

# CHAPTER 10

## INTEGRATED WATERSHED MANAGEMENT FOR SUSTAINABLE UPLAND DEVELOPMENT AND POVERTY ALLEVIATION IN LAO PEOPLE'S DEMOCRATIC REPUBLIC

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### INTRODUCTION

The Lao People's Democratic Republic (PDR) is a mountainous land-locked country with a relatively low population density. Its population of approximately 5.1 million people is poor with a per capita gross domestic product (GDP) estimated in 2002 to be only US\$331. The upland areas of the country are marginalized and have a high incidence of poverty, lower than average incomes and little social and economic infrastructure. Lao PDR has rich biodiversity resources and contains the least exploited and least damaged ecosystems in Southeast Asia. However, unsustainable resource management is beginning to reverse this favourable situation. Forest cover has declined from 70 to 47 percent over the last 50 years owing to the clearing of lowland forests for permanent agriculture, logging, reservoir construction, shifting cultivation, fires and the use of chemical defoliants during the Indochina war.

The government recognizes the importance of conserving its natural resources as it strives for economic development. The preservation of natural resources as a basis for sustainable development is highlighted in its latest Five-Year Plan (2001–2005). During the last decade, the government has introduced laws and decrees to support the sustainable use and management of natural resources.

Eighty-seven percent of Lao PDR's land is classified as upland land. In these areas, more than 60 potential sites for hydropower generation have been identified on tributaries of the Mekong River. It has been estimated that the country has a generating potential of 18 000 MW, of which only 640 MW has been developed. Hydropower installed in a sustainable way would greatly benefit the country's socio-economic development.

The major issues in the fragile upland areas are the interlinked shifting cultivation, food insecurity and poverty. The government is committed to reducing shifting cultivation significantly by the year 2005. In Lao PDR, more than 90 percent of income-earning adults make their livelihood in the agriculture and rural sectors. Most farming systems are extensive

with low productivity. While economic reforms are raising living standards in urban areas, rural households have benefited little. The Prime Minister's Decree 01 calls for promoting comprehensive and integrated rural development with more participation from local government and communities.

The Ministry of Agriculture and Forestry is applying integrated watershed management as a key strategy to address these issues. This approach was endorsed by the 2002 National Agriculture and Forestry Conference. It is being implemented within the national planning framework to improve understanding of the natural resource base and socio-economic situation in priority watersheds. It includes getting the agreement of local stakeholders more effectively to address poverty alleviation and the conservation and development of upland watersheds. The Ministry of Agriculture and Forestry is collaborating with provinces and districts to develop integrated watershed management plans.

## **GOVERNMENT POLICY**

During the last ten years the Government of Lao PDR has introduced a draft of new legislation that supports the sustainable management of natural resources (Budget Law, 1994; Forestry Law, 1996; Water and Water Resources Law, 1996; Land Law, 1997; Mining Law 1997; Electricity Law, 1997; Agriculture Law, 1998; Environment Protection Law, 1999; and Processing Industry Law, 1999). It has also been following the policy of area-based development. In the uplands this involves planning by watershed areas.

In 1999, the government developed its Strategic Vision for the Agricultural Sector (MAF, 1999). This recognizes that socio-economic development can take place more rapidly in the already developed lowlands than in the uplands. In the more ecologically fragile uplands, the vision is to reduce shifting cultivation and reverse poverty by promoting the more sustainable use of natural resources. This also involves conserving forest areas that have important hydrological and biodiversity protection functions. The government recognizes that forests play an important role in supporting livelihoods as many households obtain much of their food from forests.

The government's vision for the year 2020 aims to shift the country from a subsistence economy to a market economy through the sustainable use of natural resources. This vision gives high priority to encouraging more appropriate land use. It prescribes the three types of land use as: 1) intensive lowland agriculture in the plains areas; 2) mixed agroforestry as the main production system in sloping areas; and 3) forest conservation and protection for upland steep areas.

The targets of the government's Fifth Socio-economic Development Plan (2001–2005) that relate to integrated watershed management are to:

- ensure the progress of social security and political stability;
- create continued economic growth;
- reduce poverty by half;
- introduce a food security programme;
- solve the problem of shifting cultivation and prohibit opium plantations by creating new jobs and other income-generating opportunities;
- enhance national saving;

- reform State and private enterprises;
- develop human resources; and
- support the development of modern industry in the next stage.

The government is using integrated watershed management as an important tool to achieve its short-term (five years) and long-term (20 years) development goals. The objectives of the 2001–2005 Five-Year Plan include 7 to 7.5 percent annual GDP growth; 4 to 5 percent annual growth for agriculture; agriculture and forestry products accounting for 47 percent of GDP; and a population of around 5.9 million with a per capita GDP of US\$500 to \$550 by 2005.

As a follow-up to the Strategic Vision for the Agricultural Sector, the government produced a master plan for agriculture and natural resources. This identifies a number of programmes and specifies projects to support the government's vision of sustainable development of these sectors.

The April 2002, the National Agricultural and Forestry Conference agreed that integrated watershed management should be applied by all districts for sustainable natural resource management and poverty alleviation. At the conference the prime minister said:

Our development strategy has to follow an area-based approach. Development in the lowlands and on the major plains shall emphasize an integrated and decentralized agriculture and forestry programme. Development in the uplands shall follow a watershed approach to develop sustainable agroforestry systems and conservation in the context of sustainable use of the natural resources and decentralization. We believe that the development strategy will lead to realizing our goal in alleviating poverty in most upland areas in the context of environment-friendly livelihood systems.

