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**Reconciling protected area management and sustainable
development: a study of the socio-economics and wild food use of
local communities in the Nanda Devi Biosphere Reserve, Indian
Himalayas**

By

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A report submitted in partial fulfilment of requirements for the MSc

September 2005

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Abstract

The importance of reconciling protected area management with sustainable development has come to the forefront of conservation management in recent decades due to a realisation of the effects of exclusionist conservation policies on local communities. An examination of the present position of, and trends in, the socio-economic status of two villages in the Nanda Devi Biosphere Reserve, in conjunction with an assessment of the current levels of wild food and medicinal plant use in the park demonstrate that the closure of the reserve in 1982 continues to influence the fortunes of the Bhotiya people who live there and that the effects are, to some extent, village-specific. The attitudes of the local community towards the park reflect the impacts of the closure as well as the recent alterations in management and highlight the importance of community participation in the future administration of the park.

There are indications of positive outcomes from changes in the approach to the management of the reserve which reflect with a significant shift in Indian conservation policy in the last two decades, towards integrating conservation and development through community participation. The results of this study, however, combined with a review of conservation policy in India highlight the ongoing problems of integrating conservation and development in a developing country. The heterogeneous nature of the environment and resident local communities means that there is no universal solution to reconciling protected area management with sustainable development. The future of the management of the NDBR must therefore be tailor-made in order to preserve this unique habitat and culture of the Bhotiya people.

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Acronyms

CBC	Community-Based Conservation
CBD	Convention on Biological Diversity
CI	Calculated Income
CITES	Convention on International Trade in Endangered Species
EI	Estimated Income
IBWL	Indian Board for Wildlife
IEP	Indian Ecodevelopment Project
JFM	Joint Forest Management
NDBR	Nanda Devi Biosphere Reserve
NGO	Non-Governmental Organisation
PA	Protected Area
PAN	Protected Area Network
PRA	Participatory Rural Appraisal
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VEC	Village Ecodevelopment Committee
VFC	Village Forest Committee
WCPA	World Commission on Protected Areas
WPC	World Parks Congress

1 Introduction

Conservation in India, as with many developing countries, has been primarily based on the creation of a system of protected areas (PAs). In many regions, including the Himalayas, these networks of National Parks, Biosphere Reserves and Wildlife Sanctuaries have often destroyed the traditional way of life of the communities living there resulting in socio-economic degradation and consequent conflict between the local people and the park management and wildlife (Hough, 1988; Ghimire & Pimbert, 1997).

In order for conservation to be both successful and sustainable in the long-run, participation from all stakeholders is a prerequisite (Fiallo & Jacobsen, 1995; Walters et al, 1999). This necessitates a thorough understanding of the past and present socio-economic status of the communities involved and their dependence on natural resources for both subsistence and commercial uses. These factors will vary significantly over different spatial and temporal scales; therefore, there can be no blueprint solution for the implementation of successful participatory conservation, but only a set of guidelines which must be tailored to fit each individual situation. However, the tailoring of participatory conservation management not only requires information on the economic status of the communities involved but must take into account an appreciation of their attitudes towards conservation and the environment in which they live (Mehta & Kellert, 1998; Sekhar, 2003). Taking recommendations from the local community for what they perceive as necessary conservation and developmental actions, is also vital (Badola, 1998).

The Nanda Devi Biosphere Reserve (NDBR) provides a wonderful case study of the effects of traditional protected area management on the local community. Partly as a result of its famous namesake, there are scientific and historical records from the region dating back over 100 years. Consequently, the history of the establishment of the reserve and its impacts on the environment as well as its cultural effects on the local community has been well documented. It is possible, therefore, to study the changing relationship between the local people and the reserve to determine which management options have proved successful and why and to propose alternatives for the future administration of

the reserve. Unfortunately, the fact that it has been well studied also means that its resident community are no longer so well-disposed towards foreign researchers. The traditional protected area management approach under which the park is administered also means that it is difficult to gain access to the reserve, and this access is strictly limited, restraining the scope of the study.

Taking an historical perspective, this study aims to illustrate the current status and trends in socio-economic position and wild food and medicinal plant use in the NDBR, exploring how changes in conservation management have affected the local community; in particular examining differences between the two study villages, Tolma and Lata. Alongside this analysis, the study also describes local attitudes towards conservation and the NDBR and community suggestions for the management of the park. Recommendations for the integration of conservation and development within the NDBR will be made. It is hoped that these proposals will prove useful in the wider context of reconciling protected area management and sustainable development through community participation.

Objectives:

1. Detail the socio-economic structures of Tolma and Lata to illustrate the current status of the local inhabitants and to compare and contrast the two villages.
2. Establish the level of use of wild foods and medicinal plants in the two villages and determine how these patterns are related to socio-economic structure.
3. Draw a broad picture of the alteration in the area due to the closing of the core zone of the Nanda Devi Reserve in 1982, in particular highlighting the changes in socio-economic structure which have occurred since 1999, when the region was last studied in detail. Where possible, relate changes in livelihoods to changes in wild food and medicinal plant use.
4. Understand local people's attitudes towards the Nanda Devi Biosphere Reserve and the natural environment in general. Determine what they want to see from conservation and development in the region in the future.

5. Suggest measures for improving conservation in the region through integration with development schemes and increased participation of local stakeholders.

2 Protected area management and sustainable development

2.1 Protected Areas

2.1.1 The concept

The World Commission on Protected Areas (WCPA) defines a protected area as: *‘an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective measures’* (IUCN, 2003). Associated with this definition are six categories of protected area which provide a classification system based on different management objectives. Of these, only category VI specifically acknowledges the need for a *‘sustainable flow of natural products and services to meet community demands’* (IUCN, 2003). Consequently, by definition, the establishment of a protected area will result in limiting the use of the natural resources within that locale, with the local communities which depend on these resources being most vulnerable to the impacts this limitation will cause (Brockington and Schmidt-Soltau, 2004). Effectively, the modern concept of protected areas is a ‘classical’, ‘northern’ vision of conservation which considers local dependents as a menace to the future of the ‘untouched wilderness’ in which they live. The idea of an ‘untouched wilderness’, however, is a façade, with almost all such areas having been used by humans for thousands of years (Gadgil and Guha, 1992). However, the concept of a protected area as linked to cultural, for example, sacred uses, are ancient and widespread.

The importance of the environment to rural communities is well established: people depend on the environment for their livelihoods, health, as a safety net against agricultural failure, and for economic growth (World Bank, 2002), and it is often the poorest members of society that are most dependent on environmental goods and services (Cavendish, 1999; Adams, 2004). Protected areas have been successful in conservation terms (Milner-Gulland & Mace, 1998) and there are those who continue to support protected areas as the most effective way to conserve biodiversity (Oates, 1999; Bruner et al, 2001). However, the fact that such strictly exclusive environmental policies may cause impoverishment, endangering conservation, has developed into a key area of

concern. This was acknowledged at the Vth World Parks Congress in 2003 where a statement was made promising that *'protected area management strives to reduce, and no way exacerbate, poverty'* (WPC, 2003).

2.1.2 Biosphere Reserves

In a move to integrate development with conservation within protected areas, UNESCO held the 'Biosphere Conference' in 1968. This was the first intergovernmental conference aiming to reconcile the conservation and use of natural resources. From this arose the concept of a Biosphere Reserve as *'an area of terrestrial and/or coastal ecosystem promoting solutions to reconcile the conservation of biodiversity with its sustainable use'* (UNESCO). It is intended that each designated biosphere should fulfil three complementary and reinforcing functions: conservation, development and logistic in the form of information exchange from research, education and monitoring (UNESCO). The 'Man and the Biosphere' (MAB) programme was officially launched in 1970.

A biosphere reserve consists of three interrelated zones: the core zone, buffer zone and transitional zone; defined by UNESCO to fulfil the following roles. The core zone is essentially a strictly protected area requiring legal protection with possibly only very limited and controlled extractive uses permitted. This allows for long-term protection of the environment. The buffer zone is so called as it is meant to act as a 'buffer', protecting the core zone. It is within this region that experimental sustainable management techniques are explored, alongside other developmental initiatives such as educational schemes or ecotourism. Limited use of natural resources is also permitted in this region. The transitional zone is an area of cooperation where all stakeholders (for example; local communities, government, NGOs, scientists) in the reserve work together to manage the region's resources to allow for the sustainable development of those who live there.

