loss of water, and yields that are 25% higher due to more timely availability of water, which will reduce crop stress. As control of watercourses improves, double cropping can be introduced along with cultivation of farm wasteland.



Saneeya Hussain

"For Water Users' Associations to continue the government must back them but the decisions and the functioning should be controlled by the villagers themselves. We are ready to work, but someone has to be there to push us, to help us in these processes."

Numberdar, Chak 332, JB, District Toba Tek Singh.

# W A T E R S H E D S

Watershed lands in the upper Indus River and its tributaries suffer from both unfavourable soil and water conditions and poor management. As erosion in these areas accelerates, soil is being washed down into the reservoirs on which irrigation depends. The Tarbela Dam reservoir, for example, lost 14% of its storage capacity within a decade of being completed. Unless the sediment load of the Indus is reduced through improved cropping or watershed management, Tarbela is expected to lose another 16% of its remaining capacity between 1985 and 1995. Sedimentation in the Mangla watershed, in contrast, was reduced nearly 19% a year during

Saneeya Hussain

Hill erosion, Hazara: as erosion in the watersheds accelerates, soil is being washed down into the reservoirs on which irrigation depends. The Tarbela Dam reservoir lost 14% of its storage capacity within a decade of being completed.

the 1970s through a farmer-oriented conservation programme.

Community participation is needed as much in watershed management as it is in improving irrigation efficiencies. The success of the Mangla Watershed Project has provided valuable lessons of an approach that should be followed elsewhere. A multi-disciplinary team of experts — a forester, a civil engineer, and an agro-ecologist — co-ordinate all the elements needed for controlling excessive soil erosion and protecting farmers' fields. In some places, just a change in crops is required; in others, a different range management plan is needed. Some areas need trees to slow erosion, while others must have small dams or retaining walls at key locations.

Planning in the Mangla watershed management project is done on a small scale, no more than 400-600 hectares, and in consultation with landowners. For land held in common, a consensus must be reached about appropriate treatments.

In adapting this project to other watershed areas, farmers may need help meeting the costs of engineering structures or saplings, but it is important that they contribute labour and local materials to the project. This will increase the incentive to keep costs down and let people see that the project is theirs, and that its success rests with them.

## RECOMMENDATIONS

To protect watersheds, the NCS calls for an investment of Rs. 10.8 billion from 1992 to 2001 in one overall programme: integrated watershed management.

Part of this programme entails creating multi-disciplinary extension and support teams of foresters, agronomists, civil engineers, and community organizers. These teams can help prepare provincial, district, and local action plans, with the goal of protecting 10% of the total watershed area (and one-third of the Mangla and Tarbela watersheds) in the next decade.

Doing this will require the organization of community groups in 10% of the upland watershed villages by that time. In addition to providing information on run-off control measures and conservation structures, the government needs to supply 12.25 million saplings a year to communities in the Mangla and Tarbela areas specifically for watershed protection purposes.

The economic benefits of this approach include more reliable irrigation supplies over a longer period due to reduced sedimentation of reservoirs, and the prevention of a 10-50% decline in upland crop production. As in the programmes proposed in the next section, local communities will also have the benefit of increased timber, fodder, and fuelwood supplies.

# FORESTRY & PLANTATIONS

Land classified as forest in 1986-87 covered 4.57 million hectares, 5.2% of the area of Pakistan, which is not enough to meet the nation's requirement for wood. In fact, less than 3 million hectares actually has some form of tree cover. Closed cover forests account for less than 1 million hectares. Some 7,000-9,000 hectares a year are being lost to deforestation, although a more pervasive and destructive problem is the gradual loss of forest vegetation during the last few decades as single trees have been felled or lopped off by local people needing fuel.

In addition to providing fuel and fodder, forests play important ecological roles: they protect soil from eroding or blowing away, which reduces sedimentation in reservoirs. They slow the run-off of water and therefore reduce floods, stabilize sand dunes, and, in the case of mangrove forests, protect ports from the violence of the ocean and provide a nursery for shrimp. And forests are important repositories for the nation's wealth of biological diversity, from large animals being hunted to extinction to the smallest micro-organism that might provide the key to a crop or medicine of the future.

Top priority needs to be given to maintaining watershed, riverine, and mangrove forests, which provide vital ecological services. Sustainable forestry practices are essential in areas set aside for production, which should be used close to their maximum sustainable yields. Other forests, particularly old-growth ones, need to be preserved for the

Saneeya Hussain

"For the farmers, trees are a multi-benefit product. You cannot prioritize their benefits. All of them are extremely important...for our survival."

From the field, Chikiskot, Gilgit.

wealth of biological diversity they contain. To meet rising demands for timber and related products, programmes to plant trees on marginal agricultural lands and along field boundaries should be given wider support.

The government should strengthen forest departments and concentrate its efforts on the half-million hectares of state closed-cover hill forests, while helping community and private efforts to reforest critical watershed areas. Forestry product marketing boards can be created in each province to provide accurate market forecasts for planters. The private sector should be encouraged to take a lead role in irrigated plantations and farm forestry. And the role of women in managing this natural resource needs to be recognized and reinforced.

These efforts will involve supplying 18.5 million saplings a year to private planters and 40 million a year to organized communities. By the year 2001, this could result in trees planted on 50,000 hectares of marginal agricultural lands by private owners, and on 220,000 hectares of community lands, with a further 100,000 hectares being regenerated. Supplying households with 16 million saplings a year and with planting advice, especially for women, should yield an average of five fruit and shade trees in and outside courtyards of 25 million dwellings at a decade's end.

To increase the number of trees along canals and roadsides, departments and agencies need to be supplied with 2.5 million saplings a year. By 2001, this could lead to an additional 25% of the nation's 200,000 kilometres on canals and roadsides being planted. And urban governments should receive 650,000 saplings annually to plant in open spaces and along main roads.

Among the economic benefits of these programmes will be a 5% increase in crop production through the protection afforded by trees, in addition to the obvious benefits of timber, fuelwood, fodder, and other forest products. Furthermore, commercial energy needs will be reduced when people can draw on the fuel resources provided by trees near their homes.

## RECOMMENDATIONS

The NCS recommends investing Rs. 5.84 billion over the next decade to support forests and plantations through six programmes:

- intensive management of critical forest areas,
- afforestation on marginal private lands by land owners,
- community forestry,
- linear plantation,
- urban plantations, and
- courtyard/social forestry.

# RANGELANDS & LIVESTOCK

Desertification — the loss of biological productivity of drylands — remains an ever-present threat that can become a reality when the vegetation that protects the soils is harvested, cropped, or grazed faster than it can grow. No substantial assessment of the extent of this problem in Pakistan has been made yet, but since Independence the number of grazing livestock has grown dramatically, reaching 86.4 million head in 1986. The increase in grazing has occurred mainly along field borders, between tracts of cultivated land, and along river banks in intensively managed irrigated lands; the latter now produce three-fourths of the nation's fodder. Although the expansion in livestock in drylands has been less rapid, the increased livestock numbers there have led to overgrazing. Rangelands are now only producing at 15-40% of their potential due to this problem.

Livestock contribute some 30% of the gross domestic product generated by the agricultural sector. Some 9 million animals generate about 3 million kilowatts of draught power, and livestock supply about 16% of household energy, in the form of cow dung. This sector provides 10-25% of the income of small farmers and landless livestock producers. Livestock are owned in small herds and flocks by about 5 mil-

S.M. Shahid

Although the expansion in livestock in drylands is less than in irrigated lands the increase in numbers there has led to overgrazing. Rangelands are now only producing at 15-40% of their potential.

lion farm families and some 1 million landless households, representing 40% of the nation's people.

Unfortunately, livestock-keepers typically do not manage their stock in a way that makes best use of their value as converters of "cheap" feed into highly valued milk and meat products. The livestock sector is caught in a self-perpetuating downward cycle: as insurance against loss through death, the numbers of livestock are high because many are sickly; they are sickly because they are poorly fed; and they are poorly fed because there are too many of them.