## **INTEGRATED WATERSHED MANAGEMENT**

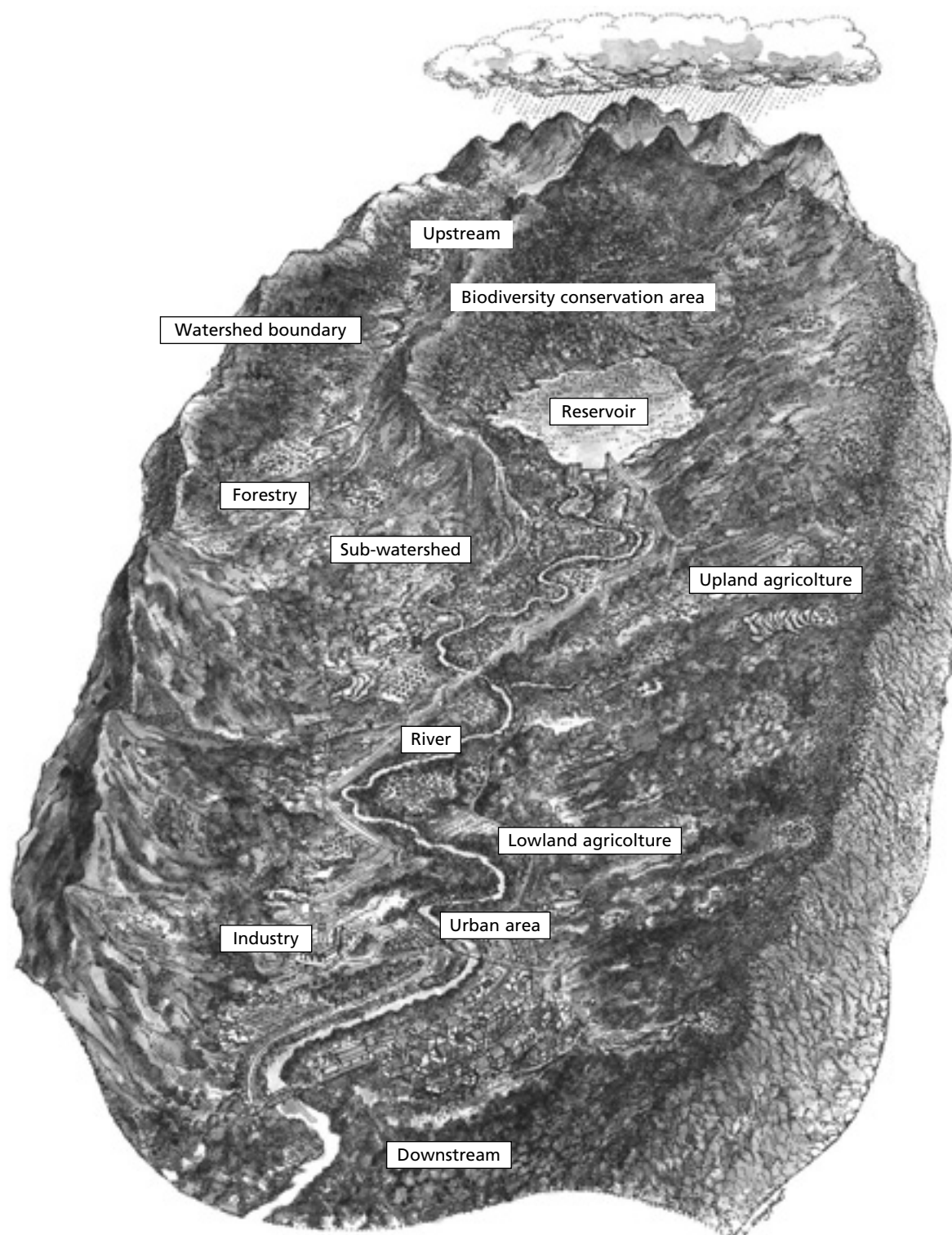
FAO (1986) defines watershed management as:

The process of formulating and carrying out a course of action involving manipulation of natural, agricultural and human resources on a watershed to provide resources that are desired by and suitable to society, but under the condition that soil and water resources are not adversely affected. Watershed management must consider the social, economic and institutional factors operating inside and outside the watershed.

Integrated watershed management is a holistic area-based planning process that extends the government's policy on sustainable natural resources management and development activities. Figure 1 shows the extent of a watershed and indicates the management issues – from biodiversity conservation in the uplands to the needs of lowland agriculture and urban areas in the lower areas – that need to be considered across a typical watershed.

DANIDA, among other donors, has supported the Ministry of Agriculture and Forestry to develop integrated watershed management as a holistic area-based planning framework. The Mekong River Commission has classified watersheds into five categories and has digitized contour lines and river network and generated digital terrain models for the whole of the lower Mekong River basin. These data are proving very valuable for watershed planning. An information system showing road networks, village locations, land-use types, soils and land suitability has also been developed.

FIGURE 1  
Schematic view of a watershed

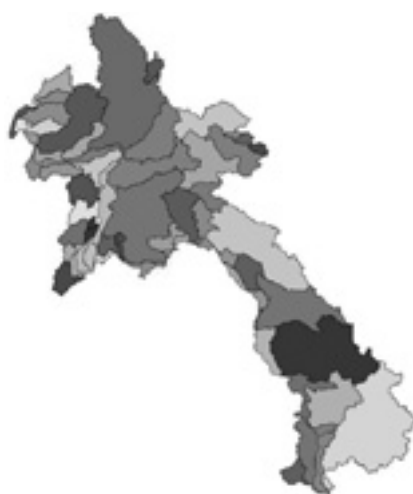


Source: Lao DANIDA National Capacity Building Project

## Watersheds in Lao PDR

Lao PDR is covered by 64 watersheds (Figure 2). Fifty-three of these, accounting for 91 percent of the country's land area, drain into the Mekong River. The other 11 watersheds drain into Viet Nam from Xieng Khouang and Huaphan provinces. The Mekong River Commission has developed a watershed directory that gives the boundaries of all first-order watersheds of the Mekong River system and gives information on their physical characteristics.

**FIGURE 2**  
**Lao PDR's watersheds**



Source: MRC Watershed Classification Project, 2000

Some of the first-order watersheds or river basins such as the Nam Ou in northern Lao PDR are very big and cover several provinces, whereas some are small covering only part of a district. It is important to distinguish between different levels of watersheds in relation to the administrative boundaries and sectors within areas as shown in Table 1. This hierarchical division of watersheds is incorporated in the government's policy on decentralization.

**TABLE 1**  
**Watershed levels in Lao PDR**

Level	Indicative area	Administrative area	Key agencies
Mekong River	International		Governments of Mekong riparian countries Mekong River Commission
	National	Whole country	Government of Lao PDR Water Resources Coordinating Committee Lao National Mekong Committee Ministry of Agriculture and Forestry
River basin or large watershed	More than 1 600 km <sup>2</sup>	Province	Provincial governments Provincial agriculture and forest services (PAFS)
Watershed	100 to 1 600 km <sup>2</sup>	District	District governments District agricultural and forestry offices (DAFO)
Micro-watershed	Less than 100 km <sup>2</sup>	Village	Village development committees (VDCs)

The provincial level is responsible for making strategies on natural resources based on the area's potential and priorities, including considerations of where to build infrastructure, site biodiversity conservation areas and linking areas with market opportunities. The districts are responsible for budgeting and planning and are therefore the key administrative level for developing integrated watershed management plans. District-level integrated watershed management plans can be aggregated into provincial level watershed plans.

### **Manageable watershed planning units**

River basins or large watersheds need to be split into smaller units to allow districts to develop integrated watershed management plans that promote and support activities to be carried out in collaboration with villages (VDCs). As a general principle, the maximum manageable size should not exceed the average size of a district (about 1 600 km<sup>2</sup>). The actual size of watershed units should furthermore be agreed on a case-by-case basis according to:

- number of villages and households and their distribution;
- infrastructure;
- available natural resources: principally forest, land and water;
- economic development potential;
- area of high biodiversity importance;
- hydropower potential; and
- biophysical features.

The Ministry of Agriculture and Forestry is promoting the development of model watersheds to serve as examples of different geographical locations and to show the effects of socio-economic and biophysical factors. The aim is to use these areas to develop further the concept of integrated watershed management. A number of model watersheds have been developed and have led to at least five integrated watershed management plans.

### **OBJECTIVES OF INTEGRATED WATERSHED MANAGEMENT**

Integrated watershed management in Lao PDR aims to:

- alleviate poverty and improve living standards by improving sustainable livelihood opportunities for households and communities whose needs are met from a watershed's natural resources;
- improve the conservation and protection of forest areas that are important for preserving biodiversity and protecting water resources;
- improve the conservation and management of natural resources within watersheds for sustainable economic productivity, while maintaining and enhancing these resources' social and environmental functions;
- improve water resource management within watersheds in order to: 1) provide adequate quality water for all users within the watershed and downstream; and 2) protect human

settlements, lowland farms, power generation and transport infrastructure, and downstream fish ponds from flood and sedimentation damage; and

- increase the marginal productivity values of the natural resources of land, water and forests (i.e. increasing the productivity of one resource without decreasing the productivity of others).