2.2 Sustainable Development

2.2.1 The concept

In 1987 the World Commission on Environment and Development published a report 'Our Common Future' from which the definition of sustainable development as *'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'* was born (WCED, 1987). Unfortunately this definition is not as clear-cut as it appears. The definition of 'sustainability' itself is a woolly topic (Lesser et al, 1997) and it also functions on different timescales depending on its dimension (Milner-Gulland & Mace, 1998). Consequently, it is almost impossible to predict whether development can be sustainable in the long term when all dimensions and potential definitions are considered (Barnes et al, 2002).

The goals of environmental conservation and development appear to be diametrically opposed; however, if development is to be sustainable it is necessary to consider the conservation of the resources upon which the people depend. Likewise conservation will not succeed unless the needs of the local communities are not taken into account. The UK government, through the Department for International Development's Wildlife and Poverty Study (2002), highlights the failure to clearly link biodiversity with poverty as the central reason for the continuing conflicts between conservationists and developers of social and economic wealth. The Millennium Development Goals (MDG, 2000) and the World Summit on Sustainable Development (UN, 2002) are the culmination of a decade of policy attempts to integrate development strategies and environmental conservation in a sustainable manner.

2.3 Integrating Protected Area Management and Sustainable Development

It has finally been acknowledged that protected areas need to be more involved in sustaining local people's livelihoods (Ghimire & Pimbert, 1997). Although biosphere reserves go somewhat towards achieving this by sharing their core principles with those of sustainable development, there are still reports of inconsistencies between the vision of

the buffer zone policy and the policy in practice (Budhathoki, 2004). However, there is evidence that the management of protected areas is beginning to evolve to integrate development and sustainable resource use with its conservation goals alongside a realisation of the need to increase stakeholder participation in resource management. It has been shown in fact that conservation efforts rarely succeed without integral support from local users (Fiallo & Jacobsen, 1995; Brandon, 1997).

In 1997 the IUCN held a conference discussing the role of protected areas in the twenty-first century. As a result they determined that in order to *'place protected areas in their broader context'* it was necessary to *'seek partnerships and encourage cooperation with neighbours and other stakeholders'* (IUCN, 1997). The Convention on Biological Diversity, in article eight, also talks about the importance of involving indigenous communities in conservation. Articles 10 and 11 encourage the development of economic incentives to engender local support for conservation (CBD). Such measures include ecotourism and integrated conservation and development projects.

2.3.1 Integrated conservation and development projects (ICDPs)

Integrated conservation and development projects are a form of community-based conservation (CBC) and within a protected area context they attempt to reconcile the management of protected areas with the socio-economic requirements of local stakeholders (Wells & Brandon, 1992), thus allowing for the costs of conservation to be shared more equitably (Stankey, 1989).

Although there are some records of successful ICDPs (BCN, 1999) they appear to be few and far between. There are, however, common characteristics of ICDPs which account for their success or failure and their potential for long-term sustainability. These include:

- The political situation of the region or country in which the ICDP has been established (Oates, 1999)
- Economics: economics often lie at the root of a conservation problem as people regularly engage in activities that lead to damage of natural resources because their private benefits are much greater than their private costs. Salafsky et al,

(2001) question whether or not ICDPs are an efficient method of paying for conservation

- The importance of community participation and the need for effective communication between stakeholders, allowing them to learn from one another. Walters et al, (1999) reported that the relative success of a project depended on the ability of the local stakeholders to adapt to local situations and to move away from an inflexible universal scheme to a more village specific management plan.

2.3.2 Community Participation

Community participation appears to be vital if conservation management of protected areas is to be reconciled with the aims of sustainable development. Participation not only enables local resource users to integrate their concerns into management plans but also ensures that they understand the rules governing the area being managed. For example, it has been shown that in India, Van Panchayats (Forest Councils) and Village Forest Committees (VFCs) were successful where resource users designed the rules themselves and where institutional arrangements were shared and understood by all members (Agarwal, 2001).

The development and dissemination of participatory methodologies under the rubric of participatory rural appraisal (PRA) in the late 1980s has aided the integration of community participation within management planning, and was behind the evolution of ICDPs (Chambers, 1994). Using these methods to gain an improved understanding of livelihood strategies is a cost-effective method to ensure that participatory research is focused on the needs of the poor (Cramb et al, 2004). Through experiences of the ecodevelopment project (an Indian version of an ICDP) at Ranthambhore Sanctuary, Sharma (2000) recommends that any ecodevelopment measures should only be carried out only after PRA has been conducted in the village concerned.

Participation, however, must be equitable. Often certain members of a community are excluded reducing the effectiveness of community participation in management planning and implementation. Agarwal (2001) suggests the following determinants of participation in community conservation groups:

- rules of entry: criteria defining membership in the group
- social norms: behaviour etc
- social perceptions regarding women's ability to contribute
- entrenched territorial claims
- personal endowments and attributes such as education, property, marital status, ages
- HH endowments and attributes, for example, class and caste

Although it is widely agreed that it is impossible to achieve conservation goals without making local people equal participants in decision making and benefit sharing (Ghate, 2003) this is often difficult to achieve. The following chapter discusses the gradual development of community-based approaches to conservation policy in India whilst the case study of this report provides further evidence for the need for community participation and offers insights as to how this may be achieved within the Nanda Devi Biosphere Reserve and protected areas in general.

3 Community-based conservation in India

India is the seventh largest country in the world, in geographical terms, with an area of 329 million hectares, and the second largest in terms of population with a current population of roughly one billion (Sudha & Ravindranath, 2004). This is expected to rise to 1.4 billion by 2026 (Dyson et al, 2004). Currently, one third of the country's citizens live in extreme poverty, amongst which are a quarter of the world's tribal people (Khare, 1998).

India is a federal country and is divided into 28 States and 7 Union Territories, with a clear delineation of powers between the two levels of government. On the 15th August 1947 India gained independence from the British before which conservation policy was based on the establishment of game hunting reserves for the British colonialists and Indian aristocracy and on the maintenance of a sustained supply of commercial timber. Consequently this practice relied on the exclusion of people from those areas being 'conserved'. Despite over 50 years of independence, current conservation policy and practice have struggled to break out of their colonial roots (Khare, 1998).

3.1 Protected Areas in India

Conservation in India has generally been considered successful, despite its high population density and elevated poverty level and often inefficient and corrupt government (Oates, 1999). Possible reasons for this achievement include:

- strength and continuity of the Indian Civil Service
- presence of a participatory democracy
- effective separation of government and judiciary
- underlying cultural respect for nature, partly as a result of the practice of Hinduism by a large sector of the population
- lack of foreign-sponsored conservation and development projects

(Oates, 1999)

However, this success has been achieved through an institutional framework for protected areas premised on the need for strict protection of national parks, including the relocation of local communities and prohibition of all natural resource use (Mahanty, 2002). This is embodied in the Wildlife (Protection) Act, 1972. Although there were a number of acts passed before 1972 relating to wildlife conservation and the creation of protected areas, the Wildlife (Protection) Act provided the necessary uniform legislation for the establishment of protected areas (Green, 1993). In India there are two forms of protected areas: National Parks and Wildlife Sanctuaries. National parks are provided with a greater level of protection, with no grazing or private landholding or rights permitted within them: *'no person shall destroy, exploit or remove any wildlife from a National Park or destroy or damage the habitat of any wild animal....except under and in accordance with a permit granted by the Chief Wildlife Warden and no such permit shall be granted unless the State Government, being satisfied that such destruction, exploitation or removal of wildlife from the National park is necessary for the improvement and better management of the wildlife therein, authorises the issue of such a permit'* (Kothari et al, 1989). Although wildlife sanctuaries are afforded a lower level of defence, to those living within the regions of these protected areas, the difference is academic (Khare, 1998)

In 1989 a report for the Indian Institute of Public Administration on the *'Status of Administration of National Parks and Sanctuaries'* (Kothari et al, 1989) recorded that 55 percent of protected areas had people living within the park, whilst 80 percent had a human population around them. The same survey also testified that from a sample of 39 national parks and 167 sanctuaries, 36 percent and 29 percent respectively, reported incidents of injury and death of humans due to attacks by wild animals whilst 37 percent of national parks and 17 percent of sanctuaries reported incidents of confrontations or clashes between the people and the authorities. These facts highlight the elevated potential for people-policy and people-wildlife conflicts within protected areas which may result in the deterioration of the relationship between local communities and those managing the parks, consequently undermining the conservation success of the reserves (Rao et al, 2002; Mukherjee & Borad, 2004).

It is only in recent decades that there has been a shift towards a more community-based approach towards conservation. It is to be noted, however, that much of the legislation and methods relate to the conservation of forests, which may be a result of colonial

influence or it may be due to the fact that 23 percent of the geographical area of India is forest, and is therefore a key ecosystem within the country. Below follows a discussion of the significant developments towards a more community-based approach to conservation policy in India.