With about half as many animals and about 20% less feed in total, Pakistan could have the same volume of milk and about the same amount of meat as it now does — and the meat would be of better quality. Some of the constraints on achieving this include the lack of a grading system (so that farmers receive the same return for a poor animal as a good one), and the limited size and capacity of provincial livestock departments.

To become more productive, rangelands need to be closed to grazing periodically, so that they can recover. This can only be achieved through community self-management, which can be encouraged through giving range licences to whole communities and helping in the formation of livestock associations. Communities need better technical advice and extension services on the management of such systems. Existing land reform laws need to be better enforced where absentee ownership is preventing the proper management of rangelands. The government can also help by developing water points for livestock, providing fodder during emergency situations, creating other employment in the area during dry periods, and giving loans to improve breeding stock.

The quality of the livestock in Pakistan can also be improved through cross-breeding with high-yielding stock. Veterinary care services need to be improved in order to reduce animal loss through disease. More management training facilities, especially for women, need to be provided. And the resource these healthier livestock will depend on can be improved through the promotion of high-yielding variety fodders, which could raise yields three- or fourfold on 15% less land than currently used.

The livestock sector is a prime candidate for the recycling and more efficient use of resources. Only half of animal excreta is collected, and half of that is burnt as fuel rather than being returned to the soil as natural fertilizer. If it were collected and used properly, the manure that is wasted could provide farmers with nearly twice as much nitrogen, twice the phosphorus, and six times the potassium they purchase commercially. And a great deal of urban and industrial wastes can be turned into high-quality

Murlidhar Dawani

"I would prefer lesser animals of an improved breed rather than more of a normal breed. Healthy, good breed animals...will give me more benefit than more animals of bad breed and bad health which I would not be able to care for properly."

From the field, Chikiskot, Gilgit.

feed for livestock. Thus a comprehensive feed-livestock-waste-manure cycle can be set up both to use resources now being thrown away and to reduce contamination of cities and waterways with industrial wastes.

By the year 2001, 30% of the non-descript cattle population (which accounts for three-fourths of the cattle in the country) should have been converted to a smaller number of more productive crossbreeds. Investments in high-yield variety fodders and in a system that makes hygienic feed from urban and industrial wastes will result in a 15% increase in feed per animal. Rangeland productivity overall is expected to increase 25-30% through the community management of the systems, supported by institutional and marketing improvements.

The economic benefits of restoring rangelands and improving livestock quality will arise from the higher productivity of healthier animals that have more to graze on.

## RECOMMENDATIONS

To restore rangelands and improve livestock quality, three programmes and an investment of Rs. 2.56 billion are called for:

- community-based range management,
- selective sand dune stabilization, and
- disseminating high-yield variety fodder and improving livestock quality.

Salman Rashid

Rangeland productivity overall is expected to increase 25-30% through the community management of the systems, supported by institutional and marketing improvements.

# WATER BODIES & FISHERIES

As much as 90% of tropical marine species pass at least one stage of their life cycle in mangrove forests, which are self-maintaining and renewable coastal protection barriers. Deltas covered by mangroves are four to seven times more productive than other deltas, so their protection is vitally important. Yet these habitats are under increasing stress from reduced freshwater flows, from sewage and industrial pollution, from the extraction of fodder, fuelwood, and timber, and from clear-cutting for development. Although the critical link between fisheries and mangroves is acknowledged, all fishery management policies focus on controlling fishing efforts; little if any emphasis is placed on the conservation and management of mangrove habitats.

Several current and proposed projects are likely to have a considerable impact on marine and coastal resources. The Indus Water Accord allows provinces to withdraw additional water from the river. The coastal zone management plan envisages recreational development from Cape Monze to the Indus Delta. And there are plans to construct a long-sea outfall for waste disposal. The possible effects of these proposals on the health of marine systems and of fisheries need careful consideration.

The products of fisheries accounted for 3-5% of Pakistan's export earnings in the 1980s, mainly due to the strong international demand for shrimp. As more and more fish are harvested, it is taking greater effort per unit of catch to reap the benefits. Signs of overfishing can be seen in the greatly reduced landings of large and medium-sized shrimp a number of years in a row during the 1980s.

To support marine fisheries, research is urgently needed on sustainable yields, and technical assistance on processing should be provided to fishers to improve their take of high-value table fish. The closed-season bans must be enforced if depleted shrimp stocks are to be restored, and government could help further by providing other employment in those areas to take the pressure off fisheries. Inland fisheries can be encouraged by introducing pen culture in small reservoirs based on market wastes and by promoting aquaculture through the development of river stretch-

es, abandoned canals, and waterlogged lands.

Considerable scope exists in Pakistan to expand aquaculture. Already, 3,266 fish farms exist in the country in dug-out ponds, covering an estimated 5,000 hectares mainly in the Punjab and Sindh. But 400,000 additional hectares in Pakistan are waterlogged, permanently under water that is not too brackish and is suitable for aquaculture. Marginal, low-lying agricultural land can also be used. And more than 1,000 small and mini-dams built in rain-fed areas provide areas where fish farming could be developed.

These programmes will involve providing off-season employment for up to 6,000 fishers, and alternative employment for 2,500 people living in mangroves. The emphasis on aquaculture is expected to result in 12,000 hectares of waste-land being used for fish farming and a further 6,000 hectares for fish ponds, nearly a four-fold increase in the two systems over levels in 1990. Pen fish culture will be improved on 5,700 hectares of small reservoirs. To supply this sector, the conversion of fruit and vegetable market wastes into fish feed will be promoted.

## RECOMMENDATIONS

Seven programmes and an investment of Rs. 1.3 billion are suggested in order to protect water bodies and sustain fisheries:

- sustaining mangroves under reduced freshwater inflows,
- improved handling of marine catch,
- ancillary employment programme for fishers,
- use of wastelands for fish farming,
- integration of fish farming into agro-pastoral systems,
- pen fish culture in small reservoirs using fruit or vegetable wastes, and
- promotion of integrated pest management.

Meraj Siddiqui

The emphasis on integrated pest management should reduce the use of chemical pesticides, improving the quality of water and lowering the threat to fish stocks.

Preventing the collapse of marine and inland capture fisheries will have obvious economic benefits, as will reducing the need to use expensive chemical pesticides as integrated pest management proves effective.

# B I O D I V E R S I T Y

Pakistan has a great variety and richness of flora and fauna and of wildlife habitats, including nine major ecological zones and 21 out of 22 of the recognized Asian wetland types, which provide winter habitats or resting stations for millions of migratory birds. The richness of Pakistan's natural environment also meets important recreation and tourism needs. In some developing countries, such as Costa Rica and Zimbabwe, tourism is one of the most rapidly growing industries and a major earner of foreign exchange. Yet recreation and tourism, if not developed and managed with care, can be a major instrument of environmental degradation and can destroy the resource base on which it depends. Hunting is an obvious example of this problem.

The statistics on the establishment of national parks, wildlife sanctuaries, and game reserves in Pakistan are at first sight impressive, with some 7.2 million hectares in these designated areas. Two national parks have been used to reintroduce previously lost species into former habitats — the black buck, and the cheer pheasant. Unfortunately, the national parks and protected areas fail to actually provide comprehensive coverage of the country's ecosystems, the policing of existing parks is inadequate, and few plans exist for the operation of these areas.

While a few species — the ibex, Marco Polo sheep, wild ass, and houbara bustard — face extinction from hunting pressures, the greater threat to Pakistan's biodiversity arises from the

Abrar Hussain Mirza

The houbara bustard: much in the news due to hunting pressure from princely quarters. But a greater threat to Pakistan's biodiversity arises from the loss of habitat.

loss of habitat. The country's natural capital is threatened by the relentless, incremental incursions into the forest by subsistence farmers; the killing of trees through lopping, burning, and tapping; the development of small agricultural plots among the trees; and excessive grazing by domestic animals. Rapid population growth, commercial forestry and fishing practices, growing industrial pollution, and expanding settlements all add to the pressures.

A national wildlife use and conservation policy is urgently needed. National parks and game reserves should be expanded to cover representatives of all national ecosystems, and their management must be improved. Helping communities adjacent to these areas to improve their food and fuelwood productivity will take pressure off the reserved areas. Local communities can also be involved by letting them develop community game reserves. In addition, incentives are needed to promote captive breeding and the artificial propagation of endangered medicinal plants, a resource that has barely been investigated and that could disappear before its life-saving properties are discovered.

