

## Summary

Forest depletion, soil degradation, solid waste management, water and air quality are the prioritised environmental problems in Nepal. About 88 per cent of the total population who live in rural Nepal face the first two environmental challenges. It is, therefore, necessary to communicate environmental information about these areas. Hence, this *State of the Environment (SOE) Report* focuses on agriculture and forestry sectors and documents information on the P-S-I-R (Pressure-State-Impact-Response) analytical framework.

Agriculture constitutes the base for Nepal's economic growth and 81 per cent of the active population depend upon it. The agriculture sector accounts for 42 per cent of GDP and about one quarter of the country's development budget has been allocated to this sector. The land use statistics shows about 2,968,017 ha of land under cultivation. On the average about 65 per cent of the total cultivated land is rain fed. About 62.8 per cent of the land is owned by 16.1 per cent of the total farmers. The per capita agricultural land has declined from 0.16 ha in 1980 to 0.13 ha in 1999. The man-land ratio in the cultivated land has increased considerably from 4.7 in 1971 to 7.5 persons/ha in 1991.

This sector is greatly affected by the loss of top fertile soil due to soil erosion, landslides, flood in the hills, and river-bank cutting, sedimentation, and inappropriate use of agro-chemicals in the plain areas. It is estimated that about 1.8 million tonnes of plant nutrients are removed away from the soils by crop harvests, and soil erosion, and only 0.3 million tonnes (16 per cent) are replenished by organic and mineral fertilisers.

Among the prominent pressures in agriculture sector in accelerating land degradation and in minimising farm production are land fragmentation, land holding, cropping practice, livestock population, inappropriate use of agro-chemicals, and introduction of high-yielding varieties. The number of landholdings has reached to 2.74 million in 1997 as against 2.19 million in 1991. The number of land parcels has increased from 9.51 million in 1991 to 10.83 million in 1997 and a family has an average number of 4 parcels. The number of marginalized farmers and small farmers with landholding below 1 ha accounts for 69.4 per cent. Sharing of parental land and small landholding has increased cultivation in marginal lands and steep slopes. Furthermore, hill farmers even grow erosion-inducing crops such as maize in the outward sloping terraces, marginal lands and steep slopes.

Livestock population has increased by about 13 per cent during the last 14 years (9.79 million livestock unit in 1984 to 11.22 LU in 1998) while the area of pastureland remains constant (1.7 million ha). Many of the urban centres have been developed in the fertile farmlands. Landslides, and soil erosion are common in hill roads, and sedimentation in the Terai and valley floor is pronounced. Symptoms of desert-like conditions have been observed in some areas. The agricultural land is also affected by agro-chemicals. The DDT contamination in foodstuffs has been observed.

Although soil loss varies from place to place and on the usage of land, about 5-10, 5-15, and 20-200 tonnes/ha/year of soil loss from well-managed paddy terraces, well-managed maize terraces, and poorly-managed sloping terraces respectively has been reported. Out of 9,827 farmland soils analysed two years back, about 48.2 and 40.2 per cent have low and medium level of nitrogen content respectively. Similarly, 64 per cent of the 7,520 soil samples analysed showed low organic matter content.

Yield of paddy, wheat and maize in kg per hectare has increased insignificantly through increased agro-inputs, cropping pattern and intensity. However, average yields of rice, wheat and maize are lower than those of other South Asian countries. Similar increase in livestock and fish products has been noticed due to increase in their population. Interestingly, Nepal is also a home for several indigenous livestock breeds. *Yak, lulu, kirko, achhame* including Hill and Terai cattle, and *chyangra, sinhal*, and *khari* goat, and *bhyanglung, baruwal, dhorel*, and *kage* sheep are indigenous genotypes. Various agricultural plants are also equally important and hence, about 10,500 samples of various crops have been preserved for germplasm.

Irrigation induced sedimentation is also an emerging issue in the plain areas. There is an increasing trend of depleting organic matter and plant nutrients due to loss of topsoil. It is estimated that the annual loss of about 5 tonnes/ha of soil would result to the equivalent loss of about 75 kg/ha of

organic matter, 3.8 kg/ha of nitrogen, 10 kg/ha of potassium, and 5 kg/ha of phosphorus. The yield rate of major crops has not increased in comparison to the increased area of irrigation facility, improved seeds, and other agricultural inputs. Furthermore, increasing number of unproductive cattle has also put additional pressure on forests, and farmland. The high numbers of cattle in limited area and its trampling effect has increased soil loss and surface run-off.