3.2 Land tenure system

Independent India inherited a semi-feudal agrarian system of land holding that was characterized by heavy concentration of cultivable areas in the hands of relatively large absentee landowners with a lack of any generalized system of documentary evidence of landownership or tenancy. Traditionally, three systems of agricultural land tenure were prevalent in India. These were *Ryotwari* (property rights held by the holder), *Mahawari* (community proprietorship) and *Zamindari* (ownership of several villages by a single family). In the early 1950s, in the first five-year plan, the government introduced ceilings on the size of landholdings, which in the 1970s were greatly reduced. Tenancy Acts were also passed as early as the 1950s in some States. These provided for:

- regulation of rents
- security of tenure,
- conferment of ownership on tenants.

The system of *Zamindari* was also abolished.

By the early 1980s, most of the cultivated area had been surveyed and records of rights prepared. In several states steps were taken to associate village *panchayats* with the maintenance of land records, the collection of land revenue, and the management of lands belonging to government. Unfortunately, the results of these efforts have frequently been unsatisfactory. The ultimate object of the tenancy reforms has been to 'put the rights of the land in the hands of the tiller'. However, despite these reforms being established 50 years ago there is still a problem of land tenure insecurity in many regions.

(Source: FAO; Indiaagronet; Indiachild)

3.3 Legal provisions for community-based conservation

3.3.1 The Constitution of India

As originally adopted, the constitution of India did not incorporate any provisions for the conservation of the environment. It was only in 1976, under the 42nd Amendment Act, that articles 48A and 51-A were introduced which declare that it is the fundamental duty of the State and every citizen of India to undertake to '*protect and improve the environment*'. Article 51-A thus gives a broad constitutional orientation to community-based conservation (CBC) (Krishnan, 1998). The first time that the need to integrate environmental considerations with economic development was explicitly articulated was in the fourth five-year Government Plan from 1969 – 1974 (Green, 1993). However, the most significant Constitutional amendment, in terms of CBC, came with the 73rd Amendment which allowed for the local village councils (*panchayats*) to act as a third level of government below the central and state governments. As State governments continue to grow in power and influence, this amendment is important as it should ensure community participation by strengthening democratic institutions (*panchayats*) at the grassroots level.

3.3.2 National Forest Policy 1988

This policy envisages people's participation in the development and protection of forests with the basic objective of maintaining environmental stability through the preservation of forests as a natural heritage (Sudha & Ravindranath, 2004). This was a reversal of the revenue-orientated policy of 1952 and signalled a step towards the reversal of a hundred years of a protectionist approach towards conservation, setting the stage for participatory forest management (Saigal, 2000). The change is a cautious one however, as it still suggests the strengthening of the network of national parks, sanctuaries, biosphere reserves and other protected areas and there is very little advice for the people living in and around the protected areas (Khare, 1998).

3.4 The Joint Forest Management approach (JFM)

In 1990 The Ministry of Environment and Forests sent out a circular to the States and Union Territories setting out a new policy on '*involvement of village communities and voluntary agencies in the regeneration of degraded lands*' (Badola, 1995). The aim of Joint Forest Management (JFM), as an approach to CBC, was to develop partnerships between state forest departments (as owners and co-managers) and local community organisations (as co-managers) in the regeneration of degraded forest lands (Badola, 2000). The role of NGOs as facilitators was also highlighted (Saigal, 2000).

Under the policy, Village Forest Committees (VFCs) are established which work alongside the forest departments to manage the degraded forests under their jurisdiction. Forest departments generally still retain a large amount of power and control over the VFCs and it is possible for them to dissolve the committees or cancel the membership of certain individuals. VFCs, on the other hand, have very little power and no means of questioning the actions of the forest departments (Badola, 1995).

Although there have been some positive impacts of JFM and the response by both states and communities has been impressive with 19 States having initiated the policy resulting in 2.5 million hectares being managed by 20,000 communities (Khare, 1998); the general feeling is that the overall impact in terms of forest regeneration has been marginal (Dutta et al, 2005) and that the policy is still in an experimental stage (Saigal, 2000). The key problem is that local institutions for the management of natural resources already exist in the form of *van panchayats* (*van* meaning forest and *panchayat* meaning council). As already discussed these organisations have been given greater powers under the 73rd Amendment to the Constitution. The decision to implement JFM in *van panchayat* areas erodes the rights of these traditional institutions whilst many of the provisions of the two institutions also contradict one another creating confusion between the local communities and forest departments (Ballabu et al, 2002). There are also latent conflicts related to caste, class and gender which threaten JFM institutions at the village level and within the forest department conflicts are arising as it moves from being an implementer of conservation to a facilitator (Saigal, 2000). It has also been suggested that the long-term success of JFM is threatened as it does not integrate sustainable development within its policy (Kanshal & Kala, 2004).

3.5 Ecodevelopment

Ecodevelopment is essentially an Indian version of integrated conservation and development projects, the main element being to substitute people's dependency on protected areas by providing alternatives outside the area (Khare, 1998). Effectively it tries to compensate for lost access to natural resources after the establishment of protected areas (Badola, 2000). The first recognition of this approach in the government system came in the form of the 1983 Report of a special Task Force of the Indian Board for Wildlife (IBWL) on 'Eliciting Public Support for Wildlife Conservation'. The strategy recommended by this report was accepted by the IBWL and the Indian Government and integrated into the Nation Wildlife Action Plan adopted by the Government in the same year (Panwar, 2001).

Originally there was a low investment in capacity building and implementation (Badola, 2000). However, from 1995, the Global Environment Trust and the International Development Association invested, through the World Bank, in the India Ecodevelopment Project (IEP) which targeted seven national parks in India. The IEP aims to reduce pressure on the target parks from resource using communities and to reduce the losses to those communities through a range of income-generating and resource-substitution activities (Mahanty, 2002). This involves promoting conservation through the provision of incentives and alternatives and through environmental education and awareness campaigns. The monitoring and research to improve understanding of the issues in order to integrate experiences and strengthen the framework is also important (Malhotra, 2001).

Through participation the IEP endeavours to avoid the 'blueprint approach' (World Bank, 1996). To achieve this village micro-planning is used throughout implementation alongside the establishment of Village Ecodevelopment Committees (VECs). The participation of NGOs is also encouraged in order to facilitate implementation of the project and ensure effective communication between the local community and the forest department. Ecodevelopment has now been taken up in over eighty protected areas (including the original seven included in the IEP) providing facilities such as drinking water, irrigation, fencing, roads, health care, education and employment (Badola, 2000).

Despite some achievements ecodevelopment, like JFM, is riddled with serious flaws. The ecodevelopment concept accepts the existing legal and policy framework relating to protected areas; and therefore, by definition, under the present legislation, limits participation of people in protected area management (Khare, 1998). As many communities are also highly heterogeneous and stratified the problem of facilitating participation is magnified further (Karlsson, 1999). There is also a difficulty in moving from planning to implementation, illustrated by the lag of nearly a decade between the planning and implementation stages of the IEP (Mahanty, 2002). Often by the time that concepts reach project level they are time-bound, target-driven action plans (Badola, 2000).

**India Ecodevelopment Project (IEP) at Rajiv Gandhi (Nagarahole),
Karnataka (Mahanty, 2002)**

This project was established as part of the IEP and constructed on the premise of protecting park resources through alternative resource and income options. This limited the scope for alternative visions to be proposed or implemented resulting in conflict between the different stakeholders. Internationally financed interventions such as Nagarahole face many complex layers of actors, relationships and institutions.

The evidence from this case study suggests that changes in the way projects are managed by donor agencies and governments are required to enable greater flexibility and longer time-frames for intervention with a shift from large scale projects like the IEP to smaller, more flexible, site-specific ones

This case study provides evidence for the importance of actors, networks and processes of negotiation to the evolution and implementation of conservation interventions like an ecodevelopment project.

3.6 Comparison with community-based conservation in Africa

Currently Africa has 4.7 percent of its total land area dedicated to conservation (Musters et al, 2000) but, as in India, due to Africa's colonial legacy and the establishment of parks for the 'conservation' of game conservation policies have been largely founded on the establishment of protected areas with the exclusion of local communities (Anderson & Grove, 1987). The main tenets upon which protection in Africa has been commonly based are:

- the importance of the exclusion of local resource users
- paramilitary style enforcement
- consumptive uses of natural resources for income generating activities are not permitted although tourism and scientific research are

(Homewood, 2004)

Once again, as observed in other developing countries, this has lead to violent conflicts over natural resources (Gadd, 2005).