## RECOMMENDATIONS

To conserve biodiversity, the NCS recommends investing Rs. 1.08 billion in seven programmes:

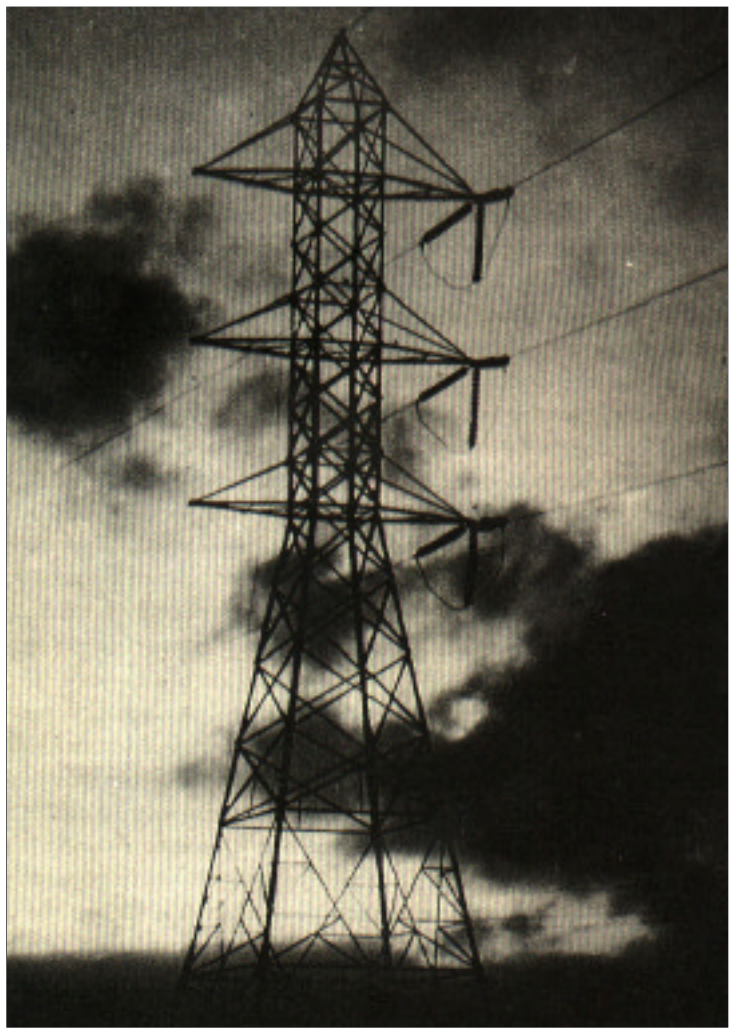
- management of national parks and protected areas,
- development of new national parks,
- development of new wetland reserves,
- a medical botanics and germplasm preservation programme,
- community management of game reserves,
- programmes for endangered species, and
- captive breeding in the private sector.

The NCS calls for the declaration of five new national parks and five new wetland reserves. Twenty management plans are needed for 15 national parks and five wetlands that are of international importance. At the community level, 20 game reserves are needed, at least three in each of six ecological zones. And encouraging 20 private game breeding farms for selected species can reduce the pressure of illegal hunting or trading. A priority research and management programme for five endangered species should make it possible to save them from extinction over the next decade.

This is one programme where it is impossible to demonstrate that investing in the future has a direct and substantial economic return in the short term. Nevertheless, such investment can be thought of as risk insurance by preserving species that may provide the key to food crops, synthetic drugs, and chemicals needed in the future.

# E N E R G Y  E F F I C I E N C Y

Pakistan is both energy-poor and energy-wasteful. Known gas reserves have a life expectancy of just 16 years, and domestic oil production meets less than a quarter of needs. Although most countries will have to deal with a scarcity of fossil fuels in time, Pakistan will face this situation sooner than many. Energy intensity in the production of a unit of goods is as high as in the United States, one of the most energy-inefficient industrial nations. During the Sixth Five-Year Plan, for example, nearly one-quarter of the energy in electricity was lost during transmission and distribution. Unlike developing countries with abundant energy supplies, such as China and India, Pakistan does not have the luxury of being able to go



Naushad Alam

Losses in electricity transmission and distribution have been calculated at upto 25%. By the end of the 1990s, these losses should have been reduced to 15% through energy efficiency and conservation pricing programmes.

## The name of the game should be cogeneration

Naushad Alam

The Finance and Trade Centre in Karachi has its own power plant. But that's only half the story for the miracle is that the plant supplies all the electricity and air-conditioning needs of the building at less than half the cost of the fuel that would have been used by the Karachi Electric Supply Corporation to supply the same amount of power. How has this been achieved? By using an energy-efficient cogeneration power plant.

Simply put, cogeneration plants generate electricity with steam as a by-product; but, instead of letting the steam go waste, it is used to heat or cool the premises where plants have been installed. Since the stations are on-site no electricity is lost during the transmission and distribution process, increasing the thermal efficiency of the power plants. FTC's boiler and two steam turbines have operated at an average annual thermal efficiency of about 66% that is, at double the national average of 33%. In reality, FTC's cogeneration plant is two-and-a-half times as efficient as any power plant in the country, for given the perennial transmission and distribution losses that haunt the national grid, the Water and Power Development Authority or KESC's thermal efficiency is closer to 25% than to 33%.

All this for an office that houses between 4,500-5,000 people at any one time during the working day.

What is even better is that FTC's plant generates enough power for both the electricity and cooling needs of the building using the same amount of sui gas originally sanctioned for just the air conditioning system. This comes to about 2.8 megawatts (MW) of power daily since 1989.

But the story does not end here: this power has been generated with practically no pollution. Almost all of Pakistan's conventional thermal power stations use furnace oil of the lowest grade, oil that contains a minimum 3.5% of sulphur; for every 1,000 MW of electricity generated, they emit about 100 tons of sulphur oxides, adding to the air pollution already present in our cities. To fulfill FTC's needs since the start of the building's functioning in 1989, KESC would have burnt 7,714 tons of furnace oil in its conventional stations — the Finance and Trade Centre plant has saved Karachiites from emissions of about 270 tons of sulphur and its attendant respiratory and health problems during this period.

Pakistan is facing an energy crisis. The solution lies in generating more electricity and in making better use of current supplies. Cogeneration power plants could be the answer to both needs, especially in the industrial sector with its coincidental requirement of electricity plus hot water, steam and the like. There are literally thousands of industrial units in the country which could benefit from cogeneration plants with the added advantage of a reduction in the country's air pollution levels.

— Ainul Abedin

through a profligate period before making efficiency adjustments.

Industrial waste is a source of energy that is increasingly being tapped in industrial nations. Cogeneration involves burning waste from industrial processes to provide energy for a factory. It tackles two problems at once: waste disposal and energy needs. Industry in Pakistan could generate up to 500 megawatts of energy through cogeneration in the 1990s. Government could encourage the development of this energy source by guaranteeing to buy any surplus energy at the utility's full marginal cost.

A kilowatt of energy saved through conservation should be considered just as much a source of energy as a kilowatt obtained from oil or gas resources. Industry has the greatest opportunity to save energy though conservation measures, with the potential to save 22% of the energy it uses with no loss of output. Tube-well energy-

David Pearson

For 1.2 million individual households, distributing 200,000 efficient cookstoves and 20,000 tandoors will lead to 25-40% savings in fuel use.

use efficiencies could be doubled, and the efficiency of cars could be improved 5% through tune-ups alone. Low-cost insulation materials are also needed for buildings, and heat losses through windows must be reduced. Efficiency has important side-benefits: better cookstoves can reduce pressure on fuelwood supplies, and vehicles that run more efficiently also run cleaner, lowering pollution levels in cities. A gradual move towards conservation pricing of energy is an important component in the societal shift towards efficiency.