Discharge of industrial effluents to natural water bodies and high rate of sedimentation in the rivers, lakes, and reservoirs has negatively impacted the fish population, and this will likely continue in the near future. Several agricultural species are considered threatened. Introduction of high-yielding varieties has replaced the cultivation of local strains of paddy such as *Taulia*, *Thapa Chinia*, *Marshi*, *Mansara*, *Siramla* and *Masino*. *Oryza nivara* and *O. rufipogon* (parents of cultivated paddy) are on the verge of extinction from Ajigara swampy area of Kapilvastu district. Genetic erosion has also been noticed in fruit and fibre crops, rice and wheat species due to increasing use of high yielding varieties.

Forest – the most important natural resources for rural people, and environmental maintenance – is under great pressure for meeting firewood, fodder, timber, medicines and infrastructure development. The extensive utilization and increasing demands for forest products has led to its dwindling both in area and quality. In 1964, forest area comprised of 6.4 million ha of the total area while by the mid-1990s it has declined to 5.8 million ha including shrub land. However, the forest area is only 4.27 million ha (29 per cent) of the total area of the country. The forests declined from 37.4 per cent in mid-1980s to only 29 per cent a decade later while the shrub land has doubled during the same period. The annual deforestation is estimated to be 1.7 per cent with 2.3 per cent in the Hills, and 1.3 per cent in the Terai.

Forest depletion has a direct bearing on food production, habitat degradation of precious flora and fauna, and pollution reduction. Forest depletion has been caused by population growth rate of 2.37 per cent per annum, the high percentage energy share of firewood (78 per cent) from forests, increase in livestock population by 2.7 million head during the 14 years period (1984 to 1998) particularly in the Hills and Terai. The Hill-Terai migration and settlement programmes caused the clearance of a total of 103,968 ha of forests from 1950s to 1985. An equal area of forests may have been encroached during the same period for crop cultivation and settlements. The proportion of agricultural land has also increased from 38.5 per cent to 49.8 per cent between 1963-1979 in the Terai. Another pressure is the decline in growing stock of forest, which has declined from 522 million m<sup>3</sup> in mid-1980s to 387.5 million m<sup>3</sup> in 1999. For example, the growing stock of sal (*Shorea robusta*) declined from 101 m<sup>3</sup> to 72 m<sup>3</sup>/ha and other hard wood forests from 76 m<sup>3</sup> to 58 m<sup>3</sup>/ha in the Terai forests. Both timber and non-timber species including valued animals and their products are also affected by forest fire, illegal hunting and poaching, commercial trade, and trans-boundary smuggling. Wildlife is also affected by habitat alterations i.e. ecological succession and infrastructure-induced habitat fragmentation. It has been estimated that more than 120,000 hectares have been deforested for infrastructure development projects only and that this has greatly affected biodiversity. Furthermore, previous forest-related policies also affected the forests due to change in ownership from private to public, and abolishment of traditional practices for forest management. These affected the area, composition and structure of the forests. The per capita forest has also declined, for example, it is only 0.14 ha/person in the Terai.

Fifty-three, 31 and 45 species of flora and fauna reported in Nepal are included in the CITES appendix I, II and III respectively, and about 120 species of flora and fauna, which are recorded in Nepal, are mentioned in the IUCN Red List. However, stringent protection measures have increased population of rhinoceros, tiger and other wild mammals. For example, rhino population has increased from 108 in 1968 to 612 in 2000. The Tiger census (1995-'96) has estimated the population of tiger to be about 97 in some protected areas.

In 1993, 270 hectares of government-managed forest was handed over to users under leasehold forestry programmes, and this has increased to over 1,100 hectares by 1996. It has been estimated that about 61 per cent of the total forest area (3.3 million ha) could be managed in the form of community forests. In 1988, only 80 ha of government-managed forests was handed over to three community Forestry User Groups (CFUGs). By 6 March 2001, a total of 9,874 CFUGs have been legally recognised, and over 1 million people are directly involved in managing about 0.748 million ha of community forests. In the recent years, women's involvement has increased in community

forests and 376 all-women CFUGs have managed over 9 thousand ha of forests. Furthermore, about 21 per cent of the total committee members in CFUGs are women. However, the quality and area of forest coverage has declined due to continued extraction of non-timber forest products (NTFP), and inadequate inclusion of NTFPs conservation aspects in the operational plans of CFUGs.

