# 1 Introduction

## Background

The 'People and Resource Dynamics Project' (PARDYP) in mountain watersheds of the Hindu Kush-Himalayas started in October 1996 and continued through three phases to June 2006. It evolved from two projects funded by the International Development Research Centre (IDRC): the 'Mountain Resource Management Project' (in collaboration with the University of British Columbia) and the 'Rehabilitation of Degraded Lands in Mountain Ecosystems Project'. PARDYP was a long-term regional interdisciplinary research programme for watershed development concerned primarily with natural resource dynamics and degradation processes and their effects on livelihoods. The project covered four countries – China, India, Nepal, and Pakistan – with five watersheds: two in Nepal (Jhikhu Khola and Yarsha Khola), and one each in India (Bheta Gad Garur Ganga), Pakistan (Hilkot-Sharkul), and China (Xi Zhuang) (Figure 1). Activities in the Yarsha Khola were discontinued in June 2001 as a result of security problems. ICIMOD was able to broaden PARDYP's partnership and funding support to include not only IDRC but also the Swiss Agency for Development and Cooperation (SDC). The strategic inputs and support of the University of British Columbia continued, and were joined by the University of Berne and the University of Zurich.

The first phase of PARDYP (October 1996 to September 1999) was devoted to establishing research infrastructure, human resources, and systems (Figure 2). In Phase 1 the natural resources research dimensions received more emphasis than social, institutional, or economic issues. The second phase of PARDYP (October 1999 to December 2002) was designed to enhance the community-based approach and to target poverty reduction and improved management of natural resources. The project focused on the development and use of participatory, community-based decision-making processes and developing relevant methodologies. During the third phase of PARDYP (January 2003 to June 2006), the focus was on research for development, with a better balance between natural resources, socioeconomic, and institutional components. An external review portrayed the three phases of PARDYP as an evolutionary process from establishment (set up/data collection), through implementation (data collection/ analysis), to consolidation (analysis/formulating of options).

Sharing of ideas, successes and failures, and research methods by PARDYP partners from all the participating countries contributed significantly to the success of PARDYP research at the country level. Following completion of the project, we are following a number of pathways to disseminate the learning more widely with the aim of contributing to the development of more effective watershed management approaches in other