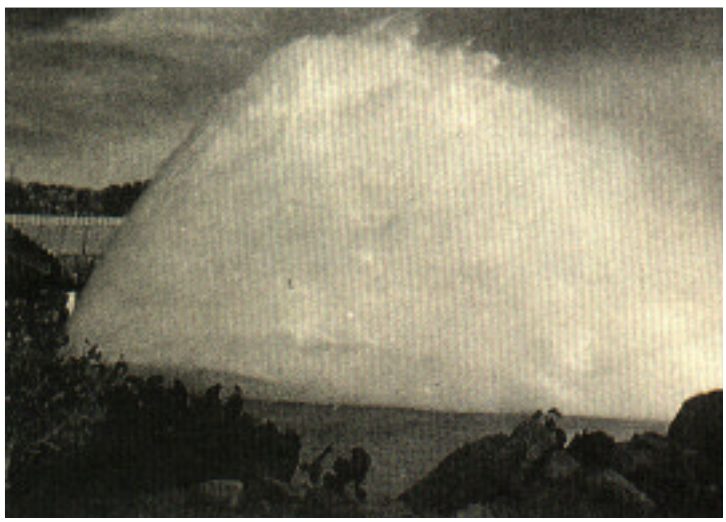
By the end of the 1990s, electricity transmission and distribution losses should have been reduced from 25% to 15% through these programmes. Investment in such industrial energy-saving devices as boiler tuneups, upgrades of steam systems and boilers, heat recovery, and better motors should cut energy use in the industrial sector by 10%. And the encouragement of cogeneration in industry could yield up to 500 megawatts of additional energy. For 1.2 million individual households, distributing 200,000 efficient cookstoves and 20,000 tandoors will lead to 25-40% savings in fuel use.

The economic benefits of this programme stem from doing more with less — getting 10-12% more energy from existing and planned commercial energy supply at a cost much below that of new supply.

## RECOMMENDATIONS

The five programmes to increase energy efficiency over the next decade require the third largest investment called for in the NCS — Rs. 21.5 billion:

- energy conservation by reducing transmission and distribution losses,
- energy conservation in large industries,
- energy conservation in buildings, retrofits, and appliances,
- energy-efficient cooking programme, and
- cogeneration in industrial units.



John Thorniaroft

A kilowatt of energy saved through conservation should be considered just as much a source of energy as a kilowatt obtained from other resources.

# RENEWABLE ENERGY

Renewable energy sources are fairly undeveloped in Pakistan. Hydropower, for example, supplies 13% of the current supply of commercial energy — mainly through the Tarbela, Mangla, and Warsak dams — but only 11% of its potential has been tapped. Given the possible negative impacts of both large and small dams, however, efforts to develop this energy source further must consider sites carefully in order to minimize the effects on the environment and on people, who must be moved in the case of a large dam. Any benefit-cost analysis of such dams must include the full cost of compensating people and of adequate watershed management.

Biogas plants are another little developed renewable source of energy. These units convert a portion of the organic content of animal dung into methane, which can be burned as a household fuel. Given the large number of livestock in the nation, the potential of biogas is considerable. Efforts to match India's success in this area (more than a million biogas plants operate there) have failed in Pakistan, due to social, technical, and financial problems and a lack of training for maintenance. A renewed attempt to develop this energy source is overdue, especially given recent advances in the technology. To succeed, it must keep overhead costs to a minimum, include maintenance training, and incorporate community support programmes.

Sabiha Daudi

Fuelwood can be considered a renewable energy source if it is managed properly. Although it is becoming increasingly scarce, 90% of rural households and 60% of urban ones still meet their needs for heating and cooking fuel from fuelwood and other biomass sources. Annual demand for fuelwood is

expected to rise from nearly 20 million cubic metres to more than 30 million by the end of the 1990s, spurring efforts to provide other renewable sources, to support community reforestation, and to use fuelwood more efficiently.

Initially, renewables may have to be sold on the basis of the advantages they bring in addition to reducing dependence on finite fossil fuels — such as the slurry that can be obtained from biogas plants and the low prices of using solar energy directly for cooking and heating water. Windmills and mini- and micro-hydels will be able to fill market niches in rural areas that the national grid cannot possibly reach. Once people in rural areas become familiar with the advantages of renewables — the prospects of local control, that is, and of not being subject to frequent load-shedding — the market for these energy sources should increase quickly.

The biogas portion of this programme involves having the private sector install 100,000 family-sized units and 50,000 larger, community-sized units over the next decade — enough to meet the energy needs of 600,000 households. Government support for this will consist of demonstration sites, training for maintenance and community organization of supply, and subsidies where necessary. The renewable energy programme also envisions installing 115,000 direct solar cookers, 30,000 solar water heaters, and enough open-core gasifiers and solid-state fermentation units to generate the equivalent of 18 megawatts of energy. A further 5 megawatts will become available from windmill pumps, 40 megawatts from micro- and mini-hydel units, and 25 megawatts from woodfuel-based plantations that can be planted on current wasteland.

The direct economic benefits of developing renewable sources of energy stem from reducing the use of fossil fuels. The indirect benefits will be felt by all those who have greater control over their energy supplies at the local level.

## RECOMMENDATIONS

The NCS recommends spending Rs. 6.34 billion in 1992-2001 on seven programmes to develop and deploy renewable energy sources:

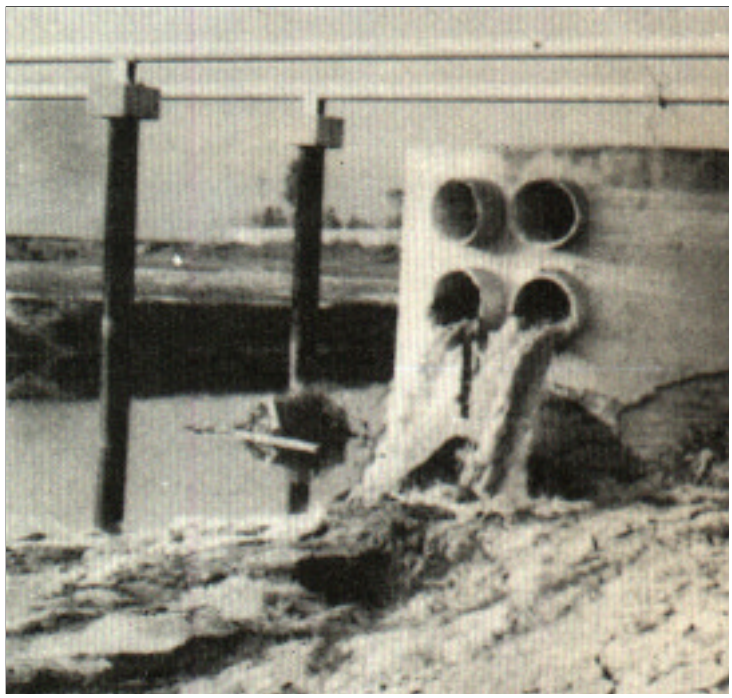
- developing and deploying biogas units,
- developing and deploying open-core gasifiers and solid-state fermentation units,
- developing and deploying solar water heaters and solar cookers,
- developing and deploying windmill pumps,
- energy from woodfuel plantations,
- development of micro- and mini-hydel plants, and
- applied research and development of wind energy farms.

# P O L L U T I O N

Pollution in Pakistan has many faces. Its sources include industry, transportation, cities, and farming. And it affects water, land, and the air.

Pakistan generates 47,920 tonnes of solid waste a day — 17.5 million tonnes per year. Solid waste is typically dumped onto low-lying land that lacks sanitary landfill facilities, causing considerable land pollution problems. The result is unsightly and unsanitary conditions in and around dump sites, the loss of land that could be used more productively, and the loss of potentially valuable recyclable materials.

Only 53% of the population has access to safe water — 79% of city-dwellers and 40% of those in rural areas. This is a good part of the explanation for the wide spread of water-borne diseases. Gastrointestinal diseases account for 25-30% of hospital cases, and about 60% of infant deaths are due to infectious and parasitic diseases, most of which are water-borne. Some rivers become mere sewage carriers at low-flow periods due to the lack of urban waste disposal services; pollution of the Ravi below Lahore has cut fish production in this river by 5,000 tonnes a year.