Unlike India, where environmental concerns have, for a long time, been formally integrated into governmental policy, in Africa, most environmental action on the ground is driven and implemented by non-governmental organisations (NGOs) whilst formal environmental policy is largely defined by international conventions such as CITES and The Convention on Biological Diversity (to which India is also a party). Unfortunately, African states are often weak and have neither local support nor the resources to carry out these policies (Homewood, 2004).

Although the importance of the role of community-based conservation in Africa has been acknowledged for many decades (Adams & Hulme, 2001), policy interventions aimed at integrating the environment and development are generally acknowledged to have had poor outcomes (Homewood, 2004). The ICDP approach evolved in the late 1980s and early 1990s, slightly later than its appearance in India. However, this has proved to be a failure in many cases (Oates, 1999). The organisational structure of many ICDPs often mimic ineffective colonial structures (Newmark & Hough, 2000), with power over wildlife management ultimately remaining with the state. For example, conservation planning in Tanzania remains a top-down endeavour, with communities and their specialized socio-ecological knowledge delegated to the margins (Goldman, 2003). Gibson and Marks (1995) suggest this may be one of the reasons why local communities in Africa remain disenfranchised from most ICDPs. This is similar to the situation in India, where despite the establishment of VFCs and VECs in areas where JFM or ecodevelopment has been established, control lies ultimate with the forest department.

3.7 Conclusion

The concepts of JFM and ecodevelopment are still not fully understood by both local people and the forest department resulting in confusion and conflicts whilst the problem of land tenure insecurity results in reducing the incentive to invest in land improvement and conservation (Badola, 2000). The forest department lacks the capacity to implement these ideas effectively due to insufficient staff and inadequate training and in almost all cases has maintained sole control over implementation, working in a manner that is almost totally non-participatory.

The historical approach to conservation in Africa is similar to that in India, being based on strictly protected areas; a legacy of their colonial past. In both regions, although this traditional approach is gradually being replaced with a more community-based methods success has been limited. This appears to be due to an inability to shift power from centralised management to community institutions, often through a lack of resources or confusion. India, in contrast to Africa, however, has a longer history of State recognition of the importance of combining conservation and development, along with a more established national policy on the environment suggesting that despite its deficiencies, community-based conservation policy in India should be judged as having made substantial progress in the field of integrated conservation and development.

4 Background to study site

The Himalayan region extends between 26°20' and 35°40' North and between 74°50' and 90°40' East and forms part of Nepal, Bhutan, Pakistan, China and India, covering approximately 419,873 km². They first rose between 60 to 70 million years ago and continue to rise even to this day (Tewari, 1996). The Indian Himalayan region comprises five bio-geographic zones: Trans, North West, West, Central and East Himalaya (Rodgers & Panwar, 1988). Over 53 percent of the total area is covered in forest (Tewari, 1996) and there are around 18,440 recorded species of plants, of which 25 percent are endemic to the Himalayas (Joshi & Samant, 2004).

A Protected Area Network (PAN) has been established throughout the Indian Himalayan Region, which currently comprises 28 national parks, 98 wildlife sanctuaries and five biosphere reserves, of which the Nanda Devi Biosphere Reserve is one.

4.1 The Nanda Devi Biosphere Reserve (NDBR)

The reserve was created under Project Six of the Man and Biosphere Programme of UNESCO on the 18th January 1988. However, it was originally declared a Wildlife Sanctuary as early as 1939 and later designated as a national park by the Indian Government in 1982 when the core zone was closed to all anthropogenic activities. In 1992 it was recognised as a World Heritage Site. It was originally located between 30°17'N - 30°41'N latitude and 79°40'E - 80°05'E longitude occupying an area of 2236.7 km² within the districts of Chamoli, Pithoragarh and Almora in the State of Uttar Pradesh. It has recently been extended to encompass an area of 5,860 km² which includes the second core zone of the Valley of Flowers (Figure 1)



Figure 2: Nanda Devi West (Photo: Caroline Howe)

4.1.1 Reasons for its establishment

The first recorded attempt to scale Nanda Devi West was made by W.W. Graham in 1883 (Green, 1993). However, he was unable to proceed beyond the gorge of the Rishi Ganga River. Later attempts were made in 1907, 1926, 1927 and 1932. Finally in 1934 E. Shipton and W.H. Tilman made a successful ascent. This opened the way for the expansion of adventure tourism in the region, which continued until 1982. The impacts of this on the biodiversity of the region was devastating and included the erosion of paths, littering of trails, use of forests for firewood and poaching; effects of tourism which were observed elsewhere in the Indian Himalayas and Nepal (Ceballos-Lacurain, 1991; Ahmed, 1993). Members of the 1993 scientific expedition recorded collecting 800 kg of rubbish (Silori, 2004). Entry to the park was finally banned in 1982 except for the purpose of ecological research; a scientific expedition is permitted into the core zone every 10 years to assess changes in biodiversity, the last survey being carried out in 2003 (UAFD, 2004).

4.1.2 Current conservation status of the NDBR

The results from the UAFD (2004) report show that there have been significant improvements in the status of biodiversity within the core zone of the NDBR since its closure. For example, since 1984 there has been a significant increase in Asiatic black bears, musk deer and monal pheasant whilst the density of many tree species is increasing. These results indicate the successfulness of the closure of the core zone in biological terms.

Increasing human and livestock populations in the Himalaya continue to threaten wildlife and their habitats through habitat loss, habitat degradation and poaching. This is currently not the case in the core zone of the NDBR due to its exclusion policy. However, the major threat to the future of its biodiversity is the continuing pressure on the Indian Government to open up this area for mountaineering and trekking activities (Sathyakumar, 2004).

4.1.3 The Bhotiya

The NDBR falls within the newly formed state of Uttaranchal which was created in 2000 to cope with the demographic scale as well as huge cultural divergences within its mother state Uttar Pradesh (Dyson et al, 2004). Uttar Pradesh was the largest state in terms of population but also the state with the highest levels of poverty. Within India one of the structural aspects of poverty includes being a member of the schedule castes or schedule tribes (Cassen & McNay, 2004). Uttar Pradesh has a very high proportion of schedule caste and tribe members which include the Bhotiya people.

Bhotiya tribal people belong to the Indo-Mongoloid ethnic group and are divided into two sub-communities, the Tolchha of Chamoli district and Marchha of Pithoragarh district. They traditional practice transhumance, having two permanent dwellings. High altitude residences are occupied between about March and October, with a migration to lower altitudes in the winter. Traditionally farmers, the Bhotiya people also traded for a long period with Tibet; exchanging spices, dyes and cloth for salt and high quality livestock (Brown, 1987). This ended in 1962 with the Indo-China war. From 1934 to 1982 a large proportion of the population was also involved in working as guides and porters for the tourist industry. After the closure of the park, the Bhotiyas lost this source of income. The Bhotiya are also known for the production of woollen goods; rugs and blankets being woven by hand and patterned using traditional natural dyes. This practice has begun to decline in recent years due to the loss of high quality sheep from Tibet, synthetic dyes and loss of a market after tourism was halted.

4.1.3.1 *The Chipko Movement*

Chipko, which means ‘to cling to trees’, emerged as a humble, non-violent protest of the inhabitants of the Garhwal region of the Himalayas against the commercial exploitation of the forests by government agencies (Bhatt, 1987). The movement originally began in the village of Reni in the 1970s, with women at the forefront led by the late Gaura Devi. The government had auctioned several forests, including one in the ecologically fragile catchment area of Alaknanda River. On the day of the proposed felling, however, the workmen were unable to proceed as the women stood in their way, hugging the trees. Consequently, what began as a protest against government policies became a highly, successful grassroots movement (Maikhuri et al, 1998). Today there are many women’s groups in the region known as the Mahila Mangal Dals (Figure 3), in which women work together to help each other maintain a place in a male-dominated society.



Figure 3: Mahila Mangal Dal of Lata (Photo: Caroline Howe)

4.1.4 The study villages

The two study villages are located in the Chamoli district of the Nanda Devi Biosphere reserve. Tolma (Figure 4) is a small village numbering 10 households. It is located at an altitude of 2800 metres and covers an area of 1214.7 hectares. It is accessed by a 4

kilometre trek from the road. Lata (Figure 4) is much larger with a population of 80 households. It is at slightly lower altitude of 2400 metres and covers an area of 2380.45 hectares and is only situated one kilometre from the road-head. Both villages also have winter settlements at lower altitudes. In both cases the nearest large town is Joshimath, 25 km from Lata and 40 kilometres from Tolma. In both cases this is their nearest health facility. Lata has both a primary and junior high school, whereas the children of Tolma must go to Surraithota (four kilometres on the road head) to attend primary school and must go to either Tapowan (10 km) or Joshimath as they get older. The populations of both villages are Bhotiya tribal people, although in Lata they are divided into schedule caste (lower caste) and schedule tribe (higher caste) members, occupying different sectors of the village.