The main challenge of integrated watershed management in Lao PDR is to find ways in which these objectives can all be met simultaneously. The characteristics of different watersheds vary. Some are important for their biodiversity and as water sources and so call for total protection, while for most watersheds in Lao PDR, the ultimate goal is to promote the sustainable and equitable use of natural resources. This requires establishing mechanisms based on assigned land use and water rights in order to allocate and enforce these rights among competing sectors such as fisheries, tourism, irrigation, hydropower, domestic and industry. This calls for developing and adopting more productive forest, crop and livestock management practices that enhance and sustain the natural resource base.

### **INTEGRATED WATERSHED MANAGEMENT PLANNING**

Integrated watershed management planning is a five-stage process (Figure 3). The first two stages involve identifying a watershed and developing an integrated management plan. Stages 3 and 4 involve each sector planning and implementing its activities in collaboration with local people, following agreements made in the integrated watershed management planning process. Finally, the implementation of all sector plans is monitored and evaluated, and findings are fed into a new round of planning to update the plan. Plans should be live documents that are regularly updated.

The ministry's guidelines for developing district-level integrated watershed management plans (MAF, 2002) recommend following a seven-step procedure (Figure 4). These plans serve as frameworks for managing natural resources based on a district's biophysical and socio-economic assessments. Although the planning process for each level of watershed is similar, the needs and requirements differ. For example, watersheds with low population densities and limited economic development potential require fewer interventions because commercial and human pressures on the natural resources are low and sustainable. The highest priority in these watersheds is to protect the resource base through carefully planned zoning and land-use allocation and sustainable socio-economic development, in line with indigenous, village-based resource management. In contrast, plans for watersheds with high population density and high economic development potential need to address the problem of natural resource degradation that often arises from development activities.

In watersheds with hydropower potential, important issues include the resettlement of communities and the downstream impacts of hydropower development. In these areas natural resource conservation zoning is needed to preserve and regenerate forest cover on upstream steeply sloping and erodable land. Hydropower development needs to pay close attention to the management of upstream areas in order to prevent damage to hydropower structures. This can be done, for example, by setting up a watershed management fund made up of an agreed percentage of turnover.

**FIGURE 3**  
**Integrated watershed management process**

**1. Watershed identification and analysis**

**Watershed analysis:**  
Develop watershed profile and diagnose problems

**SECONDARY DATA SOURCES**

- MAF technical departments: NAFRI, DOA, DOI, DOLF, NAFES, etc.
- Lao agencies: STEA/ WRCC, MIH, MCTPC etc.
- Bilateral projects in Lao PDR
- Mekong River Commission
- Regional Institutions: AIT, RECOFTC, WOCAT, ICIMOD, etc.
- UN: FAO, UNDP, etc.
- CGIAR: ICRAF, ILRI CIFOR

**2. IWM strategy and plan**

Integrated watershed management plans give the priorities and directions for future natural resource management for an area. These plans should be regularly updated

**3. Subsector implementation plan**

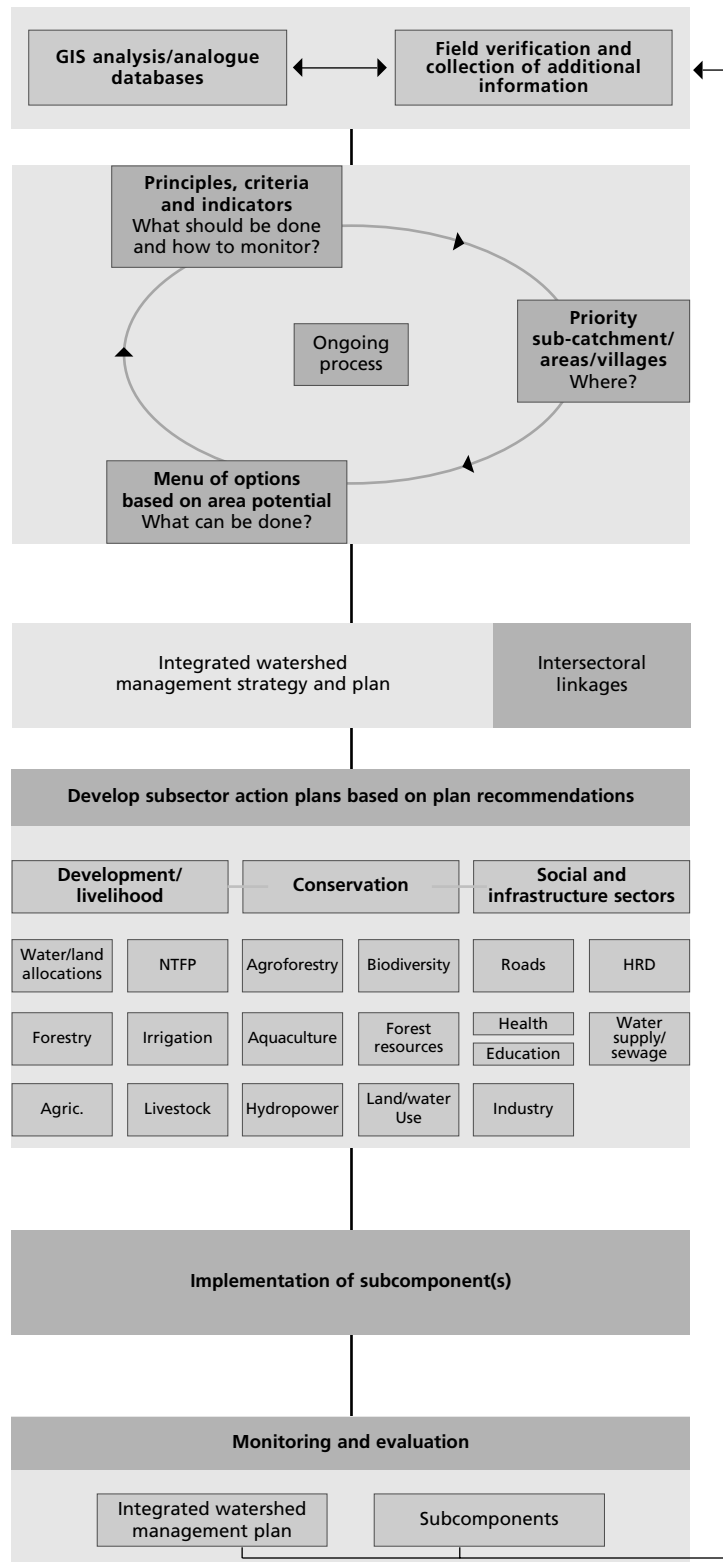
Action (work) plans are developed for priority subsectors based on directions given in IWM plans with specific links to other sectors

**4. Implementation**

Implementation of subcomponents by village, district, province, central level or donors

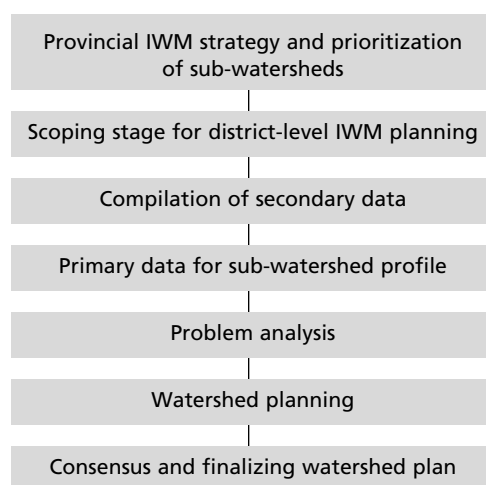
**5. Monitoring and evaluation**

- M&E according to identified indicators
- Output of M&E should feedback to coordinating unit
- Assess training and HRD needs





**FIGURE 4**  
**Development of district-level integrated watershed management plans**



Producing detailed plans for watersheds of more than 1 600 km<sup>2</sup> is costly and involves extensive consultation. Therefore, such plans are normally only justified if large infrastructure investments exist or are planned for an area. Where resources and technical capacity are constrained, plan making should be simplified and applied, and regularly scaled up in line with available resources.