Beena Sarwar & Ijaz Ahmed

A practical blend of regulations and incentives is recommended to control water, air and land pollution. The best pollution control measures use and restore the body that receives the pollutants, or recycle pollutants in ways that are safe as well as profitable.

Industry commonly discards wastes directly on the land or into waters, with little regard for the consequences. A 1985 country-wide survey of 100 hazardous chemical industries, for example, found that only three plants treated their wastes to accepted standards; the rest just got rid of them in the most convenient way. The SITE and LITE industrial estates in Karachi dump large amounts of organic matter, heavy metals, oils and greases, and other materials into local rivers and the city's polluted harbour. Companies in Faisalabad do the same with their wastes, disposing of them in municipal sewers without any pre-treatment. And discharges from the Pak-Arab fertilizer plant in Multan have been linked to livestock deaths and contaminated agricultural land.

Industry and power generation are becoming major sources of carbon dioxide and sulphur dioxide emissions. As industries expand their reliance on natural gas, coal, and oil as fuels, air pollution is expected to increase substantially, which can damage crops in the vicinity, contribute to the deterioration of soil quality, and harm human health. Full information on industrial air emissions in Pakistan is not available, as neither comprehensive surveys nor spot checks have been reported. Nor has a comprehensive, systemic assessment of pollution in the nation's coastal zone been done.

The transportation sector is responsible for a good deal of the worsening air pollution problem. Motor vehicle emissions in Lahore account for approximately 90% of the total annual emissions of hydrocarbons, aldehydes, and carbon monoxide there — the latter the most common toxic urban air pollutant, which reduces the blood's ability to carry oxygen. The average vehicle in Pakistan emits 25 times as much carbon monoxide, 20 times as many hydrocarbons, and 3.6 times as much nitrous oxides in grams per kilometre as the average U.S.
vehicle. Carbon monoxide in both Lahore and Karachi is at levels known to cause temporary impairment of nervous system functions after eight hours of exposure.

Farming is also contributing to pollution problems as pesticides and fertilizers build up in groundwater and in rivers and streams. Incorrect use of these chemicals adds to the problem as water runs off agricultural fields. Dead fish, apparently due to pesticides, have been reported on the banks of the Kabul River in certain seasons. Shallow wells used for drinking water in villages and cities can also become contaminated.

A practical blend of regulations and incentives is recommended to control water, air, and land pollution. For industry, these must work hand in hand with careful consideration of where to place factories and efforts to promote envi-

Saneeya Hussain

"Vehicular pollution is a problem of the poor, but it is caused by the rich. The poor don't have cars but for the rich there is a car for the daughter, one for the son and yet another for the begum sahib. If you want to make a good policy make one that stops the wasteful habits of the rich."

Student, Bahauddin Zakariya University, Multan.


SCOPE

Air pollution must be tackled through better maintenance of motor vehicles and of industrial boilers and furnaces.

ronmentally beneficial industries through fiscal and trade incentives. Government should promote rural industrialization, but guide companies away from prime agricultural land. Clean processes and recycling can be supported through the dissemination of no- and low-waste technologies, support for waste trading networks, and tax holidays for the recycling industry.

The best pollution control measures use and restore the body that receives the pollutants, or recycle pollutants in ways that are safe as well as profitable. Domestic wastewater, for example, can be used to irrigate non-food crops, and sludge can be used as fertilizer, so long as it is monitored to avoid heavy metals. In industry, reducing the amount of waste at source is the preferred method, combined with disposal methods that prevent discharge into municipal sewers. Government regulations and standards need to be

established in consultation with industry, along with specific waste management plans.

Air pollution must be tackled through better maintenance of motor vehicles and of industrial boilers and furnaces. All new cars can be required to meet the most stringent standards for emissions, fuel-efficient cars can be favoured through a sliding scale of import duties, and a high price for fuel (except diesel) can cut down on unnecessary trips and encourage people to use public transport and trains. Abandoning or reducing the subsidy on kerosene could prevent its being mixed with diesel fuel, which results in high emission levels. A move towards unleaded petrol can be encouraged through a tax adjustment that makes this fuel choice 5% cheaper.

Pollution of the land can be reduced by supporting the already active scavenging sector. Nearly all the glass, paper, and metal discarded is already retrieved and recycled. Most of what is left — 85% in rural areas and 65% in cities — could be composted if appropriate support programmes were available. At the same time, proper sanitary landfill practices need to be enforced.

By the year 2001, following these programmes will shift about 10% of new industry towards innocuous, biodegradable, or non-toxic processes, wastes, and products. These companies will either use the wastes of another industry, support an environmentally benign practice, contribute to energy conservation, make pollution abatement equipment, or substitute a safe process for an environmentally degrading one. By subsidizing the retrofitting of pollution abatement equipment, some 750 of the most hazardous industrial units, 1,250 moderately hazardous ones, and 2,500 potentially hazardous

## RECOMMENDATIONS

Preventing and abating pollution requires the second largest investment called for in the NCS — Rs. 22 billion for seven programmes over the next decade:

- shifting industry composition towards environmentally benign processes and products,
- integrating clean, low-waste technology in new large manufacturing,
- retrofitting of pollution abatement equipment in existing formal industry,
- collection and treatment of wastes of urban small industries,
- refineries upgrading programme,
- vehicle tune-up and related programmes, and
- setting up compressed natural gas stations.

S.M. Shahid

units can be brought into compliance with accepted standards. A waste collection system could cover 70,000 small industry units within a decade, and 10 central industrial waste treatment plants should be in operation.

Pakistan can begin switching to lead-free petrol and to compressed natural gas (CNG), with a goal of having 75 CNG stations open by 2001. Motor vehicle maintenance programmes and the incorporation of quantitative standards in the Motor Vehicles Ordinance will help the nation's vehicles reach compliance with emission standards now required in most industrial countries.

The economic benefits of this package of programmes will flow from lowered levels of pollutants in Pakistan's air, water, land, and food, which in turn will reduce human illnesses and deaths. The production of crops and fish will also increase as the natural systems on which they depend become cleaner.

The economic benefits of this package of programmes will flow from lowered levels of pollutants in Pakistan's air, water, land and food which in turn will reduce human illnesses and deaths.

# URBAN WASTES

Of the nearly 48,000 tonnes of solid waste generated each day in Pakistan, 19,170 tonnes comes from cities. The only sewage treatment plants are found in Islamabad and Karachi, and those in the latter function only intermittently. For all practical purposes, essentially all urban sewage outside of Islamabad is discharged raw and untreated.

Waste disposal already often takes 20-25% of a city's budget, although only about half the wastes are collected. And only half the human waste in cities makes its way to sewers; the rest is deposited on the roadside, dumped in waterways, or incorporated in solid waste. Karachi alone discharges approximately 300 million gallons of sewage a day and Lahore, 240 million gallons.

Given the general failure of municipal collection of wastes, garbage collection should be handed over in stages to the private sector, in the form of the extensive network of scavengers. Local governments will still need to arrange for proper disposal in sanitary landfills of materials from which everything of value has been extracted. To collect such remnants, garbage purchase schemes can be set up at various delivery points.

An initial investment under this programme will involve improving solid waste management and establishing composting plants in eight cities and 60 small towns over the next 10 years. Energy-from-waste plants would be brought into operation in 12 cities, sewage farms would be established in four cities, and oxidation ponds for the biological treatment of waste would be found in 13 towns. By

## RECOMMENDATIONS

To manage urban wastes in the next 10 years, the NCS recommends spending Rs. 13.35 billion on four programmes:

- garbage collection and disposal,
- energy-from-waste plants,
- wastewater treatment of livestock farms, and
- construction of oxidation ditches and other biological treatment of wastes.

the year 2001, about 40% of the urban population should be served by some form of improved effluent management.

Included in the economic benefits of managing urban wastes better are improved health, the production of non-food crops from treated municipal effluents, and energy supplies extracted from materials that would otherwise have been wasted.