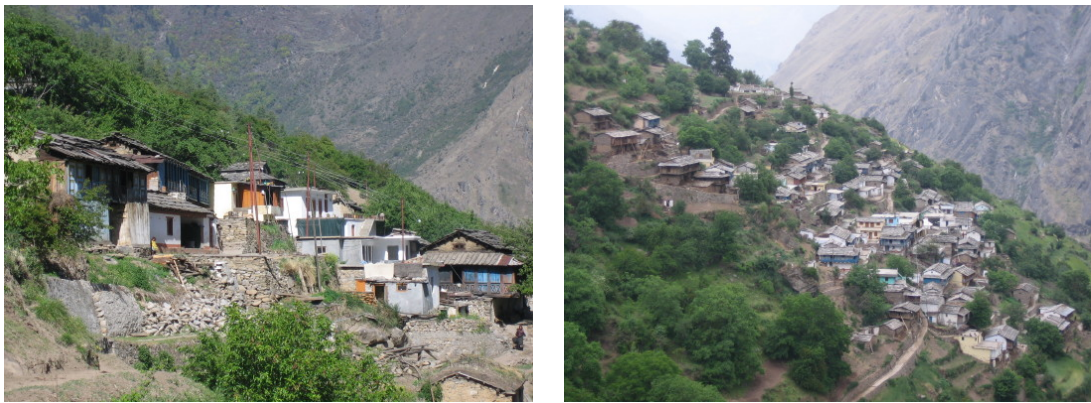


Figure 4: Tolma village (left) and Lata village (right) (Photos: Caroline Howe)

5 Research Methods

A combination of participatory rural appraisal (PRA) and questionnaire survey methods were used to obtain data on the livelihood structure and attitudes of the communities living in two study villages in the Nanda Devi Biosphere Reserve in order to answer the objectives outlined in the introduction. It has been suggested that combining methodologies in this manner combines the advantages of each method whilst overcoming their disadvantages (IISD, 2003). This specific combination of methodologies is ideally suited to this type of study due to its combination of qualitative and quantitative techniques. PRA tools facilitated communication between the researcher and the communities allowing for a large amount of mainly qualitative data to be collected within the short time frame available for field-work. Quantitative data meanwhile can be obtained through questionnaires. Combining both a variety of PRA techniques and the questionnaires allows for information to be triangulated, which is important when collecting socio-economic data; in this case concerning sensitive issues of wealth and potentially politically sensitive issues regarding conservation and attitudes towards the Forestry Department of India.

5.1 Background to methodology

5.1.1 Participatory rural appraisal (PRA)

Participatory rural appraisal techniques have been defined as ‘*a growing family of approaches and methods to enable people to share, enhance and analyse their knowledge of life and conditions, to plan and act*’ (Chambers, 1992). PRA methodology has been evolving since the 1970s, around the time that policy makers began to appreciate the importance of community participation in integrating conservation and development; consequently they have been developed to facilitate this process. It is often difficult to carry out long-term, in-depth socio-economic studies but PRA methods have been shown to provide high-quality data within a short time frame, provided that the research question is precise (Chambers, 1992). PRA techniques are not limited to rural development projects but have been used in a wide variety of fields.

The methodology of PRA is based on a set of principles which highlight the importance of reciprocal learning and sharing of information with the researcher acting as a facilitator rather than an implementer. The following list is a summary of the key values drawn from Kumar, 2002; Chambers 1992; Pretty et al, 1995:

- Informal group discussions instead of individual interviews
- A movement away from verbal to visual techniques
- ‘Handing over the stick’ (transferral of power from the researcher to the community)
- On-site learning
- Rapid, progressive and iterative learning allowing for flexibility
- ‘Reverse learning’ of the researcher from the community
- Triangulation (on-site cross-checking)

PRA methods are either: space-related, exploring the spatial dimension of people’s realities, including social and resource mapping and transects; or time-related, such as trend-analyses, time-lines, seasonal and daily schedules. There are also relation methods which include the use of flow charts, spider diagrams and ranking exercises (Kumar, 2002).

5.1.1.1 Advantages

The main advantage of PRA techniques is the high level of community participation a particularly important feature in research into integrating conservation and development. The use of visual aids not only allows for the participation of all members of the community, including those who are unable to read or write, but it also helps to overcome cultural and language barriers between the researcher and the community. The emphasis on reciprocal and iterative learning prevents the researcher from directing the answers due to preconceived ideas on what the results ‘should be’.

5.1.1.2 Disadvantages

Although premised on the principle of community participation it is often difficult to get a representative view of the community being studied as often some members are unwilling or simply not allowed to join in, such as women or members of lower caste

groups. Even where groups appear representative there are often domineering participants and it is important to bear this in mind when recording the results of the discussion. When discussing politically sensitive issues, for example in this study, local opinion of the Forestry Department of the Government, it is difficult to encourage people to be open about their views. It is vital, however, that every effort should be made to ensure, as far as possible, equitable participation. It is also important to remain open-minded to the results of discussions and to use a variety of techniques to validate any outcomes. Finally, it is necessary to remain self-critical; becoming a good facilitator requires time, experience and patience (Kumar, 2002). If inexperienced, it is important to take this into account when analysing results.

5.1.2 Questionnaire-based methodology

In order to study livelihood patterns and to carry out a comparative analysis it is necessary to carry out household interviews. Likewise to make quantitative conclusions regarding attitudes of local communities, an interview-based methodology is required. Structured questionnaires are the traditional method of collecting information from a community but in combination with semi-structured open questions a depth and breadth of information can be obtained (Bernard, 2002). This method was applied in this study.

5.1.2.1 Advantages

A questionnaire is useful as it allows the input to be controlled through pre-set questions so that comparable data can be produced. Questionnaires are also an efficient method for obtaining data containing large quantities of figures. Questionnaire surveys may be carried out on the phone, via email or post or through face-to-face interviews. In this study the latter was the most appropriate due to the isolated nature of the villages, making communication other than in person almost impossible. The nature of the questions being asked also relied on flexibility on the part of the interviewer, where necessary probing further to clarify a point or developing a conversation further where more information could be provided due to the knowledge of the interviewee.

5.1.2.2 Disadvantages

Face-to-face interviews have the problem of being 'reactive', in that it is very difficult for the interviewer not to guide a question in the direction he or she wants it to go in, consequently biasing the results. This occurred during this study due to the inexperience

of the translator. In this study access to the study site required a permit from the Forest Department; consequently the researcher was associated with the department by the interviewees resulting in the researcher losing their neutrality, potentially biasing the responses. Finally, as a result of their nature, questionnaires often only access a limited amount of information need to be supplemented and triangulated through the PRA exercises.

5.2 Application of methodology

Research was carried out in the Nanda Devi Biosphere Reserve between the 14th and 30th May 2005 in the villages of Tolma and Lata in the Nanda Devi Biosphere Reserve (Figure 5).