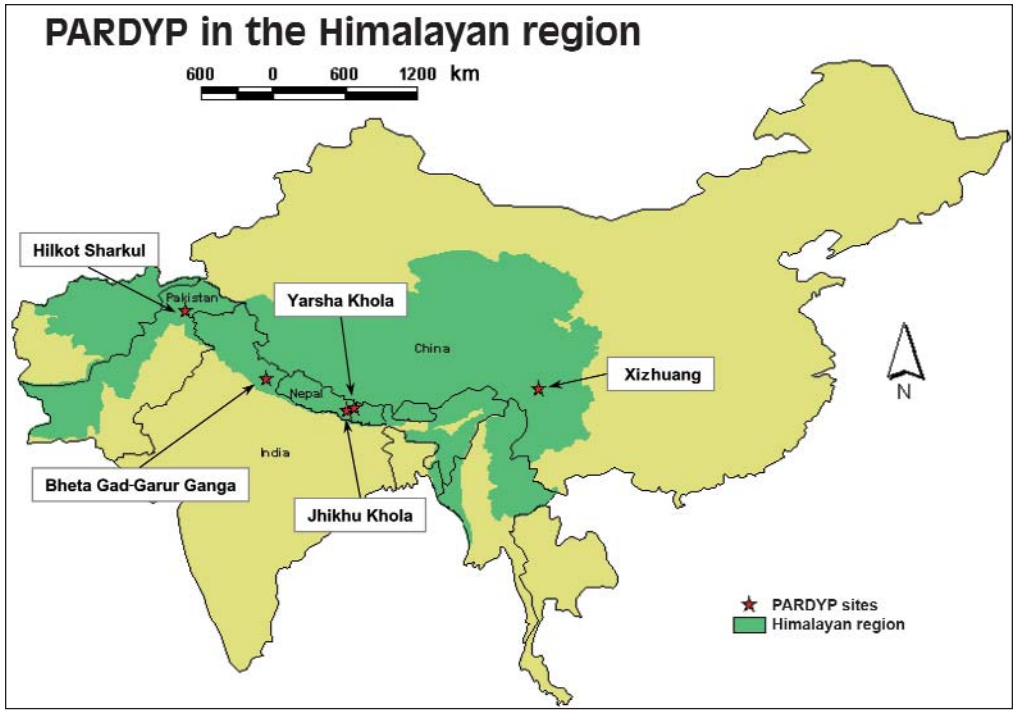


Figure 1: Location of PARDYP watersheds

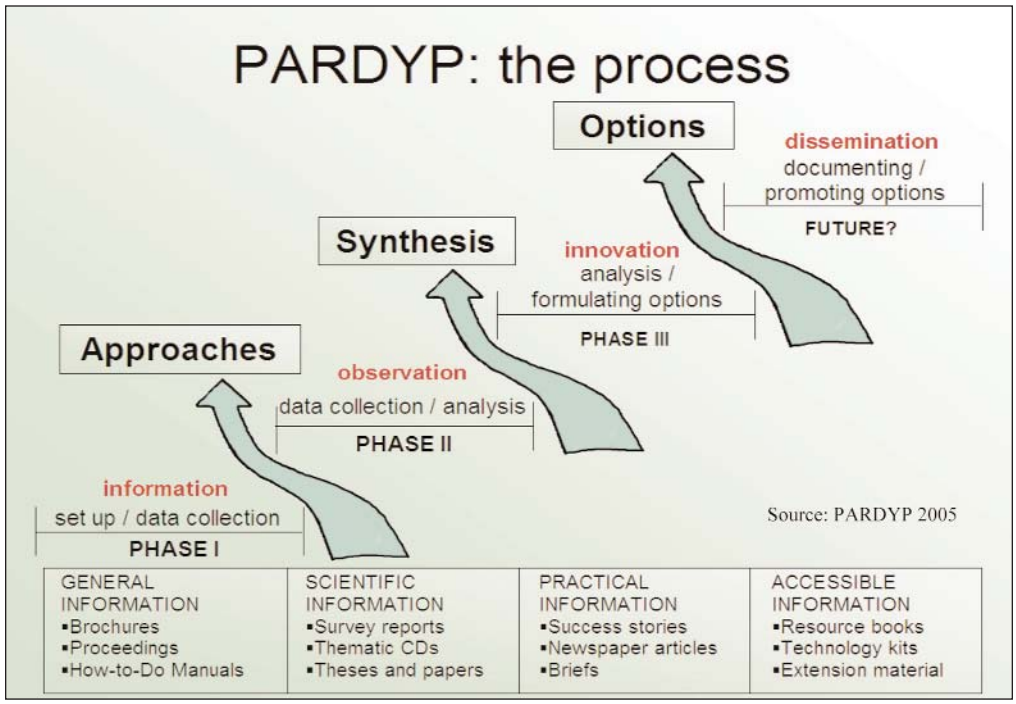


Figure 2: PARDYP history: the three phases with their key characteristics and main outputs related to natural resources (socioeconomic and institutional components not included) Source: PARDYP Phase 3: External Review Report

watersheds in the Himalayan region. The present document is one of these pathways. In it, we summarise the learning from the two watersheds in Nepal during the lifetime of the project in order to share the knowledge with others, as well as to provide a record of the achievements.

## Brief Description of the Watersheds

The major characteristics of the Jhikhu Khola and Yarsha Khola watersheds are summarised briefly in the Table 1 and described in more detail in the following. Much of the data is taken from the Livelihood Survey carried out under the project in 2004/05 and prepared as an internal report in 2005 (see box).

### Livelihood Survey of 2005

PARDYP conducted a livelihood survey in the Jhikhu Khola watershed to develop livelihood profiles, promote insights into problems and opportunities, and develop linkages with institutions for a comparative study. The fieldwork was conducted between November 2004 and January 2005 using local enumerators. A total of 169 households were selected using spatially stratified random sampling to represent the whole watershed area proportionately. The survey included respondents from Brahmin (37%), Tamang (21%), Chhetri (15%), and disadvantaged groups (17%), the remaining 10% being classified as 'other', with 66% males and 34% females. The results of the study were used in the assessment of PARDYP activities as described in this volume. The report itself is included in PARDYP project documentation which is held in the ICIMOD library for reference.