S.M. Shahid

"We want to keep our homes clean even if it means living in filthy streets. We throw our garbage on the streets thinking our own house is now clean. Thus to talk about pollution is useless because we ourselves are contributing to this pollution. If I am able to keep myself clean it would mean there is one less dirty person in the world. This itself would be a sufficiently positive change."

Dr. Amjad, Faculty of Food Technology, Agriculture University, Faisalabad.

# INSTITUTIONS FOR COMMON RESOURCES

Community organizations are essential for the success of efforts to better manage Pakistan's use and maintenance of natural resources. They are cited as integral to the proposals in most of the 13 other core areas of the NCS, and are the foundation for the programme area focused on institutions for common resources.

Non-governmental organizations (NGOs) can be supported by federal, provincial, and local governments in the establishment of these institutions. In areas where they are not active, community participatory programmes can form the launching pad for such institutions. Where government funds are provided, provincial government can play an annual monitoring and evaluation role. Local bodies should be encouraged to consult with the institutions for common resources on the preparation of district development plans.

## RECOMMENDATIONS

To support institutions for common resources, the NCS calls for an investment of Rs. 3 billion in one programme: rural and urban community organizations.

- This investment should result in 8,000 rural and 3,550 urban grassroots organizations that are pursuing community development initiatives by the year 2001. The economic benefits are difficult to quantify: they will be found in the many projects undertaken by these groups to preserve natural resources and improve the quality of life locally.

Soni Zuberi

In areas where they are not active, community participatory programmes can form the launching pad for institutions for common resources.

## Helping itself: Gunyar

Barely fifty years ago, Gunyar village in Malakand Agency was surrounded by chir pine and eucalyptus trees. The mountain overlooking the village is called Nakhtargay after the pine trees that covered its slopes. Today it is still known by that name though there are barely any trees left.

The denuded slopes around Gunyar bear testimony to the increasing need for fodder and fuelwood. Deforestation has also contributed to the loss of soil cover resulting in a substantial decrease in the farmers' wheat and maize yields. But Gunyar is determined to reverse its impending fate.

In 1984, there was a landslide in the village and several lives were lost. No outside help arrived. Though there was disappointment and disillusion, it did not deter or discourage the villagers. In fact, it brought about a small revolution: the youth of the village united to form the Anjuman-e-Behbud-e-Naujawanan-e-Gunyar, or the Gunyar Youth Welfare Association. It was registered in 1985 under the Voluntary Social Welfare Agencies Ordinance, 1961.

The idea of a youth organization was initially resented by village elders, but they soon relented when they saw that the Anjuman's only motive was to serve the community. Their first project was to build a tank to store water from the stream for the village followed by a drainage scheme to channel household waste water.

But GYWA was to be motivated to do more than community work; they were to do work to improve the quality of their community life by improving the environment. The impetus came from Dr. Hanif Qazi, a professor of biology in Peshawar University whose family had lived in Gunyar for generations. On frequent visits to Gunyar, he noticed the loss of forest cover around the village. He also noticed the efforts of the Anjuman and their willingness to do more.

In February 1987 there was an opportunity to put the GYWA's energy to good use. Dr. Qazi chanced upon 15,000 saplings of chir pine and eucalyptus which the US Embassy's Narcotics Affairs Unit had failed to utilize in a poppy substitution project at Agra in the NWFP. These were happily promised to Dr. Qazi who then approached the Gunyar group; stressing that tree cover led to better agricultural yields, he proposed the reforestation of the denuded slopes. The GYWA readily agreed to do the planting and after the saplings were planted, the area was closed to grazing. The group had managed this on a voluntary, self-help basis.

When the community's endeavours had registered success and had been noticed and assisted by a grant from the New Zealand government, the GYWA was confident enough to prepare a resource conservation project to present to other donors.

This was launched with funding from the Canadian International Development Agency and the assistance of IUCN Pakistan. When the project began in June 1992, the time for sowing maize was approaching. The Anjuman recommended the use of an appropriate variety of maize seed, a specific amount of fertilizer and a deep chisel plough for the fields. Twenty-nine farmers agreed to participate; the results were highly encouraging. The farmers harvested twice the amount of grain and stover than usual. When it was time to sow wheat, 69 farmers were eager to try out the project recommendations. Here again, the yield was two-and-a-half times the previous amount. The PATA ground water projects have offered to buy extra seed from Gunyar and the farmers can now afford their own seeds and fertilizers for the next sowing season.

The Gunyar folk are now bursting with enthusiasm and energy. They have found the confidence to steer the project and their lives, themselves.

— Sahar Ali

# POPULATION AND ENVIRONMENT

Pakistan has the fourteenth highest rate of increase among countries with more than 1 million people. Among the nine more populous countries, only Nigeria has a comparably high growth rate, and only Bangladesh, Japan, and India are more densely settled. Pakistan covers 0.67% of the world's land, contains 2% of its people, but in the next 10 years will account for 4% of world population growth. By the year 2010, it is likely to be the eighth most populated country in the world. About 45% of the population is under the age of 15, putting a heavy burden on the adult population and implying future rapid growth even if fertility rates decline.

Although death rates declined dramatically in the

David Pearson

"With each generation land holdings are getting smaller and smaller. Now farmers have such small holdings that they can neither afford to keep too many cattle nor buy fertilizer, pesticides and weedicides. What should the small farmer do?"

From the field, Chak 332, JB, District Toba Tek Singh.

1940s and 1950s following the introduction of various public health measures, the crude birth rate has stayed largely unchanged. Currently the average number of children per woman is 6.5. And the infant mortality rate has only recently started to fall, reaching 108 per thousand live births in 1988. Thus a substantial share of deaths in Pakistan are of infants and children.

Contraceptive usage rates among married women remain below 10% despite 25 years of an official Population Planning Programme. The desire for more than four children has not changed during the last 20 years, and only recently has it seemed that fertility rate declines expected to follow urbanization may actually be occurring.

Urban areas occupy less than 1% of Pakistan's land area but contain 30% of the population. Karachi alone accounts for one-fifth of urban dwellers, and seven other cities above 500,000 population each contain another 30%. More than one-quarter of the urban population lives in illegal settlements, many on marginal sites subject to floods and other hazards. Given the continuing high population growth rates in cities and migration from rural areas, the nation is expected to become predominantly urban sometime after 2010.

S.M. Shahid

Population planning needs to be addressed in a broad perspective that considers natural and capital resource balances. It needs to acknowledge that Pakistan may just be able to accommodate the 200 million people projected to live there by 2010-13, but that there is no possibility of providing a decent standard of living for the 400 million expected by 2035-40 if current growth rates continue. One study of population carrying capacities suggests that food shortages may first intensify in the sandy deserts and other ecologically fragile zones.

Efforts thus need to be made to reduce the fertility rate as rapidly as possible through the support of family planning and increased allocations for education

One study of population carrying capacities suggests that food shortages may first intensify in the sandy deserts and other ecologically fragile zones.

and health care programmes. When women are more confident the children they bear will survive, they will be less likely to have large families as a form of insurance against the death of children. And education of parents, particularly mothers, has been found to be critical for improving chances of child survival.

People should be encouraged to move from ecologically fragile areas, and to stay in districts where irrigation provides a supportive agricultural base. At the same time, a national human settlements policy is needed to focus growth on selected secondary cities, taking pressure off established and overcrowded urban areas. Within cities, to improve the quality of life efforts must be made to provide housing and services for the poor, put currently vacant land to better uses, improve public and mass transit systems, and support private voluntary organizations that can increase citizen involvement in city affairs.

With a concerted effort and investment in population welfare and family planning programmes, Pakistan can reduce its total fertility rate by one-third within a decade — from 6.5 children per woman to 4.4. A longer-term goal would be to reach replacement-level fertility (2.1 children per woman) by the year 2035. The intensive programme in ecologically fragile areas, combined with efforts to bolster secondary cities and provide more jobs in irrigated zones, could reduce the pressure of numbers on the natural resources most under threat.

The economic benefits of a population that is growing more slowly are obvious: financial and natural resources that are already straining to meet the needs of the current population have to be stretched that much less farther. In addition, investments in the infrastructure of society — roads and bridges, for example — do not become redundant before they are already completed. And reduced population pressures in ecologically fragile zones can relieve some of the strains that lead to such uneconomical situations as downstream reservoirs that fill with sedimentation just a few years after they are completed.