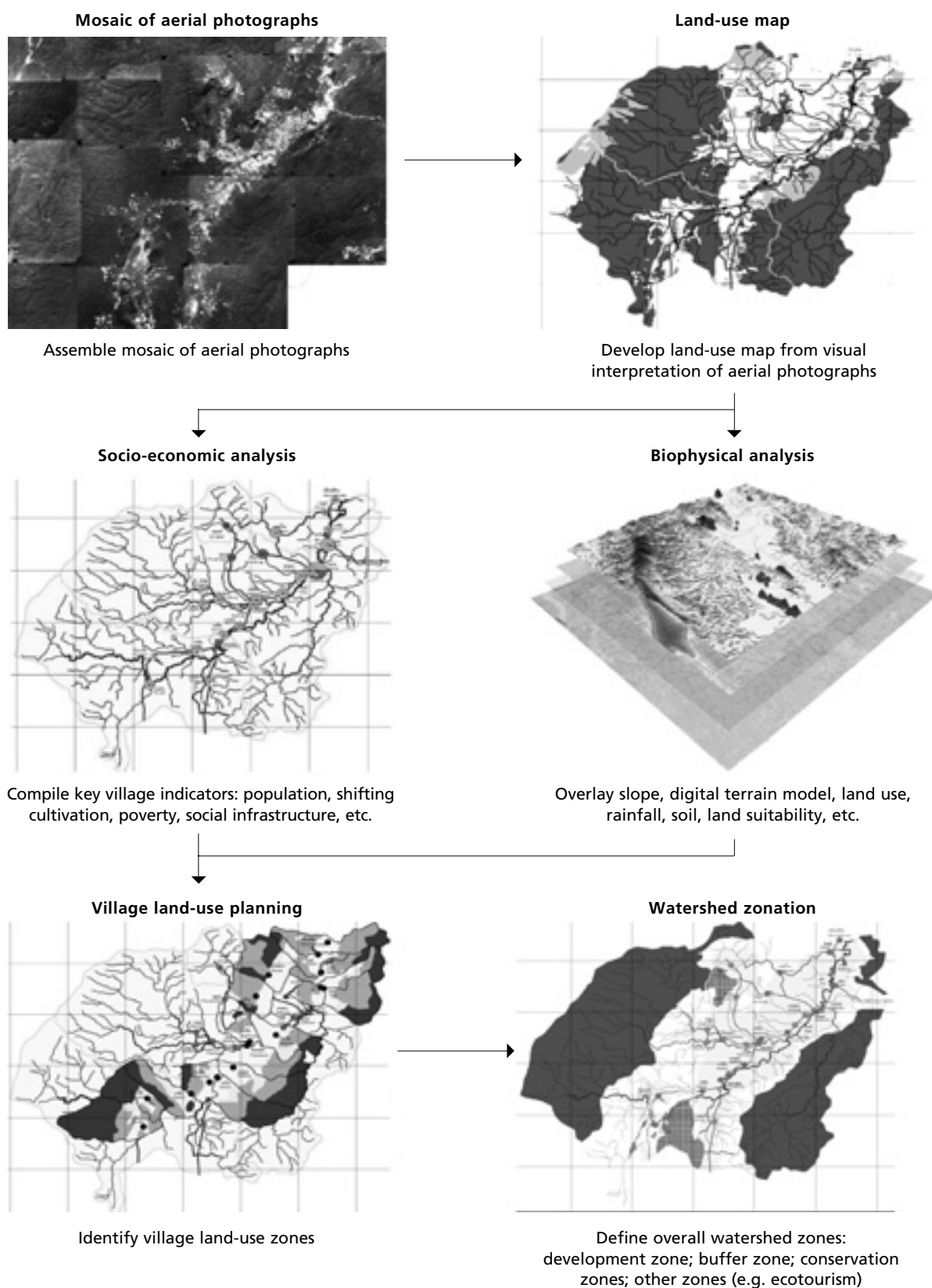
#### **LAND-USE PLANNING AND WATERSHED ZONATION**

The land-use planning process in Lao PDR is generally divided into eight steps (LSFP, 2001). This planning plays a very important role in integrated watershed management. Experience shows the importance of carrying out an overall socio-economic and biophysical assessment before individual villages delineate their land. In the Nam Tong Integrated Watershed Management Plan, Vientiane such an analysis was not carried out, and as a result agricultural land was allocated as forest land and vice-versa. Traditional land-use practices should be identified and incorporated into land-use planning. The delineation of village boundaries should begin by local people identifying their village's boundaries and the common lands that they use and have rights to. Villages can then zone their lands according to the most appropriate use. This can then be aggregated into overall zones for the whole watershed, including development, buffer, conservation, and even ecotourism zones.

This overall watershed zonation is important for defining future land use and for identifying potential areas for agricultural development and biodiversity and water resource conservation. Figure 5 illustrates the process of developing watershed zones by combining socio-economic, biophysical and land-use analysis. The process uses aerial photographs, land-use maps and socio-economic and biophysical analysis to assist village land-use planning and to identify different zones in a watershed. The different zones will commonly include development zones, conservation zones and buffer zones.

This integrated watershed management planning helps village land-use planning by carrying out biophysical and socio-economic assessments of their areas. These assessments often raise issues

**FIGURE 5**  
**Process for zoning a watershed**



concerning the use of common lands such as forests, pastures and streams. Common resources are often degraded when villages cannot agree on their use. The fragmentation of village land is another issue that needs considering. Villagers often use land close to their settlements and further away, in line with traditional arrangements or owing to the limited availability of agricultural land.

## **DEVELOPING INTEGRATED WATERSHED MANAGEMENT**

The integrated management of watersheds in Lao PDR is in its early stages. The approach is still being developed in a number of ways including the further development of guidelines, human resources, information management and demonstration sites. Concepts and guidelines have been developed for district-level planning, but they need further development based on experiences from training and demonstration watersheds.

Many staff involved in watershed planning, especially at the district level, have insufficient skills. There is a great need to build up their capacity to communicate, deal with data and information, and plan. Central-level planning staff have been trained on integrated watershed management planning, information collection, Geographic Information Systems (GIS) and remote sensing. Provincial and district staff have been trained in areas where demonstration watersheds have been developed. As well as upgrading basic and technical skills, there is an immediate need to build up a core group of integrated watershed management facilitators at the central and provincial levels to facilitate planning.