Table 1: **Major characteristics of the Jhikhu Khola and Yarsha Khola watersheds**

| | Jhikhu Khola | Yarsha Khola |
|---|---|---|
| Location<br>District<br>Distance from Kathmandu | <br>Kavrepalanchowk<br>45 km east of Kathmandu | <br>Dolkha<br>190 km east of Kathmandu |
| Total area (ha) | 11,141 | 5,338 |
| Elevation range (masl) | 750 – 2,050 | 990 – 3,030 |
| Climate | Humid subtropical to warm temperate | Humid subtropical to warm temperate |
| Dominant geology | Mica schist and limestone | Gneiss and slate + graphitic schist |
| Topography | High vertical relief, steep slopes, and shallow soils | Steep slopes, no flat areas |
| Population | 48,728 (1996) | 20,620 (1996) |
| Population density 1996 (persons per sq.km) | 580 | 386 |
| Average family size | 6 | 5 |
| Dominant ethnicity | Brahmin, Tamang, Chettri, Danuwar | Tamang, Brahmin, Chettri |
| Main staple foods | Rice, maize, wheat, potatoes, millet | Rice, maize, wheat, potatoes, millet |
| Major cash crops | Potatoes, tomatoes, rice, fruit, vegetables | Seed potatoes, fruit |

## Jhikhu Khola Watershed

The Jhikhu Khola watershed lies in Kabhrepalanchowk District in the central mid hill region of Nepal about 45 km east of Kathmandu (Table 1). It covers an area of 11,141 ha. The watershed lies in the humid sub-tropical agro-ecological zone (Figure 3) with a distinct dry period from November to January and a very wet monsoon from June to September characterised by high-intensity long-duration rainfall. Rainfall information is given in Annex 1. The elevation ranges from 750 to 2,050 masl and is characterised by high vertical relief, steep slopes, and shallow soils (Figure 4).

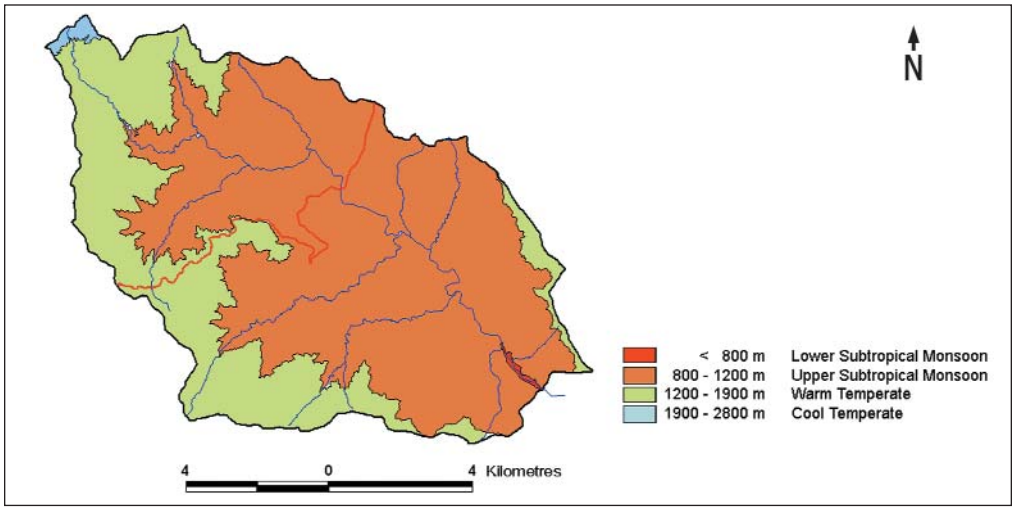


Figure 3: Climate Map of the Jhikhu Khola watershed

Figure 4: View across the Jhikhu Khola watershed

The watershed is among the most densely populated areas in the Himalayas with a projected population density in 2006 of more than 716 persons per km$^2$ (Table 2). The population growth rate between 1990 and 2001 (around 6% per annum) was much higher than the value across the whole district (1.74% per annum from 1991-2001). The population comprises Brahmins (37%), Tamangs (21%), Chhetris (15%), disadvantaged groups (17%), and others (10%) (Livelihood Survey 2005).