## RECOMMENDATIONS

In order to integrate population and environment programmes, Rs. 14 billion needs to be spent during the next 10 years on three programmes:

- acceleration of conventional population welfare programme through health system and NGOs,
- involvement of resource sector extension agents in disseminating family planning goals, and
- intensive population programme in fragile areas with high fertility rates.

# CULTURAL HERITAGE

Pakistan has a rich cultural heritage of archaeological remains, monuments, old cities, and historic and architecturally significant buildings and streets. Less tangible but no less important are the nation's social customs, languages, and oral traditions on the wise use of natural resources. This heritage carries with it a sense of identity, place, and purpose for successive generations of Pakistanis. These resources have both aesthetic and economic values: they stimulate business enterprise and social, religious, research, and academic interest; they provide recreational enjoyment for locals and visitors alike; and they serve as places of residence. The Walled City of Lahore, for example, is home to 186,000 people.

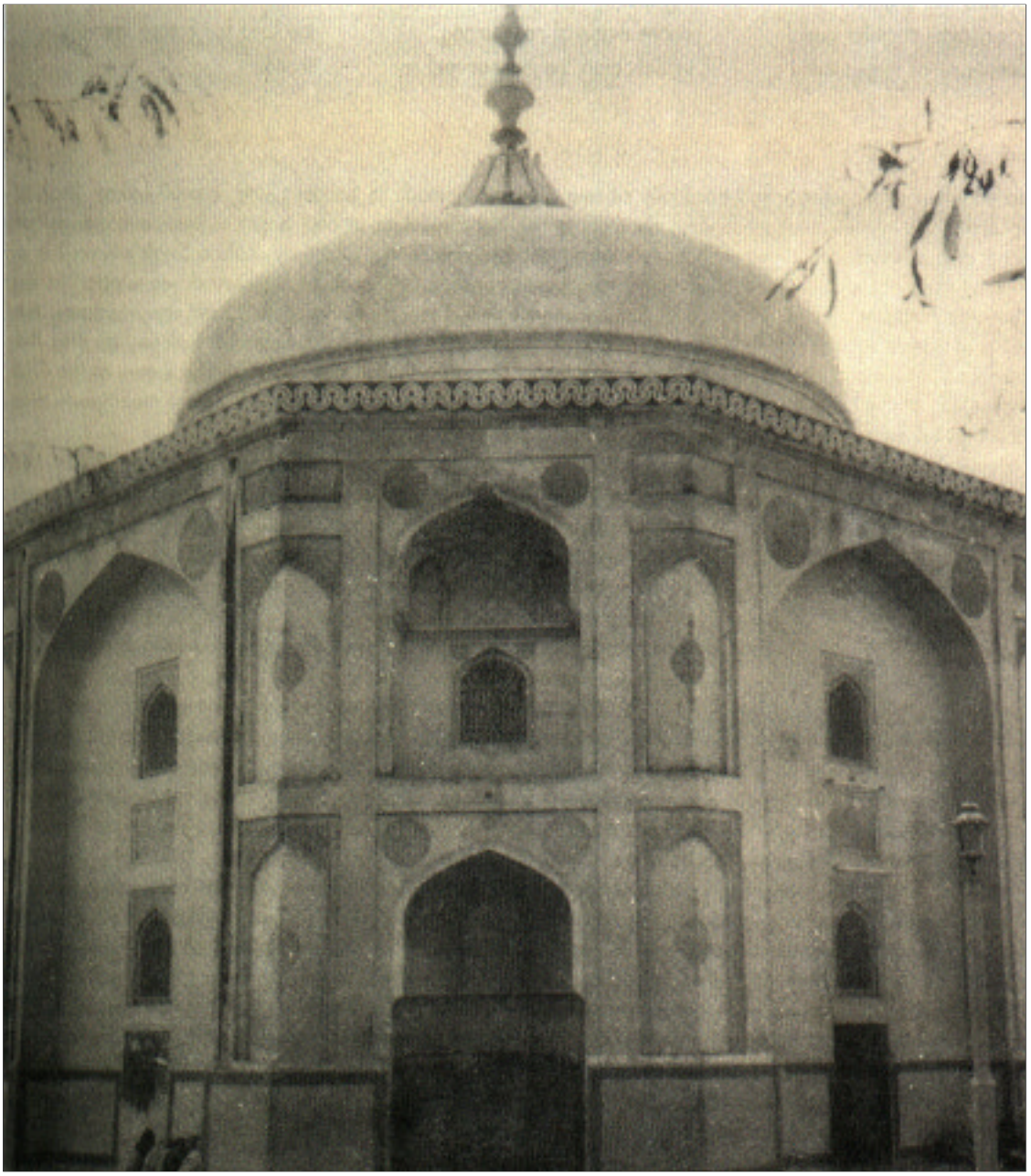
Natural deterioration of these sites is being accelerated by vandalism, urban pressures, encroachment, and insensitive restoration. Only 146 out of 1,799 historical monuments and 33 out of 112 archaeological sites identified thus far have been conserved to date. The growing revenues from tourism at these sites should be directed to environmental restoration of these sites and at more neglected locations that hold high potential for tourism in the future.

By decade's end, these programmes will have resulted in the designation and conservation of priority old city and historic towns, buildings, and localities of architectural merit. Joint research by university anthropol-

## RECOMMENDATIONS

Preserving the cultural heritage of Pakistan will require an investment of Rs. 2.45 billion from 1992-2001 in six programmes:

- area conservation in large urban centres of historical and cultural significance and shopping precincts,
- area conservation in small historic towns,
- conservation of historical monuments and buildings,
- conservation of archaeological sites, monuments, and forts,
- restoration of buildings of architectural merit, and
- identification and documentation of traditional resource-conserving cultural practices.



Matanat Mohsin

The growing revenues from tourism at cultural heritage sites should be directed to environmental restoration of these sites and at more neglected locations that hold high potential for tourism in the future.

ogists and the Institute of Folk Heritage should yield an inventory of regionally significant practices to conserve natural resources, which can be preserved in recorded form so as not to be lost for future generations.

## From the jaws of demolition

Located on a small island in the middle of two diverging roads in Lohari Gate, Haveli Lakhe Shah is arguably one of the most beautiful structures in the old city. And at one point in imminent danger of being demolished. Like most of Lahore's antique buildings in the Old City, Lakhe Shah's haveli is a tall — four-storeyed — structure built of narrow rose-coloured brick. Huge bay windows supported by lotus flowers fashioned from cut brick jut out on three sides of the building. Aside from the windows, the facade is a frieze of delicately wrought pillars and arches. A continuous covered balcony girdles the second floor. At the top of the building is a large roof terrace which affords wonderful views of the Old City's skyline, of the deep quadrangle of the Neeven Masjid — possibly Lahore's oldest mosque — and the flower seller bazaar of Lohari gate.

The haveli was built in 1901 by a rich Hindu merchant called, predictably enough, Lakhe Shah. His son, Kashmiri Lal, still owned the building in 1940. When the family fled Lahore at Partition, the haveli was declared evacuee property and eventually changed hands through the settlement process. But for years it served as a dormitory for migrant squatters from across the border. Originally there were five spacious rooms to every floor which were subsequently partitioned into several small cubicles, some no larger than a closet. An inner stairwell collapsed and the old well eventually choked up with debris. No money was spent on the building; when the wooden balcony was badly scorched in a fire or when cracks appeared in the facade, no repairs were made.

Not too long ago, the Pakistan Environmental Planning and Architectural Consultants drew up a detailed conservation plan for the haveli. Despite its decrepit appearance, they discovered that the building was structurally sound though some of the steel girders and floor slabs which support the masonry walls would need extensive repairs, and in places, reconstruction. Minor repair work would restore the facade and balcony. Altogether the requisite conservation work was not extensive, but would necessarily be slow and expensive.

However, since the owner was not interested in conservation, the plan was never implemented.