The Ministry of Agriculture and Forestry is establishing an information centre to coordinate data collection within the ministry and support districts and provinces with data analysis and the generation of maps for planning purposes. The ministry is also promoting collaboration with partners, such as donors and training and research institutions, to exchange information.

### **Model watersheds**

Lao PDR has very diverse biophysical and socio-economic features, and therefore needs development models for different types of watersheds in order to assist in the development of other watershed plans in areas with similar characteristics. Model watersheds also need to cover the planning process and implementation, with feedback mechanisms to allow for learning from experiences. Model watershed planning processes have developed at Nam Tong, Nam Tin, Nam Neun and Nam Et Phou Loei watersheds (see Boxes 1 to 4).

**BOX 1**

**NAM TONG WATERSHED**

The Nam Tong watershed in Vientiane Province, northern Lao PDR covers 556 km<sup>2</sup> and contains 27 villages. The area has a wide valley with relatively good soil conditions. It has medium levels of immigration. Shifting cultivation is not a major problem, although a few households still practise it. Although the area is self-sufficient in rice, some households lack enough rice at certain times of the year and thus live below the poverty line. The area has relatively good market access, mainly to the capital city Vientiane, and good development potential for diversified agriculture and aquaculture. To maintain the present 70 percent forest cover of this area, the land-use options of diversifying agriculture, livestock and aquaculture have been identified during the watershed planning process.

**BOX 2**

**THE NAM TIM WATERSHED**

The Nam Tim watershed in Bokeo Province, northern Lao PDR covers 220 km<sup>2</sup> and has 23 villages and a population of about 10 000 people from a number of ethnic groups. Twenty-one villages with a total population of about 6 500 are located outside, but practise shifting cultivation in upper parts of the watershed. The government has built a reservoir in the area to irrigate 1 200 ha of land. The Nam Time Integrated Watershed Management (IWM) Plan was produced in 2002 by a watershed facilitation team under the Department of Planning, together with provincial and district officials. It identified pressure from shifting cultivation as a serious problem. This problem has been aggravated by outside villagers also practising shifting cultivation in the area, leading to erosion and land sediment loads that are reducing the storage capacity of the reservoir. The major threat to the watershed function has been identified as this shifting cultivation. The management plan proposes protecting the watershed's headwaters and introducing improved agricultural practices and alternative income-generating activities.

**BOX 3**

**NAM NEUN WATERSHED**

The Nam Neun watershed in Xieng Khouang and Huaphan provinces in northeastern Lao PDR is a mountainous area of 6 881 km<sup>2</sup> with about 400 villages that practise shifting cultivation, upland rice farming and livestock raising. Local people also gather non-timber forest products (NTFPs) and grow some opium. Prospects for improving the management of natural resources include promoting vegetable and fruit tree farming, small-scale handicraft production and improved management of NTFPs collection. Paddy farming is limited to a few river valleys. Activities proposed in this area's watershed plan address not only conservation, development and upstream-downstream linkages, but also poverty alleviation and the eradication of opium cultivation.

**BOX 4**

**NAM ET PHOU LOEI NATIONAL BIODIVERSITY CONSERVATION AREA**

The Nam Et Phou Loei National Biodiversity Conservation Area in Huaphan and Luang Prabang provinces, northern Lao PDR is a mountain range with an area of 4 200 km<sup>2</sup> that has high levels of biodiversity. It contains the headwaters of four major watersheds, including the Nam Neun watershed. The area has about 110 villages in its buffer zone. A further 35 villages are located inside the conservation area and mainly practise shifting cultivation and produce some opium. The planning process recommended focusing on the sustainable use of the area's natural resources, because this is an important biodiversity conservation area. The plan emphasis for the headwater areas should be on: a) integrating conservation and development activities; and b) participatory management of natural resources.

The four examples were part of the Ministry of Agriculture and Forestry's efforts (with DANIDA support) to develop the capacity of planners at the central, provincial and district levels to develop watershed management plans. It has led to improved awareness of the IWM approach. Experiences from IWM planning have been disseminated at numerous events, such as at the ministry's annual agricultural and forestry conferences. This has raised the demand from districts and provinces for support to develop integrated watershed management plans throughout the country. In two cases, this has resulted in increased financial support from the government to develop IWM plans. Vientiane and Sayaboury provinces have funded provincial watershed planning as the provincial authorities realized the benefits of systematically analysing socio-economic and biophysical aspects in planning and, at the same time, using the planning exercise to build up staff skills.

The Ministry of Agriculture and Forestry, as the lead agency, is preparing to implement the Nam Ngum River Basin Development Sector Project with about US\$22 million support from the Asian Development Bank and the French and Japanese governments. This project aims to develop and implement integrated watershed management plans for the entire Nam Ngum River basin in northern Lao PDR, which covers 16 watersheds over an area of 16 906 km<sup>2</sup>. It will demonstrate and test further the integrated watershed management approach on a large scale.

**VISION FOR INTEGRATED WATERSHED MANAGEMENT AND THE SUSTAINABLE USE OF NATURAL RESOURCES**

The Ministry of Agriculture and Forestry aims to allocate more resources for upland development, based on integrated watershed management plans. Mechanisms and procedures for incorporating such planning into the national planning framework are being developed in collaboration with the Committee for Planning and Cooperation.

The Ministry of Agriculture and Forestry recommends that all provinces develop strategies to manage their watersheds. In the same way all districts should develop watershed plans either by themselves or along with neighbouring districts, depending on the biophysical boundaries of their watersheds. The Ministry of Agriculture and Forestry has a GIS and mapping facility under the Department of Planning, which can be used to delineate watershed boundaries.

The government has the vision that by 2010 integrated watershed management plans will be developed for the whole country at the district and provincial levels. The emphasis in the

current Five-Year Plan (2001–2005) is on developing watershed plans for all eight northern provinces that contain the country's priority watersheds. This will support the government's plan to reduce shifting cultivation by 70 percent and alleviate poverty in northern Lao PDR.

Integrated watershed management plans need to be made for the areas around all hydropower projects, including the downstream impact area. These plans need to include environmental and socio-economic analysis of the upstream area and should assess the investments needed in these areas. All natural resource-based projects working with district and provincial authorities should include a watershed management planning process as part of their design.

The interdisciplinary approach of integrated watershed management includes carrying out environmental impact assessments. The Ministry of Agriculture and Forestry, supported by the Science, Technology and Environment Agency, is investigating how to incorporate such impact assessments into integrated watershed management.

To fulfil these goals, the skills of all levels of staff need building up and the planning tools improving. All levels of staff need more basic and technical training. This is best undertaken on the job or linked to actual watershed planning. There is a continued need to develop tools for watershed planning, implementation, and monitoring and evaluation. The focus should be on developing simple and practical tools that apply to the context of Lao PDR.

The Ministry of Agriculture and Forestry is setting up an information centre to support districts and provinces developing local watershed management plans. However, the centre still needs to be linked to and provided with modern communication facilities.

Interventions for promoting agriculture and rural development need to be implemented according to integrated watershed management plans in order to improve rural livelihoods through the sustainable use of natural resources.

The government is committed to applying integrated watershed management to combat poverty and manage the natural resources in fragile upland areas. It is incorporating integrated watershed management into the national planning framework. As well as the government's own resources, there is a great need for more collaboration with international donors. The government is striving to establish more partnerships to promote sustainable development in its fragile mountain areas. Time is limited and action is urgently needed.