Table 2: **Jhikhu Khola population**

| Year | Population[a] | Population Density per km$^2$ | Annual Growth Rate % | Annual Growth Rate % |
|---|---|---|---|---|
| 1947 | 8,761 | 79 | | |
| 1990 | 31,202 | 280 | 3 | 6% between 1990 and 2001 |
| 1996 | 44,011 | 395 | 5.9 | |
| 2001 | 59,242 | 532 | 6.12 | |
| 2006 | 79,744[b] | 716[b] | | |

Note: [a]Shrestha 2005a; [b]Projected population based on 1996 to 2001 growth rate

In 2004 the average family size per household was 6.5, with a range from 2 to 19. Some 40% of households had 7 or more individuals, and 20% had 4 members or less. The overall literacy rate was 65-79% for men and 53% for women (Livelihood Survey 2005).

The great majority (77%) of people work in agriculture; 7% (mostly women and older men) are engaged mainly in domestic work, 2% have small shops, and 14% have other services or businesses (Livelihood Survey 2005).

Most people (98%) own their own house, nearly one fifth of households have more than one house. Electricity, including solar, was available in 77% of households questioned, compared with a national average of only 5% (Livelihood Survey 2005). The electricity is mainly used for lighting.

Agricultural land accounts for 55% of total land; forest, grassland, and shrubland for 42%; and other land uses for 3% (Table 3 and Figure 5). Some 96% of households have access to some cultivated land with a median landholding per household of 0.56 ha, including 0.36 ha irrigated land (khet) and 0.15 ha rainfed outward sloping agricultural land (bari). Some 16% of households have less than 0.25 ha of land and 5% more than 2.0 ha (Table 4). Of the total cultivated land, 35% is irrigated, 58% is rainfed, and 7% is steep (pakho and khar bari/waste-land). Around three-quarters of households have access to irrigated land (Livelihood Survey 2005).

The Jhikhu Khola watershed is economically very active in terms of agriculture as a result of its closeness to Kathmandu and to district markets such as Dhulikhel and Banepa.