The pressure has a direct impact on forest depletion, forest structure, and biodiversity. A total of 60 non-endemic and 47 endemic plant species have been documented as threatened. About 60 wild animal species are considered endangered. Landslide and floods affected about 42 thousand ha of land in 1995 alone. Scarcity of livestock fodder has accelerated pre-grazing and overgrazing. Emission of greenhouse gases has been increased. It is estimated that annual deforestation of 26,602 ha has emitted 7.77 million tonnes of carbon into the atmosphere. Fuelwood burning has also emitted other pollutants such as TSP, HC, NO<sub>2</sub>, and SO<sub>2</sub> considerably into the atmosphere.

Forest depletion has made the forest area far from settlements and local people have to spend more time fetching firewood, fodder, and water. Forest depletion has also resulted in the decline of forest soil nutrients. Cases of drying-up of water sources have also been noticed.

In recognition of the existing environmental issues in these two important sectors for Nepal, His Majesty's Government has formulated several policies, enacted legislation, issued standards and guidelines and implemented several activities since the start of planned economic development in mid-fifties. Before the re-instatement of democracy in 1990, several policy and legal measures were aimed to exploiting natural resources and agro-chemicals even at the cost of environment. However, recent policy and programmes are more environment-friendly and there is a clear shift in policy from command-and-control to people's empowerment i.e. people's participation with a view to ensure natural resource conservation, promote sustainable economic growth, and alleviate poverty.

To provide a long-term focus to the agriculture sector, which is a priority sector of economic planning since the mid-1950s, HMG has implemented the twenty-year Agriculture Perspective Plan (APP) since 1997. The APP sets out the long-term strategy for improving the agriculture sector and accelerating the growth rate to about 5 per cent per annum. The APP aims to: (i) accelerate the growth rate through increased factor productivity; (ii) reduce poverty through creation of increased employment opportunities; (iii) transform the existing subsistence-based agriculture to a commercial one through crop diversification; (iv) expand opportunities for an overall economic transformation by providing the preconditions for agricultural development; and (v) identify implementation strategies and provide clear guidelines for preparing future plans and programmes. These objectives are now translated in a more detailed medium-term strategy and investment plan, including in the Ninth Plan and the annual budget from 1997/98.

The APP's implementation strategy involves; (i) expansion of year-round irrigation schemes with increased farmer participation; (ii) rapid growth of fertiliser distribution through private sector participation; (iii) streamlining agriculture research and extension; and (iv) institutional strengthening for construction and maintenance of rural infrastructure (rural roads and electrification). The APP has also adopted a strategy to improve wildlife habitat and preserve species diversity, introduce integrated pest management (IPM) programmes, and integrated plant nutrition system (IPNS) to improve soil fertility.

The reduction of poverty and the commercialisation of subsistence agriculture are two key aims of the APP. The Ninth Five Year Plan aims at poverty alleviation and has a target to reduce the proportion of those living below the poverty line from 45 to 32 per cent. Furthermore, the Plan has a single objective of poverty alleviation and has adopted a strategy to integrate agriculture and forestry sector for sustainable economic growth.

The Forest Policy underlines the long-term objective of forest development to meeting people's basic needs for fuel-wood, timber, fodder and other forest products on sustained yield basis; to protect land against degradation; and to conserve the ecosystems and genetic resources. The Ninth Plan re-emphasizes not to destroy the forests while implementing development activities. The Plan further emphasizes the need for biodiversity conservation, and use of NTFPs to alleviate poverty. The guiding principles in forest management are to promote participatory management,

ecosystem-based management, sustainable forest development and poverty alleviation. The Plan also recognises the role of private sector and need for women's involvement in managing forests, national parks, reserves and conservation areas, and in conserving soil and watersheds. Equal emphasis has been given for the conservation of medicinal and aromatic plants, and development of NTFPs in all categories of forests. Similar attention has been given for the development of participatory environmental impact assessment systems, promotion of women led non-governmental organisation in conserving natural resources.

Community forestry programmes have proved to be a successful policy initiative with a direct bearing on addressing land degradation problems and involving local beneficiaries in the mainstream of natural resource conservation, particularly forests, soil, water, and biodiversity. There is a clear policy shift in forest management from state to people's management by introducing user group and buffer zone management concepts through legal provisions. The user group concept has also been mooted in soil conservation and watershed management activities and irrigation water management. These activities have been instrumental in rehabilitating the degraded hill slopes, torrent/stream-bank control by bio-engineering techniques, and run-off harvesting dams, particularly in the Siwaliks.