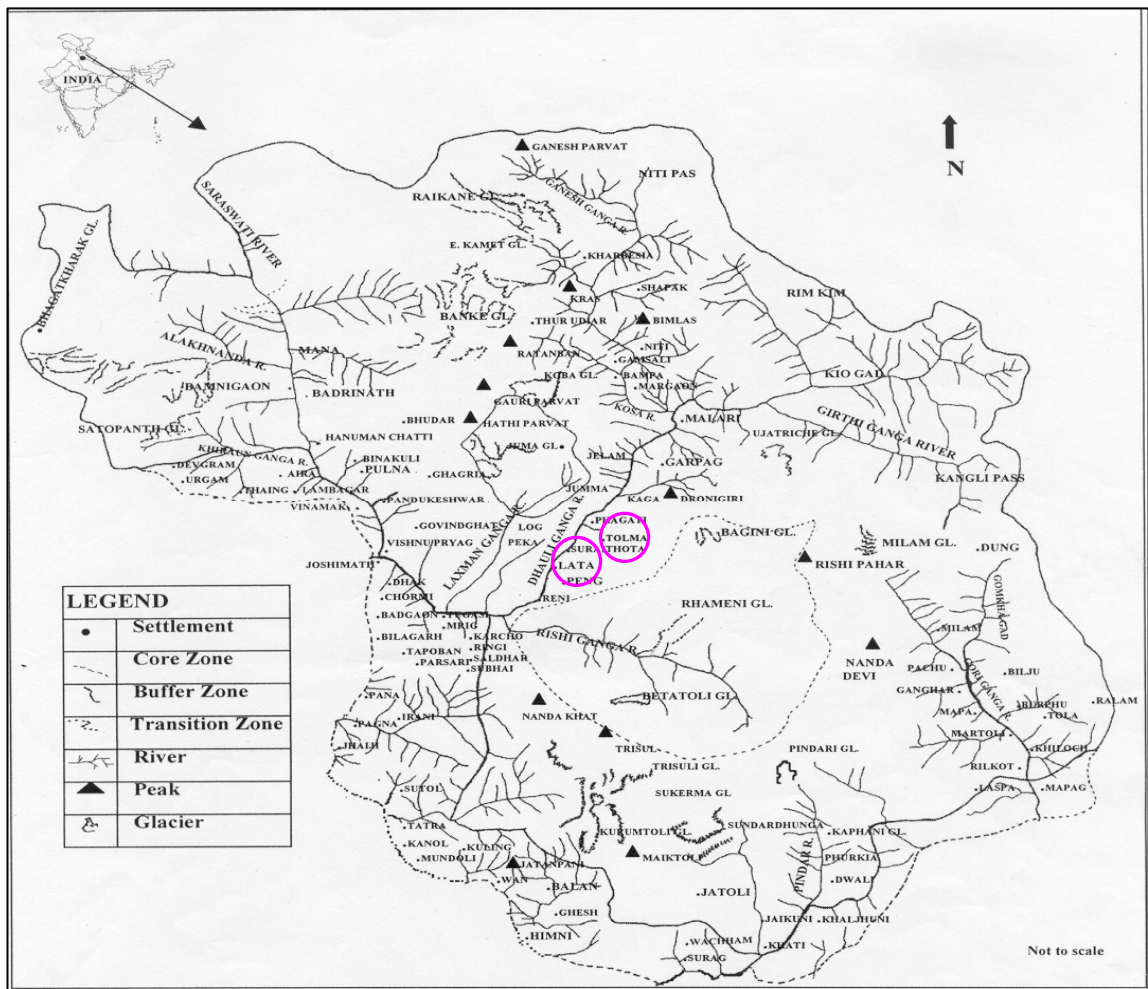


Figure 5: Location of Tolma and Lata villages within the Nanda Devi Biosphere Reserve to show their position relative to each other, the core zone and the road (Source: G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora).

5.2.1 Selection of study site

Tolma and Lata were chosen due to their relatively easy access from Joshimath, the largest town accessible by road from the plains. The need for permission from the Forest Department also partly dictated which villages could be studied. The time allowed to carry out the research was limited by both these factors, the time frame for the dissertation period and the climate. The villages can only be accessed for a limited amount of time between end of March to May and late August to October when the snow line is high enough and before/after the monsoons make the road impassable. Tolma and Lata are also relatively small which meant all the households could be interviewed in Tolma and a representative sample, of 25 households, made in Lata. Finally, both these villages have been well studied and therefore comparisons could be made with previous research allowing for a more in-depth analysis of the changes in socio-economic structure over time. Unfortunately, this also meant that some members were bored by repeated studies of their livelihoods by outsiders.

5.2.2 Participatory rural appraisal methods

Participatory rural appraisal methods were used to obtain qualitative data, which was then triangulated with the results of the questionnaire survey.

5.2.2.1 Objectives

The objectives of the exercises were to obtain information regarding:

- the layout of the villages
- the use of areas surrounding the village
- household classification according to wealth
- background knowledge of livelihood options
- the impact of the climate and terrain on the livelihoods of the villagers
- the trends in economic status, livelihood options and natural resource use since the closure of the park
- opinions of the villagers on life in general, conservation, the NDBR, the management of the park and current development schemes being implemented
- differences between different sectors of society such as men and women and schedule caste and schedule tribe members

5.2.2.2 General methodology

With the exception of the reconnaissance walk and informal interviews, which were carried out with one or two individuals, the exercises were all conducted with groups of between 5 and 10 people. The daily activity schedule of the villagers meant that groups were organised through the help of our host in each village. In both cases they invited people to come to a specific place at a certain time, the time and place varying depending on who had been invited. The meetings were made very informal with tea and biscuits being provided. All exercises were carried out in Garhwal, the local language and Hindi. Before each discussion group the translator and the host were briefed on the aims in order that they could then explain them to the participants. As the discussion proceeded they also helped in facilitation. By having the host present it was hoped that those present would be more at ease and receptive to the aims of each meeting. This appeared to be the case. Originally it was hoped that each meeting would be recorded, however the few recordings made were of poor quality due to the available technology and also the presence of a recording device made participants nervous and less willing to talk. The solution was for the translator to make notes which were later expanded on. This approach presented difficulties as the level of the translator's English meant that details were lost in the translation.

The aims of the following four methods were: to understand the layout of the village, how the village functions, who is who, what people do, wild food use and where and when it is collected and how, people's perceptions of their environment and surroundings and to determine a stratified method of sampling for the questionnaire survey.

5.2.2.3 Focus groups

Three focus groups were carried out: men, women and elders. In both villages women were unwilling to be present at group discussions with men and therefore separate sessions were organised through the Mahila Mangal Dals (women's welfare groups). The host was not present in these discussions and facilitation was carried out by the translator alone. Although the translator was male, he was an outsider and therefore the women were more willing to talk in his presence than in the presence of their own men-folk. Having a women-only session ensured that their opinions were taken into account and

livelihood tasks carried out solely by women also recorded. The problem of domineering individuals within all three focus groups was encountered and involved facilitation on the part of the translator to ensure that every member of the group was given the opportunity to speak.

The overview focus groups discussed the following:

- history
- occupations (of men or women or both) including explanations of traditional methods
- village groups, in particular women's groups
- opinion of the NDBR
- life before and after the closing of the park
- opinion of the forest department and officers
- opinion of ecotourism and ecodevelopment
- what makes them happy and what do they want in the future

5.2.2.4 Informal interviews

These were carried out ad-hoc as, and when, the situation arose. They were carried out with the hosts and hostesses, their friends, forest guards, and interested individuals.

5.2.2.5 Reconnaissance walk

A walk was conducted with two members from each village; the host and another male suggested by the host. This gave a male-bias to the exercise but in both villages participants were able to provide in-depth information regarding the layout of the village and the areas used by the villagers. Throughout the research period informal walks with individuals, including women provided supplementary information to triangulate the results of this exercise and those of the social and resource-mapping exercise.

5.2.2.6 Social and resource mapping exercise

In Tolma this exercise was carried out during the men's overview focus group, which had the disadvantage of being male-biased, however, participants appeared eager to carry out

the exercise and did not require the help of the translator which was an advantage. The map was triangulated by the reconnaissance walk. In Lata participants were unwilling to carry out this exercise, due to the size of the village and a general feeling that it was patronising. In this case the map was produced during the reconnaissance walk by the two village members participating and the translator. Once again this meant that the results were male-biased, however, undertaking the exercise during the walk meant the results could be easily triangulated.

5.2.2.7 Trend Analysis

Aim: to explore changes in livelihoods and wild food use over time

This was carried out during the elder's focus group. Following a discussion on the key events in the history of the park and the impacts of those events a diagram was produced highlighting the changes in livelihoods and natural resource use in relation to the events discussed. This diagram was produced by the translator during the focus group.

5.2.2.8 Wealth ranking

Aim: to obtain wealth indicators for later analysis in order to relate socio-economic status to livelihood options and wild food use.

Originally it was proposed to carry this exercise out through triangulating results from discussions on wealth indicators during the focus groups, a card-sorting exercise and a well-being ranking exercise during the social-mapping. However, participants were unwilling to rank their neighbours through any of these methods and the only possible wealth indicators suggested during the focus groups were those of caste and electricity. Consequently, wealth was determined by asking interviewees during household questionnaires to estimate their total annual income (EI). Throughout the interview respondents were also asked for details and quantity of crops, fruit, wild food, medicinal plants, dairy or woollen products sold as well as any sources of alternative income such as labour. Using this data a measure referred to a calculated income (CI) was produced. The two were later triangulated through correlation analyses.