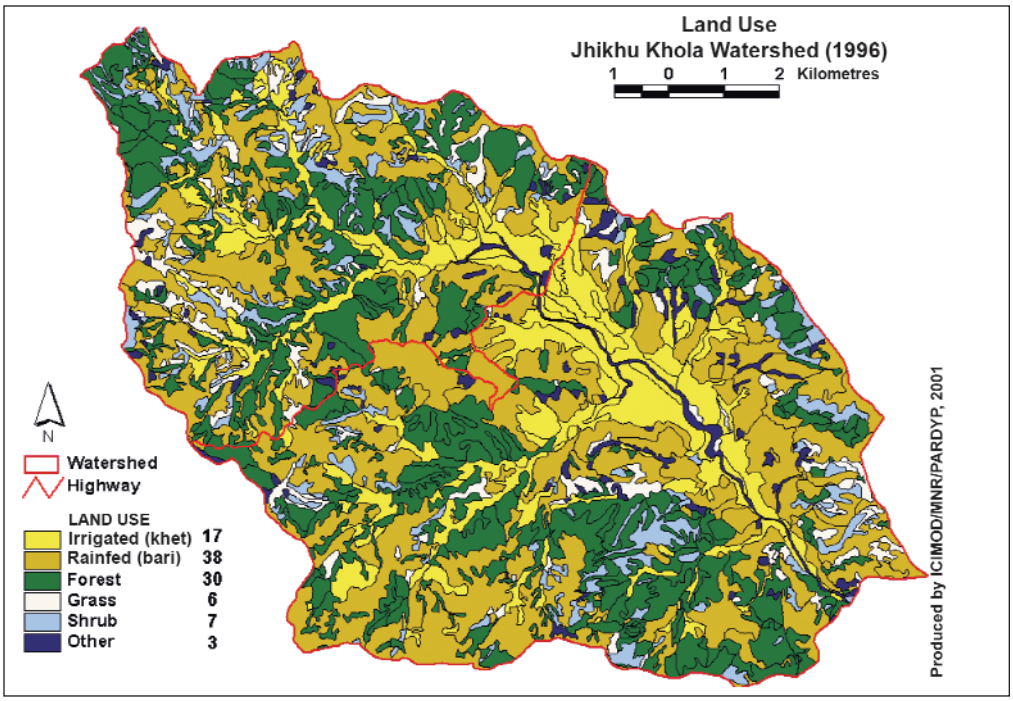


Figure 5: Land use map of the Jhikhu Khola. Source: Shrestha (2005b) based on LRMP (1986)

Table 3: **Land use characteristics of the Jhikhu Khola (1996)**

| Land use | % |
|---|---|
| Irrigated land | 16.7 |
| Rainfed land | 38.3 |
| Forest | 31.2 |
| Grassland | 6.8 |
| Shrubland | 3.9 |
| Other (%) | 3.0 |
| **Total Area** | **11,141 ha** |

Source: Shrestha 2005b, based on LRMP 1986

Table 4: **Cultivated landholdings in the Jhikhu Khola**

| Landholding Size (ha) | % of Households |
|---|---|
| 0 | 4 |
| 0.01-0.25 | 16 |
| 0.25-0.50 | 20 |
| 0.5-1.0 | 30 |
| 1.0-2.0 | 25 |
| >2.0 | 5 |

Source: Livelihood Survey 2005

## Yarsha Khola Watershed

The Yarsha Khola watershed is located in the central mid hill region of Nepal about 190 km east of Kathmandu on the Lamosangu-Jiri Road in Dolakha District (Table 1) covering an area of 5,338 ha. It lies in the humid sub-tropical agro-ecological zone (Figure 6) with a distinct dry period from November to January and very wet monsoon from June to September characterised by high-intensity, long-duration rainfall. Rainfall information is given in Annex 2. The elevation range is 990 to 3,030 masl. The topography is dominated by steep slopes, with almost no flat areas (Figure 7). The projected population density of the Yarsha Khola watershed in 2006 was about 590 persons per sq.km (Table 5). The population growth rate between 1990 and 2001 of around 4% per annum was higher than the value across the district as a whole (1.65%). The three main ethnic

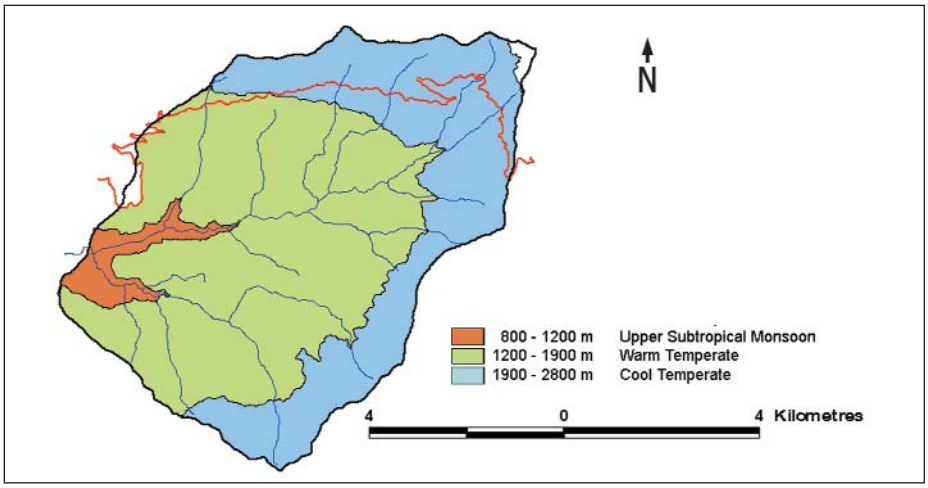


Figure 6: Climatic Map of the Yarsha Khola watershed

Figure 7: View across the Yarsha Khola watershed



communities are Tamang (27%), Brahmin (25%), and Chhetri (25%) (Shrestha 1999). In general, Sherpas and Tamangs dominate the higher parts of the watershed. In 1999, the literacy rate was 70% for men but only 8% for women (Brown 1999).