Similarly, HMG has regulated the use of 18 plant species and their products since February 2001, and handed over 0.75 million ha of government forests handed over to 9,874 Community Forestry User Groups (CFUGs) as of March 2001. HMG has also protected 26 species of mammals, 9 species of birds and 3 species of reptiles along with the declaration of 8 national parks, 4 wildlife reserves, 1 hunting reserve, 4 conservation area, and 5 buffer zones, which covers 18.14 per cent of the total area.

In order to maintain food quality, HMG has registered 78 insecticides, 13 herbicides, 25 fungicides, and other 6 acaricides, rodenticides and growth regulators in 1998. Plants and livestock quarantine services have been internalised. One hundred and fifty-three varieties of crops, vegetables, pulses and oil-bearing plants have been registered and released. Standards have been established for milk and milk products, fats and oil, spices and condiments, fruit and vegetable products, tea, coffee, cocoa and their products, salt, cereal, pulse and their products, mineral water, and sweetening agents. Similar standards have been established to regulate the contamination of foodstuffs by inorganic and organic matters, and pesticides.

HMG has also issued a Chemical Fertiliser (Control) Order in 1999 to regulate production, import and sale of the fertilisers, and specification for seven chemical fertiliser including Diammonium Phosphate, Ammonium Sulphate, and Urea have been issued. These interventions will promote production of quality foodstuffs and minimise effects of agro-chemicals on the environment. To facilitate the identification and mitigation of environmental impacts, the environmental guidelines have been issued. Proposals requiring different levels of environmental assessments have been listed in Schedule I and II of the *Environmental Protection Rules, 1997*.

In implementing master plans and in meeting the obligations of international instruments, HMG is implementing environment-friendly activities. The Nepal Biodiversity Action Plan (NBAP) is in the finalisation stage, which will be another milestone in conserving biodiversity in different ecosystems.

The community forestry programmes have been instrumental in conserving the forests, minimising soil loss and increasing farm production. Income generated by most of the community forests has been used for community development. It has also contributed in saving time required for fetching water, fodder, firewood and timber. A study has concluded a net saving of 3.625 hours per family per day after the formation of Gaukhureshwor CF, located at Dhulikhel. This saving in monetary values reaches to NRs. 0.434 million a year.

Several conservation successes are found in the protected areas due to increase of wildlife population, and habitat improvement. The protected areas have been instrumental in reviving key stone species, and promoting sustainable tourism. They are also the prime sites for *in situ* conservation of biodiversity. Eleven botanical gardens and an alpine conservatory have been established to ensure *in situ* and *ex situ* conservation of plant resources of different ecological zones. Equal emphasis has also been given to developing biogas plants, solar energy photovoltaic

systems, and wind energy to minimise pressure on forests and agricultural residues, including cattle dung.

Despite these initiatives, Nepal's agricultural and forestry sector, a prioritised and lead sector for socio-economic development and poverty alleviation, still needs additional attention for sustainable agriculture and forestry development and also to ensure biodiversity conservation.

In order to address these issues, and promote sustainable agriculture and forestry activities, it is necessary to make more an accurate classification of forests, expand community-based forest management in additional areas, declare the Siwalik forests as protected area and increase management through, an ecosystem approach. Similarly, more steps are required to encourage private sector, NGOs and CBOs in plantation and their sustainable use, create public awareness, promote *in situ* and *ex situ* conservation of biodiversity including agro-biodiversity, promote synergistic combination of organic and inorganic fertilizers through intensive extension and training of farmers, and enhance integrated soil fertility management systems linking with income generation.

Forest depletion has a direct linkage with the decline in agricultural production. In view of Nepal's landscape, it has been estimated that about 1 to 2.8 ha of forests is required to support one ha of arable land.

Resource depletion and land degradation is pronounced in rural areas. Unless proven management prescriptions are expanded and replicated in different ecological zones, the resource degradation will likely to continue. Expansion of agricultural land over sloping areas, and encroachment upon forests should be minimised with people's participation, and land use should be regulated through integrated environment management (IEM) approach. It is necessary to promoting ecosystem-based participatory management, particularly of forests, soil, water and biodiversity, and also to promoting non-regulatory measures to empower local people in natural resource conservation, keeping in view the successes in community forests, soil conservation, irrigation water, and buffer zone management.