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# CHAPTER 11

## WATERSHED MANAGEMENT IN NEPAL: CHALLENGES AND CONSTRAINTS

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### WATERSHEDS: A CONTEXTUAL BASIS

Nepal's terrain is dissected by many rivers and streams to form a complex of watersheds. Natural and human-induced processes operate on these watersheds. The main processes that lead to the degradation of watersheds are landslides, soil erosion, floods, biodiversity loss, and unsustainable water extraction and farming practices. These lead to the loss of soil fertility, the depletion of water tables, the drying up of springs, desertification and sedimentation. A study carried out 20 years ago found that about 10 percent of Nepal's area was covered with very degraded watersheds (Table 1). Only 33 percent of the country was under "very good condition" watersheds.

TABLE 1

**Watershed conditions in Nepal, 1983**

Watershed conditions	Proportion of land
Very poor	10%
Poor	3%
Marginal	19%
Good	35%
Very good	33%

Source: DSCWM, 1983 referred to in Guragain et al., 2002.

Himalayan watersheds have relatively high population densities with nearly all the people relying on watershed-based resources for their livelihoods. The frequent natural disasters are partly caused by the overexploitation of natural resources and lead to large losses of life and property, principally in downstream southern plain areas (Box 1). Much landscape degradation is associated with the heavy monsoon rains. Parts of Nepal suffer from desertification, glacial lake outburst floods (GLOFs) and avalanches. Watershed management has paid little attention to threats to biodiversity, but it is an important issue.

**BOX 1**

**SOME FACTS ABOUT LAND DEGRADATION IN NEPAL**

- About 1 140 ha of land in 35 districts was lost in the 1993 monsoon to landslides and flooding.
- 41 800 ha of land was damaged in 1995.
- 74 000 ha of cultivated area in 16 districts in east Nepal was affected by drought in 2001.
- From 1983 to 2000, about 20 000 lives were lost to natural disasters; landslides and floods accounted for about 30 percent of these deaths.

A watershed is an area above a given point that is drained by a stream system. Watersheds are hydrologic units that have been used as the major spatial units for land, water and soil conservation by planners. Programmes and policies have focused on stabilizing the watershed environment. Integrated watershed management involves working on the natural and human resources in a watershed in accordance with the social, political, economic and institutional factors that operate within the watershed and its river basin (Easter, Dixon and Hufschmidt, 1991).

Himalayan watersheds have a complex physiography from the interaction of physical, biophysical and human activities. They generally have a weak geological structure and shallow soils, and are tectonically unstable and fragile. Most are characterized by steep slopes, large variations in altitude over short distances, incised river and stream beds with scars from landslides and gullies, large boulders in narrow watercourses from mass wasting and floods, sparse vegetation, agricultural fields and scattered human settlement.

Most cropland is carved out of hillsides by building terraces. Mountain farms usually have a few cattle and poultry. Households use their local common lands and forests for livestock grazing and as sources of fuelwood, fodder and timber.

It is only in recent times that roads, salaried jobs, health care and schools have reached these areas. This has had a large effect on natural resource use and management patterns, even in remote mountain watersheds, often disturbing the balance between nature and humans.

Food security and environmental degradation are two of the main challenges facing humanity in the twenty-first century (Lal, 2000). Protecting and strengthening watershed ecosystems is one of the main strategies to address these two issues.

Misconceptions about the causes of environmental degradation and food insecurity have often led to watershed management initiatives failing to deliver. This paper highlights the main watershed management issues concerning Nepal. It covers the approaches of watershed management adopted by the Government of Nepal, the links between population pressure and government policy, the land and food situation, information gaps on watershed management, and policy directions and constraints for watershed management.



## GOVERNMENT WATERSHED MANAGEMENT

The indigenous management of Nepal's watersheds revolved around building terraced fields for crop production. Formal watershed management in Nepal began with the establishment of the Department of Soil Conservation and Watershed Management in 1974. Three years of work (1975 to 1977) in the Phewa Tal catchments in west-central Nepal by the Department of Soil and Water Conservation, Agriculture, Forest and Water Supply was the first project to work for the integrated management of a water catchment (Fleming, 1983).

The second half of the 1990s saw the adoption of a participatory and integrated approach to watershed management (Sharma, 1999). This involves the use and conservation of land, water and forest resources at the farm household and community or watershed level to improve livelihoods and human development (Sharma *et al.*, 1997). Chapter 10 of the government's Tenth Five-Year Plan (2002–2007) says, "Priority will be given to integrated watershed management to conserve the underground water and soil in the Chure-Bhawar and Terai areas by coordinating the work of agriculture and water resources sectors" (NPC, 2003). The plan significantly recommends the integrated watershed management approach, although it only names the Chure hills and the Terai areas.

## POPULATION PRESSURE AND MACROLEVEL POLICY

Nepal's population has grown from 9.4 million in 1961 to more than 23 million in 2001. The 2001 census recorded about 7 percent of these people living in the mountains, 44 percent in the hills and 48 percent in the Terai plains. Much of the population growth has occurred in the Terai, as it has grown from more than 3 million in 1961 to more than 11 million in 2001.

In the 1950s, the government focused on relieving population pressure on the steep and environmentally fragile hill and mountain areas. The First Five-Year Plan 1956–1961 promoted a rehabilitation programme in the Terai. It sought to settle landless hill people there to provide them with a means of livelihood. The government took unsettled areas of the Terai for the planned resettlement of poor hill peasants. The Rapti Doon Multi-Purpose Development Project was the first such project (NPC, 1963). Successive five-year plans promoted resettlement in the Terai and its foothill valleys. They also promoted off-farm activities for income generation, and the introduction of high-yielding crop varieties and hybrid domestic animals. Most of these programmes were launched with advice from Western experts.

By the time of the Eighth Five-Year Plan 1992–1997, the national priority had turned to alleviating poverty. An important strategy for achieving this was to promote off-farm and foreign employment. Government policies assisted the existing trend of going abroad to work. In 2003 there were between 400 000 and 500 000 Nepalese working in foreign countries, not including the hundreds of thousands working in India. This has brought much foreign currency into the country, but has caused some problems. Although it has relieved population pressure on mountain watersheds, it has deprived these areas of workers. This has led to increasing wages for agricultural labourers. Wages have reportedly doubled in the past decade, from US\$0.67 (NR 50) per day in 1990 or 2 *pathis* of grain (6.3 kg) to US\$1.33 (NR 100) per day in 2000 (grain is now rarely accepted as payment). Over the same period, the price of agricultural products only increased by about 50 percent. This has led to decreasing labour

inputs in the farming sector, which in turn has led in many places to the abandonment of basic tasks such as terrace maintenance and the subsequent environmental degradation of mountain watersheds (Poudel, 2000; 2003).

Other important trends have been urbanization, the reluctance of young people to do farm work, the increasing use of modern amenities and the increasing use of manufactured goods. This has reduced the self-reliance of local communities.

The mass movement of people away from the hills and mountains has reduced population densities in some areas. It has been estimated that in 1952 to 1954 rural-to-rural migration (mostly from the mountains and hills to the Terai) accounted for 65 percent of total migration in Nepal. That figure stood at 91 percent in 1961, increasing to 93 percent in 1971 (Kc, 1983). The 1981 census reported 26 042 people having migrated from the mountains and hills to the Terai in the previous ten years. Among all migrants to the Terai, 67 percent were from mountain and hill districts. This trend continues, as the 2001 census reported that 16 percent of the Terai's population were internal migrants and 4 percent international migrants (who had moved there since 1991).