Agricultural land accounts for 51% of total land; forest, grassland, and shrubland for 43%; and other land use for 6% (Table 6 and Figure 8). Of the total cultivated land, 27% is irrigated and 73% is rainfed. All households have access to some cultivated land with a median landholding per household of 0.8 ha, of which 0.3 ha is irrigated and 0.3 ha is rainfed (Brown 1999). Some 30% of households have less than 0.5 ha of land and 11% more than 2.0 ha (Table 7). The Yarsha Khola watershed is economically less active than the Jhikhu Khola watershed in terms of agriculture as a result of the lack of markets within a reasonable distance.

Table 5: **Yarsha Khola population**

| Year | Population[a] | Population Density per km$^2$ | Annual Growth Rate % |
|---|---|---|---|
| 1971 | 10,885 | 204 | |
| 1981 | 13,737 | 257 | 2.35 |
| 1991 | 16,688 | 313 | 1.97 |
| 1996 | 20,620 | 386 | 4.32 |
| 2006 | 31,482[b] | 590[b] | 4.32 |

Note: [a] Shrestha 1999; [b] Projected population based on 1991 to 1996 growth rate

Table 6: **Land use characteristics of the Yarsha Khola (1996)**

| Land use | % |
|---|---|
| Irrigated Land | 13.9 |
| Rainfed Land | 37.4 |
| Forest | 31.5 |
| Grassland | 5.8 |
| Shrubland | 5.4 |
| Other | 6.4 |
| **Total Area** | **5,338 ha** |

Source: Shrestha 1999

Table 7: **Cultivated landholdings in the Yarsha Khola**

| Land Size (ha) | Total land % |
|---|---|
| <0.5 | 30 |
| 0.5-1.0 | 38 |
| 1.0-2.0 | 21 |
| >2 | 11 |

Source: Brown 1999

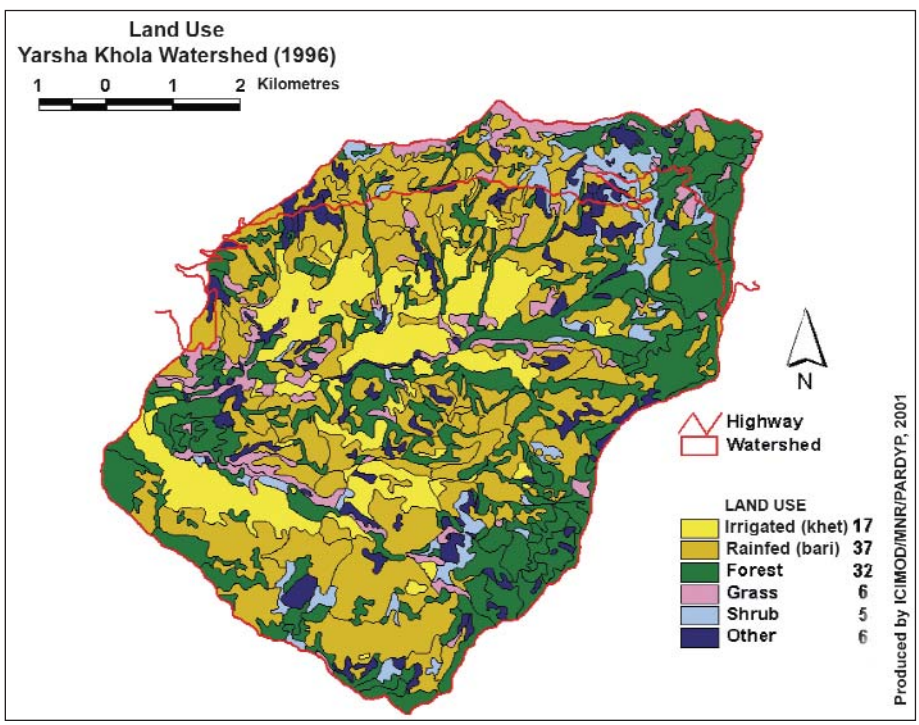


Figure 8: Land use map of Yarsha Khola. Source: Shrestha unpublished data, based on LRMP (1986)