5.2.3 Questionnaire survey methods

5.2.3.1 Design and adaptation

The designs for the questionnaires was outlined before leaving for India and, once there, developed using questionnaires carried out by Badola et al, 1998 on villages in the same region. Comments were then made by Dr Ruchi Badola and Dr EJ Milner-Gulland and the questionnaire subsequently altered before field-work was started. Unfortunately, due to time constraints it was not possible to run pilot interviews. The first few interviews and the PRA exercises highlighted where further changes needed to be made. These were mostly cuts to the length of both questionnaires. All changes had to be made during the interview process and as a consequence there were slight differences between the standard questionnaires used in Tolma and in Lata, the second study village. The objectives, however, were unaltered.

Both questionnaires were based on a combination of structured and open-ended questions. This allowed for specific information regarding income and production to be obtained, as well as making it possible for interviewees to discuss certain issues further. The attitude questionnaire also contained ranking exercises which meant that quantitative as well as qualitative analyses could be carried out on the data. The main problem during this section of the study was translation problems. The translator was inexperienced both as an interviewer and as a translator which meant that it was important to watch out for biases within the information obtained as a result of the interview technique. It was harder to recover information lost as a result of translation problems.

5.2.3.2 Sampling methods

In Tolma it was possible to interview all the households whilst in Lata a sample was generated by giving each household on the social map a number. Random numbers were then generated and the corresponding household interviewed. In order to make most efficient use of time, one member of each household was also interviewed for the attitude questionnaire after the general household interview was carried out. The interviews were carried out by the translator in Garhwal and Hindi. In order to get a representative sample of the population for the attitude questionnaires an attempt to interview equal numbers of men and women and individuals of different ages was made. Unfortunately, in Tolma no women would agree and in Lata it was also difficult.

Likewise, younger members were often not available for interview. Consequently, it was impossible to analyse opinions in relation to age or sex. Interviews took place over a week in each village.

5.2.3.3 General household interviews (Appendix 1)

All ten households were interviewed in Tolma and a sample of 25 households in Lata. The households sampled in Lata are numbered on the map in Appendix 4. A 'household' was defined as the basic residential unit. Usually this interview was conducted with the head of the household, possible with a few other members present. Interviews were conducted on a voluntary basis and in all cases interviewees appeared willing to cooperate in the study. Interviews were carried out in the houses of those responding and were consequently an informal process, often accompanied by tea and biscuits. This appeared to relax respondents.

Objectives: to obtain qualitative data concerning:

- household size and composition
- occupation patterns
- estimated annual income (EI)
- residential patterns
- landholding patterns
- information regarding sources of income in order to produce an estimate for calculated income (CI)
- consumption patterns
- collection and use of wild foods

5.2.3.4 Attitude questionnaires (Appendix 2)

35 attitude questionnaires were carried out, 10 in Tolma and 25 in Lata. The aim of this exercise was to determine local opinion of the environment in general and the NDBR.

Objectives: to obtain qualitative, and where possible quantitative data regarding:

- general attitude of the community towards the environment
- opinions on environmental provisions

- understanding of the purpose and rules governing the NDBR
- personal opinion of the park
- views on the conservation success of the park
- views on and suggestions for the management of the park
- opinions on ecotourism and ecodevelopment in general
- visions of the future

5.3 Data Analysis

The data was analysed using SPSS 12.0 for Windows and Mini-Tab 12.21. Spearman's rank correlation, Mann-Whitney-U tests, Kruskal Wallis and regression analyses were used. Significance was determined at $\alpha = 0.5$ (unless otherwise stated). Excel was used to aid graphical representations of the data.

6 Results

6.1 Socio-economic status

6.1.1 Social structure

6.1.1.1 Village map

In both villages a social and resource mapping exercise was carried out the results of which can be seen in Appendices 3 and 4.

6.1.1.2 Demographics

The current population of Lata is 370 with an average annual growth rate of 2.6% since 1999. In Tolma the growth rate is lower at 1.2% per year with the population currently numbering 72. The distribution of ages is given in Figure 6, which also illustrates the demographic changes occurring since 1999. In Tolma there has been a slight drop in the number of people falling into the 15-58 and >58 categories of 6 and 3 % respectively, whilst there has been a 9 % increase in the number of individuals younger than 14. In contrast, in Lata, there has been a drop of 8 % in those younger than 14 whilst there has been an increase of 3 % in the 15-58 class and 4 % in the >58 group. The 1999 data is provided by Badola et al, 1999 and the Forest Department of the Government of India (FDGI, 1999).

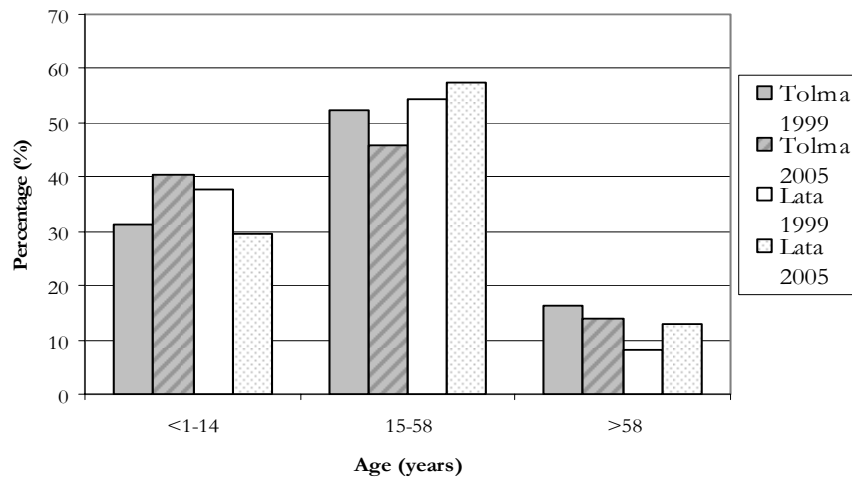


Figure 6: Age class distributions in Tolma and Lata in 1999 (Badola et al, 1999) and 2005 (this study)

Table 1 illustrates the changes in the number of households living in the villages over the six year period between 1999 and 2005. In Tolma, the number of households no longer living in the village is almost twice as many as it was in 1999. In Lata it is not known how many households have emigrated since 1999.

Table 1: Comparison of the number of households living in Tolma and Lata in 1999 (data sourced from: Badola, Silori et al. 1999; FDGI 1999) and 2005(data obtained during this study).

Year	Village	No. Families		
		In the village	Migrated	Total number of families
1999	Tolma	14	8	22
	Lata	72	26	98
2005	Tolma	11	14	25
	Lata	80	not known	not known

In both villages a Mann-Whitney test showed no overall significant difference between male and female age structure. However, in Tolma, the ratio of males to females in the 15-58 age group is almost 1:2 in favour of females. This could suggest that male members of the village have left to find work or it may simply be an artefact of natural variation in the sex ratio. This discrepancy is highlighted further by the significant difference in female age structure between Tolma and Lata ($w=20809$, $p=0.0487$). There is no difference in male age structure between the two villages.

6.1.1.3 Literacy

Since 1999 there has been an increase in literacy in both males and females in Tolma but in Lata the rate has only increased in females whilst male literacy has declined resulting in an overall decrease (Appendix 5). There is a significant difference in education between males and females, with males being educated for longer (Tolma: $w=819.5$, $p=0.0433$; Lata: $w=33164.5$, $p=0.000$). There is also a significant difference between the villages with both males and females in Tolma having a significantly higher literacy rate (males: $w=2623$, $p=0.0466$; females: $w=4356$, $p=0.0383$), although no females in Tolma have a degree compared to five women in Lata (Appendix 5).

6.1.2 Trend Analysis

Figure 7, combined with comparisons to 1999 data from Badola et al (1999) and FDGI (1999) which have been made, where possible, throughout the results section, show significant changes in socio-economic status and natural resource use over time. These changes correlate to external factors including the 1962 Indo-China War and the closing of the core zone of the NDBR. Economic benefits from changes in livelihoods have followed a parabolic course, peaking during the period between about 1960 and 1980 when tourism was the main source of income. The woollen industry has been steadily declining since the Indo-China war due to poorer quality livestock and loss of grazing land after the closure of the park. Income from other sources, such as the sale of medicinal plants and wine, has never been significant, although cultivation of medicinal plants for sale is currently being encouraged as part of the ecodevelopment schemes being set up in the region. In the past, the collection and use of wild foods and medicinal plants was widespread. Since the closure of the park, the collection of natural resources has become limited to the wild areas surrounding agricultural land in the buffer zone and has consequently decreased, although poaching is known to occur.