The population increase in the Terai has led to the destruction of swathes of Terai forests, especially along riverbanks. This has exacerbated riverbank cutting and flooding. The continued loss of life and environmental destruction is due to the failure to carry out integrated watershed management.

## **LAND AND FOOD**

Nepal covers an area of 147 181 km<sup>2</sup>. It has three main ecological belts in its mountain, hill and Terai areas that extend from west to east. The mountains and hills make up about 83 percent of the area, and the Terai 17 percent. Less than a quarter of the land is suitable for agriculture, and forest covers just over a third of the area. A considerable area is covered by steep and rocky terrain. Much of the hill and mountain areas are very fragile and vulnerable to landslides and mass wasting. Terai lands are regularly threatened by flooding and sedimentation.

Nepal, therefore, has only a limited amount of land that is suitable for mechanized farming. The National Sample Census of Agriculture, Nepal 1991/1992 (CBS, 1994) reported that about 2 597 400 ha of Nepal's land was under private ownership, of which 6.8 percent was in the mountains, 40 percent in the hills and 52 percent in the Terai. Of that total, 2 323 400 ha (89.5 percent) was arable land, of which 162 300 ha was in the mountains, 871 300 ha in the hills and 1 289 700 ha in the Terai. The average holding size was 0.96 ha, varying from an average of 0.68 ha in the mountains to 1.26 ha in the Terai. The mountains and hills have comparatively smaller landholdings.

The Nepal Living Standards Survey (CBS, 1996) recorded 83 percent of Nepalese households practising agriculture, including 98 percent of all mountain households, 87 percent of hill and 76 percent of Terai households. Agriculture is therefore a major source of livelihood for most Nepalese and it is the amount of land that often determines people's livelihood security. The same survey found that more than 50 percent of total households had less than adequate food consumption, with mountain people as the most deprived at 63 percent with inadequate food.

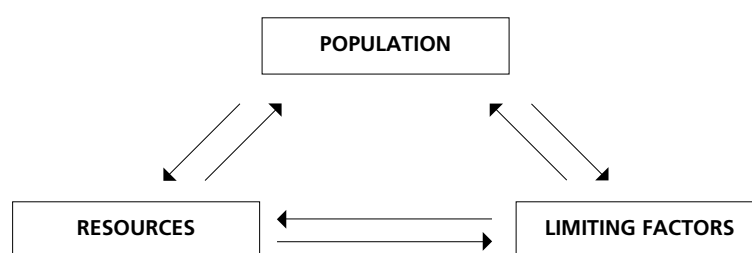
By calculating the total crop production per district and its calorific value, Subedi (1995) recorded that only one mountain district, one hill district and two Terai districts had relatively good food security. Eight of Nepal's 16 mountain districts, 13 of the 39 hill districts and three of the 20 Terai districts had poor food security. A 1997 ranking of Nepal's 75 districts ranked 25 as poor and deprived, of which nine were mountain districts, seven hill and nine Terai districts (ICIMOD, 1997).

The reliance on agriculture and the poverty and hunger of many Nepalese means that sound land management should be a government priority. But the periodic five-year plans have failed to give enough attention to this. Measures need to be taken to make the distribution of land more equitable and the land more productive, and to counteract land degradation. These can be achieved through the sound management of watersheds.

### INFORMATION GAPS

It is difficult for proposed management activities to achieve their goals without a proper understanding of the many interrelated physical, biophysical and human factors that act on watersheds. However, this is often lacking in watershed management.

**FIGURE 1**  
**Relationship of population, resources and limiting factors**

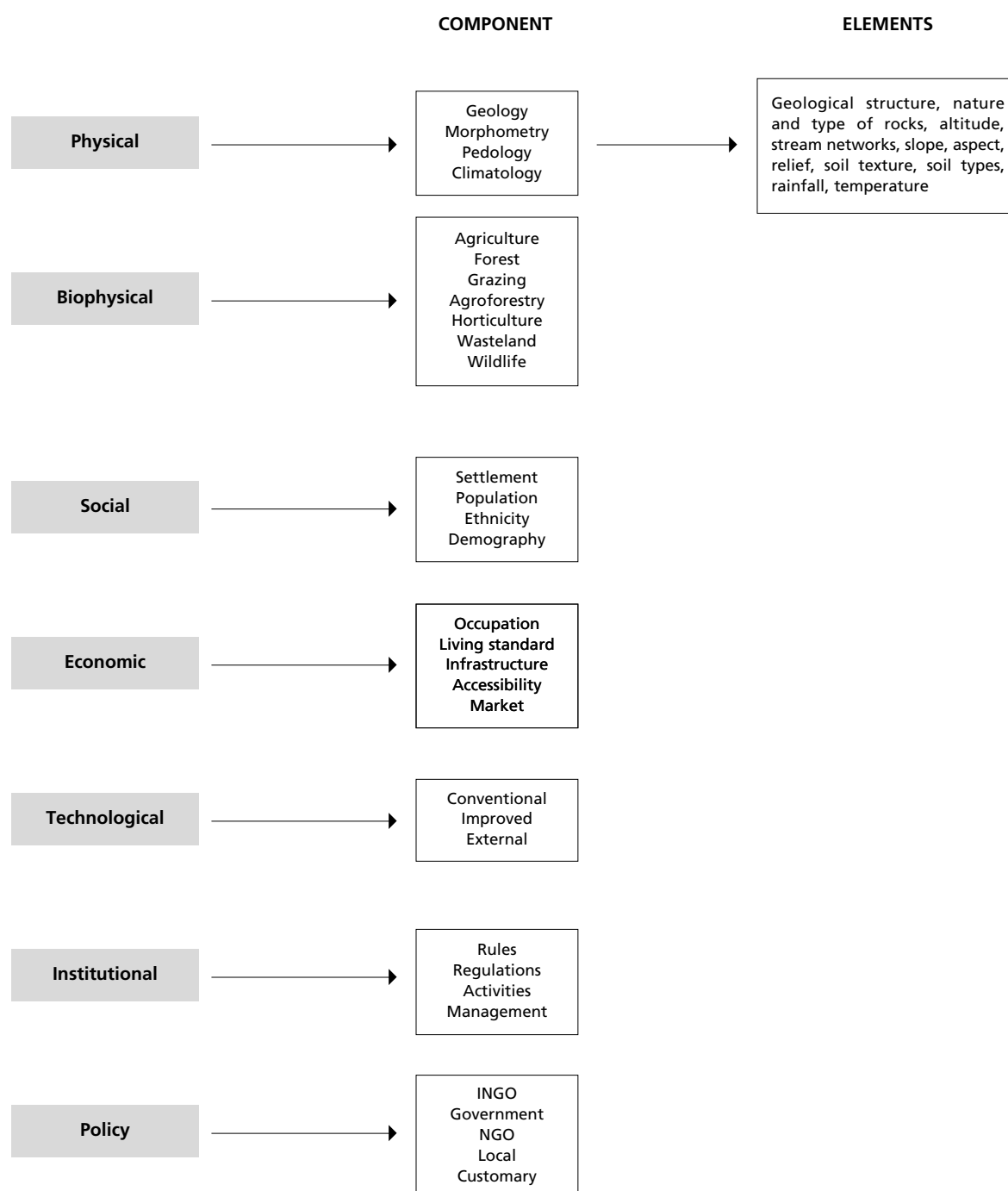


Source: Poudel, 2003.