During the real estate boom of the 1980s, the owner of Lakhe Shah's haveli woke up to the market value of his property and decided to sell it to property developers. It took some years to evacuate the squatters but by mid-1993, the owner was ready to sell. However, his asking price, Rs. 3 million, was too steep for local plaza builders and so negotiations halted for a while.

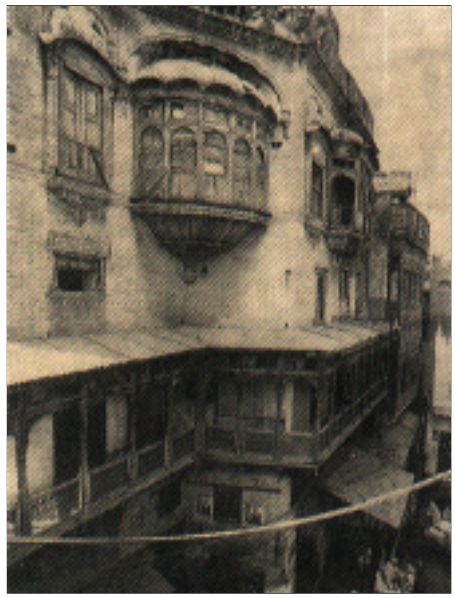
It was at this stage that Anjuman-e-Mimaran, a Lahore based non-profit organisation dedicated to conserving and studying architectural heritage, stepped on to the scene. Eager to prevent yet another historical landmark from disappearing, it set itself the task of raising the necessary cash in order to buy and restore the building. The way Anjuman-e-Mimaran planned it, once restored the building would

The economic benefits of this programme are more easily quantified than some: the revenue from entrance fees to tourism sites, and the increased income of local residents who provide services near these sites.

serve as a resource centre for people involved in the building crafts. The haveli would become a repository of books, technical drawings, manuscripts and other information on architectural design and techniques of construction. It would also serve as a headquarters for restoration and repair work on old buildings in the walled city and through seminars, exhibitions and lectures held here would educate the public on the value of conservation.

Since the haveli would have to pay for its own future maintenance it was planned that fund-raising events such as art exhibitions, book launchings, musical evenings and possibly even fashion shows be held here. Part of the haveli could also serve as a small but very special Mughlai restaurant.

Fortunately help was at hand in the shape of the National Fund for Cultural Heritage.



Hasan Gardezi

An initiative of Moin Qureshi's government, the heritage fund was set up specifically for the purchase and conservation of historically valuable buildings. When Anjuman-e-Mimaran approached the Fund for assistance in rescuing Lakhe Shah's haveli, the secretary for culture came down from Islamabad, took a look at the building and promptly agreed to provide matching funds, provided the Anjuman could rustle up the other half of the price. He also committed funds for the complete restoration of the building.

Since Anjuman-e-Mimaran itself is a non-profit organisation, it could not produce the matching funds. The only solution was to appeal to the public — which it did. One party which immediately evinced interest was a group of wealthy Lahoris, who have long bemoaned the loss of Lahore's architectural heritage. Together they agreed to put up the funds and save the haveli for use as a crafts centre for the public.

The National Fund for Cultural Heritage for its part has been as good as its word. The Anjuman's proposal has been formally accepted and in November 1994 it received the first installment of the amount committed.

Thanks to the efforts of local citizens, Haveli Lakhe Shah looks as though it is going to be saved after all. And when visitors return to the walled city after a long absence, the familiar landmark of Haveli Lakhe Shah will be there to welcome them, to guide them and orient them.

— Matanat Mohsin

# SUPPORTING PROGRAMMES

The success of all the programmes in the 14 core areas rests on numerous initiatives to build the capacity of people and institutions to undertake them. This entails effective communication, improved education, research and technology development, women in development programmes, specialized training for key groups, and better environmental information.

Effective communication of sustainable development requires sending appropriate messages to appropriate audiences through the most appropriate medium. Although television is the fastest growing medium, radio covers the whole country, broadcasting 300 hours of programming a day in 21 local and 15 international languages. It cuts through the literacy barrier and is particularly effective in reaching rural and female audiences. Radio should thus be the leading environmental medium in Pakistan, with due attention to regional variations in language, traditions, and culture.

Less traditional communicators are also important for delivering the message — mothers, teachers, religious leaders, celebrities, and community opinion leaders. By treating these individuals as partners rather than as targets of information, NGOs and government extension agents can share the urgent message about environmental issues.

Sustainable development and environmental ethics needs to be incorporated throughout the education system, through both formal and informal avenues. It generally should be developed and nurtured throughout the system, rather than being added on as a separate agenda. Many courses in primary and secondary schools can include environmental themes; these are particularly effective when they are related to issues students can recognize in their own local environments. In colleges, the subjects that already have ecological components need to be strengthened and given local relevance; environmental science could be introduced as an optional subject.

At the non-formal level, NGOs can be supported in their efforts to reach the large segment of the population not involved in schools. Basic literacy

programmes can incorporate environmental themes that focus on people's immediate concerns: family size, health, and hygiene.

Research and technology development in Pakistan has suffered from inadequate funding, a lack of incentives for Pakistani scientists currently working elsewhere, the absence of clear national research priorities, and a lack of support from the corporate sector and others who could benefit from research breakthroughs. Conservation sciences and technology need to become a national priority and an integral part of the National Science and Technology Policy. Research

Naushad Alam

"We get information from the radio and use it ourselves. No other institution has helped us with new and useful information."

From the field, District Toba Tek Singh

efforts need to focus on the nation's critical needs, such as improving water-use efficiency and energy conservation.

An important component of efforts to slow population growth and to better manage natural resources is initiatives to improve the status of women. Most women in Pakistan live in rural areas. They are largely illiterate, usually marry early, bear innumerable children, and suffer from health problems such as anaemia. They have little say or control over their lives, have low self-esteem, and are viewed as dependents. Yet as daily resource managers and as the primary keepers of environmental values, women have an important role to play as active and equal partners in sustainable development.

A women in development programme can help mobilize women in a way that enhances their social status. The media can help by portraying women as active participants in agriculture, industry, community work, and health care. Women's issues can be included in the expanded non-formal education and literacy programmes mentioned earlier. And in formal education, efforts must be made to meet the commitment of the Seventh Five-Year Plan to raise the enrolment of girls in primary school to 70% and to make schools available to all within a radius of 1.5 kilometres. Relaxing the age limit for entering schools could encourage women who married early to continue their education.

Women are also one of the key groups needing specialized training on all the issues covered in the NCS, with a focus on improving their employment prospects and earning capacity by emphasizing public health, human ecology, agriculture, and social forestry. Others needing special training — workshops, refresher courses, newsletters, and so on — are educators, the media, information officers, government extension agents, civil servants, and managers of NGOs. The ripple effect of such efforts is significant. Extension agents from the main government departments, for example, can become responsible for passing on sustainable development practices to their colleagues at the community level.

Information on the environment in Pakistan is erratic at best, hampering efforts to address problems. Institutions need to be developed that can devise a range of environmental information systems. Among those needed are natural resource inventories, dissemination systems that include a network of clearinghouses and resources centres, NGO state of the environment reporting, and environment statistics that can be incorporated into economic analysis and, eventually, the calculation of national income accounts.

# IMPLEMENTING THE NCS

Even as the NCS was being launched by the Government of Pakistan and IUCN on May 21, 1992, plans were being made to hold workshops with key sectors of society on its implementation. People are excited by the scope of the programmes recommended, and anxious to begin the hard work that lies ahead.

The NCS cannot succeed without the cooperation of the people of Pakistan, its ultimate resource. They are as creative as any people on earth. And resourceful in the most basic sense: they try to use resources wisely, and to take advantage of improvements that become available.

The creativity of Pakistanis could be further unleashed if their health, education, income, job security, and shelter needs were better met. And it is certainly true that this is made difficult by too rapid a growth in their numbers, which puts a strain on natural and societal resources.

But the people themselves are not the problem. Indeed, they must be part of the solution. That is why the National Conservation Strategy is addressed to the people of Pakistan.

Saneeya Hussain

The National Conservation Strategy cannot succeed without the cooperation of the people of Pakistan, its ultimate resource.