Figure 1 illustrates the interrelationships among population, resources and limiting factors in mountain watersheds. In a watershed, the local population demands various services from a watershed's resources. Various physical, legal and institutional policies regulate demand and supply. For example, steep slopes and large rivers restrict the flow of resources and goods and services. A high demand will cause pressure on resources, and once this pressure passes a certain threshold, watershed environments begin to deteriorate. Studies of watershed management therefore need to gather information about the population, resources and limiting factors.

Planners and managers can use watersheds as functional units to consider physical, socio-cultural, economic and institutional factors, and develop comprehensive and integrated development plans to achieve specific objectives (Figure 2). GIS-based tools and techniques are very useful for analysing the situation in watersheds. Information provided in this way helps to increase understanding about environmental processes and to analyse and assess the impact of interventions (Michalak, 1993).

**FIGURE 2**  
**Watershed-based sources of information**



Source: Poudel, 2001; 2003.

In Nepal, there is a lack of information and management plans at the watershed level. Achet (1999) points out that “benchmarks and changes resulting from an intended watershed management intervention need to be quantifiable”. Quantitative indices of watershed parameters need developing for different sizes of watersheds within different regional contexts. For Nepal, 5- to 25-km<sup>2</sup> sub-basin areas have been suggested as the size range of a sub-watershed (Achet, 1999). The “micro-catchment development model” should be adopted to solve local-level problems.

Nepal’s watersheds have not been properly evaluated according to their resource endowment and degree of fragility. The Nepalese government does not have a land parcel system that delineates land by most appropriate use. Watershed-based data are available only by administrative unit, and these units only sometimes coincide with physical boundaries. Time series data for human-induced factors are lacking, and most studies have failed to separate out natural and human causes.

In mountain watersheds, energy and matter flow downwards with gravity. This has on- and off-site effects from source to sink, and watershed management has to account for these flows. In Nepal, the devastating landslide and mass wasting in the upper watersheds are usually blamed on local people overexploiting natural resources. But many catastrophes are natural events. In the Terai, floods and heavy sedimentation are partly the result of mass wasting in the hills and mountains. The overall causes are complex. Dams are also responsible for floods in lower watersheds. The accumulation of sediments in river channels, intense human pressure on riverbank areas, construction, and excavation of channels increase the risk of downstream flooding. Watersheds need to be studied to scrutinize multi-layer, multisectoral, and multi-date interactions.

## **POLICY DIRECTIONS AND CONSTRAINTS**

Watershed management needs to consider every sector and component relating to a watershed in order to be able to plan for integrated management. Many policy documents stress the need for watershed management for poverty alleviation, environmental sustainability and nation building, but many of these documents are silent on implementation strategies.

In Nepal, watershed management is covered in seven pieces of legislation: Soil and Watershed Conservation Act, 1982; Land Act, 1964; National Parks and Wildlife Conservation Act, 1973; Environmental Protection Act, 1996; Forest Act, 1993; Water Resource Act, 1992; and Local Self-Governance Act, 1999. However, this legislative framework suffers from overlapping responsibilities, unclear jurisdiction for implementation, lack of clear-cut resource allocation for watershed management and lack of emphasis on ground-level coordination. Specifically, the Soil and Watershed Conservation Act has not been effective owing to overlapping responsibilities, lack of resources and poor coordination (Guragain et al., 2002).

The separate acts are directly related to the sectoral ministries, departments and local bodies, whereas watersheds are composite units. For example, the Local Self-Governance Act, 1999 gives the right to protect or manage local resources to local bodies (VDCs and district development committees), but other acts work through central bodies and district line agencies. This leads to overlapping of responsibilities on jurisdiction, accountability and liability.

Management strategies have usually been given in an abstract form of the theoretical point of view by watershed managers and planners. There has also been the conceptual issue of perceiving watershed problems in a subject-wise way, in terms of, for example, forestry, agriculture, land development or poverty alleviation. Management strategies have called for people’s participation, but there is a gap in understanding about the level of participation. Policy documents have failed to explain who is to gain and who could lose from participation. The interests of people living along a watershed vary, from upstream source to downstream sink vary, and implementation must:

- identify who the stakeholders are;
- make it clear whether watershed management is the responsibility of local people, stakeholders outside the watershed or central-level managers;
- specify the appropriate size of area for forming focus groups or community-based organizations; and
- specify how interboundary resource use disputes are tackled.

Another serious problem is that the Department of Soil Conservation and Watershed Management’s district offices often lack adequate resources and skilled personnel. Strategies are needed to cope with these problems with clear “do’s” and “don’ts” (Table 15.2).

**TABLE 2**  
**Do’s and don’ts of watershed management**

Do	Don't
Stress positive aspects and promote win-win solutions Help participants generate lasting success to justify political decisions Adopt holistic approach to natural resource management, linking biophysical and socio-economic issues Encourage the two-way flow of information Ensure long-term continuity Improve marketing systems Generate non-farm income Strengthen institutional support Attend to farmers' real needs Aim to benefit non-farmers	Use reductionist discipline-based solutions to complex problems Provide unnecessary financial incentives, with hidden agendas Use excessive instrumentation to analyse water, soil and biota

Source: After Lal, 2000.

## CONCLUSIONS

Maintaining environmental quality and food security is the major challenge of the twenty-first century and is directly related to watershed management. Watershed territorial units cover a large part of the world’s land area. The ultimate target of watershed management is to improve environmental quality and food security. Participatory integrated watershed management has become the accepted approach to managing watersheds.

The major challenges for adopting participatory integrated watershed management lie at the policy formulation level, in information gaps, identifying watershed parameters, integrating the various parameters and taking a holistic approach. The main problems in the legislation are overlapping responsibilities, unclear jurisdiction for implementation, lack of clear-cut resource allocation and inadequate attention paid to grassroots coordination. These problems can be overcome by clearly identifying the responsibilities of individual users, defining watershed resource stakeholders, delineating the appropriate size of watersheds to implement watershed management activities and forming community-based organizations to allow for people's participation and promote sound indigenous practices.

## RECOMMENDATIONS

Watersheds have several components. The most difficult part of analysing watersheds is to combine several spatial factors to give the overall picture of the processes at work. To combine factors in this way involves rating each one. Future studies need to build consensus on how to carry out this rating. This is quite difficult and often involves subjective judgments.

The most pressing issue concerning watershed management is inconsistencies in socio-economic databases. Even single-date socio-economic databases of watersheds are not available, never mind time series information. Watershed studies collect socio-economic information only as per need at the time of a study. Such data cannot give information over time about people, as illustrated in Figure 1. Census data are only available for administrative units and not for micro-watersheds. This needs recording at the VDC level. It would greatly help if VDCs – the lowest statutory unit for census survey and local-level planning – were delineated according to watershed boundaries.

A general consensus needs to be developed by watershed managers and planners on the scale of operation, where there are clearly defined physical boundaries. All parts of a watershed may not need urgent attention. The micro-catchment development model should be adopted to solve local watershed-related problems according to the need of discrete areas.

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