	1947 Independence	1962 Indo-China War	1982 Closure of NDBR	2005 Present Day
Livelihood	<ul style="list-style-type: none"> Mainly subsistence farming No transport, sanitation, education or health facilities Trade with Tibet - received salt and good quality sheep and in return traded crops such as phosphor, wheat and maize. Income from selling good quality livestock and woolen products 	<ul style="list-style-type: none"> Rapidly expanding tourist industry now main source of income Still subsistence farming but subsidiary End of trade with Tibet resulting in lower quality woolen goods. Woolen trade subsidiary Medicinal plants sold Small wine industry - made by women and sold to tourists Road created for the army during the war resulting in indirect benefit to villages 	<ul style="list-style-type: none"> Loss of main income source from tourism Subsistence farming and labour main occupations No longer able to sell medicinal plants Woolen industry in very bad condition Loss of grazing land Most goats and sheep sold as no grazing land and no longer needed to carry supplies for tourists Increased loss of crops and livestock to wild animals 	<ul style="list-style-type: none"> Limited alternative livelihoods to subsistence farming Potential for eco development scheme to increase welfare of villagers through provision of water, grasslands, better quality livestock, LPG gas burners, employment, education and transport facilities etc.
Natural resource use	<ul style="list-style-type: none"> No restrictions on natural resource use Collection of medicinal plants such as katuki, hathazaxi, chiphi and faran from the core and buffer zones Fodder and firewood collected from the forest and livestock grazed in the forest and alpine meadows Hunting of wildlife is legal and the skins kept in order for gun licenses to be renewed. Animals killed for meat and in defense of people or property. 		<ul style="list-style-type: none"> Limited use of natural resources No collection from core zone permitted No wild animals killed as gun licenses revoked Wood only collected from boundaries of fields Mushrooms collected from Panchayat forest Poaching by outsiders and some villagers 	<ul style="list-style-type: none"> Cultivation of medicinal plants Gradual development of well managed ecotourism Improvements in livelihoods may potentially increase villager's contribution to environmental conservation

Figure 7: Diagram to show changes in livelihoods and natural resource use during the last 50 years; highlighting the main external influences occurring during that period. Information was obtained through a trend analysis exercise with the elders of Tolma and Lata

6.1.3 Wealth indicators

6.1.3.1 *Choice of measure of wealth*

Two measures of wealth were obtained through semi-structured interviews: estimated income (EI), which was approximated by the interviewee and calculated income (CI), which was determined by adding together all sources of income recorded during the interview.

The average annual income (EI) for Tolma is Rs 12770 +/- 9138.20. In Lata this is Rs 5528 +/- 3490.29. No individual income data from 1999 is available for these villages,

however, the average income for the district of Chamoli was 10,601 +/- 1132.53 (Badola et al, 1999).

In both villages a regression analysis suggests a significant correlation between EI and CI (Tolma: $F=9.16$, $R^2=0.5339$, $p=0.016$; Lata: $F=18.43$, $R^2=0.4448$, $p=0.000$) (Figure 8).

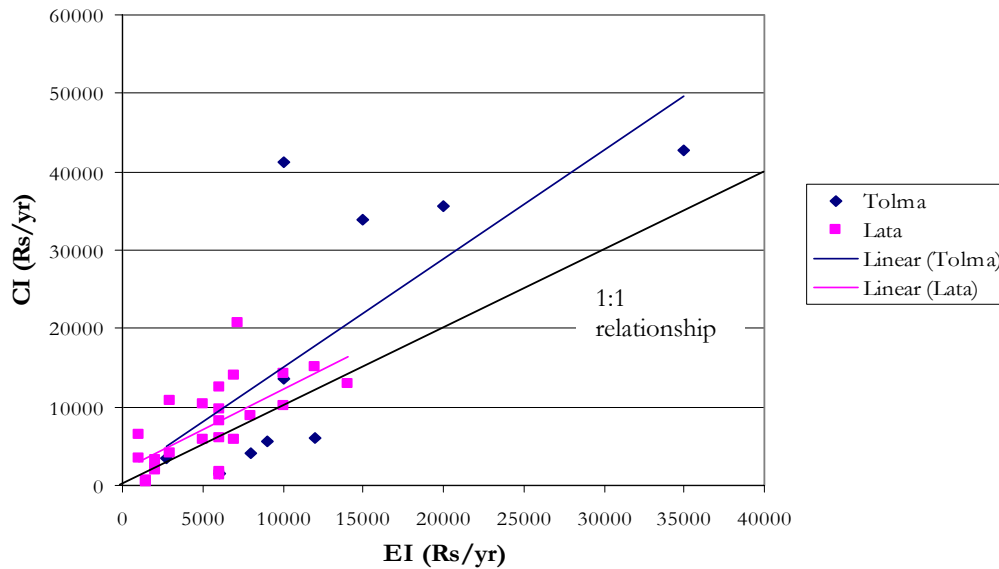


Figure 8: Regression analysis of estimated income (EI) and calculated income (CI) in Tolma and Lata. The 1:1 linear relationship is also drawn for comparison.

EI was chosen as the more robust of the two measures for two reasons: firstly, calculating CI was difficult as interviewees were often not able to recall accurate production figures, there were large discrepancies between estimated market prices and in some cases interviewees were unwilling or unable to provide income source details; secondly, Figure 8 illustrates the closeness of the relationship between CI and EI in Lata to 1:1, however, in Tolma this relationship appears to diverge from 1:1, with CI at the top end appearing chaotic suggesting that these figures are unreliable.

6.1.3.2 Determinants of income

The data were not adequate to carry out a General Linear Model; instead a correlation analysis was undertaken to determine which factors had a significant effect on income (EI) and could be considered as reliable indicators (Table 2). The data from both villages was combined. Although there were observable differences in the appearance of wealth

between schedule tribe and schedule caste members, the correlation between caste and income was not statistically significantly.

Table 2: Correlation values from correlation analysis to determine significant wealth determinant factors. All correlations were significant at $\alpha = 0.05$ with $n=35$. Factors in bold differ significantly between villages (see 6.1.3.4 for further analysis).

Factor	Correlation	Probability
Agricultural land	0.481	0.003
Crop production	0.368	0.021
Crop income	0.444	0.008
Fruit production	0.609	0.000
Fruit income	0.534	0.001
Milk production	0.567	0.000
Marcola (mushroom) collected	0.360	0.033
Marcola income	0.336	0.048
Total wild foods collected (not inc. marcola)	0.341	0.048
Total income from natural resources	0.394	0.019
Education of head of household	0.396	0.019
Average education of adults in household	0.567	0.000

A correlation analysis between these factors was then carried out to determine inter-relationships (Table 3).

Table 3: Results of correlation analysis between factors influencing income (EI). Significant correlations are illustrated by a + and highlighted in grey ($\alpha = 0.05$, $n=35$).

	Land	Meat	Crop Prod.	Crop Inc.	Fruit Prod.	Fruit inc.	Milk	Marcola collect	Marcola inc.	Wild foods	NR inc.	Head edu.	Av. edu.
Land		+	+	+	+	+	+	+	+	-	+	-	-
Meat	+		-	-	+	+	-	+	-	+	+	-	-
Crop prod	+	-		+	+	-	+	-	-	-	-	-	-
Crop inc.	+	-	+		+	+	+	+	+	+	+	-	-
Fruit prod.	+	+	+	+		+	+	+	+	+	+	+	+
Fruit inc.	+	+	-	+	+		+	+	+	-	+	+	+
Milk	+	-	+	+	+	+		+	+	+	+	+	+
Marcola collect	+	+	-	+	+	+	+		+	+	+	+	-
Marcola inc.	+	-	-	+	+	+	+	+		+	+	-	-
Wild foods	-	+	-	+	+	-	+	+	+		+	+	+
NR inc.	+	+	-	+	+	+	+	+	+	+		-	-
Head Edu.	-	-	-	-	+	+	+	+	-	+	-		+
Av edu.	-	-	-	-	+	+	+	-	-	+	-	+	

The following conclusions were drawn:

- Overall there is a positive relationship between income and both wild food collection and income derived from natural resources. It is unclear whether this correlation is causative or not.
- The statistics from the correlation analysis (Table 3) appear to indicate a complex interaction between agricultural land, fruit production, fruit income, milk production and income from the sale of marcola (mushroom). It is hypothesized, and borne out by the statistics, that as the amount of agricultural land that a household owns increases there is more land available for high income fruit species which would explain the correlation between these three factors. Milk production depends on the quantity and quality of fodder which is collected from around the edge of fields and that provided by fallen leaves and fruit from fruit trees and should, therefore, rise as the quantity of fruit trees owned increases. Marcola grow around the base of trees in sparse, but not in dense forests, therefore the quantity of marcola which can be readily collected to sell should increase as the number of fruit trees and hence the availability of suitable habitat expands (Figure 9).

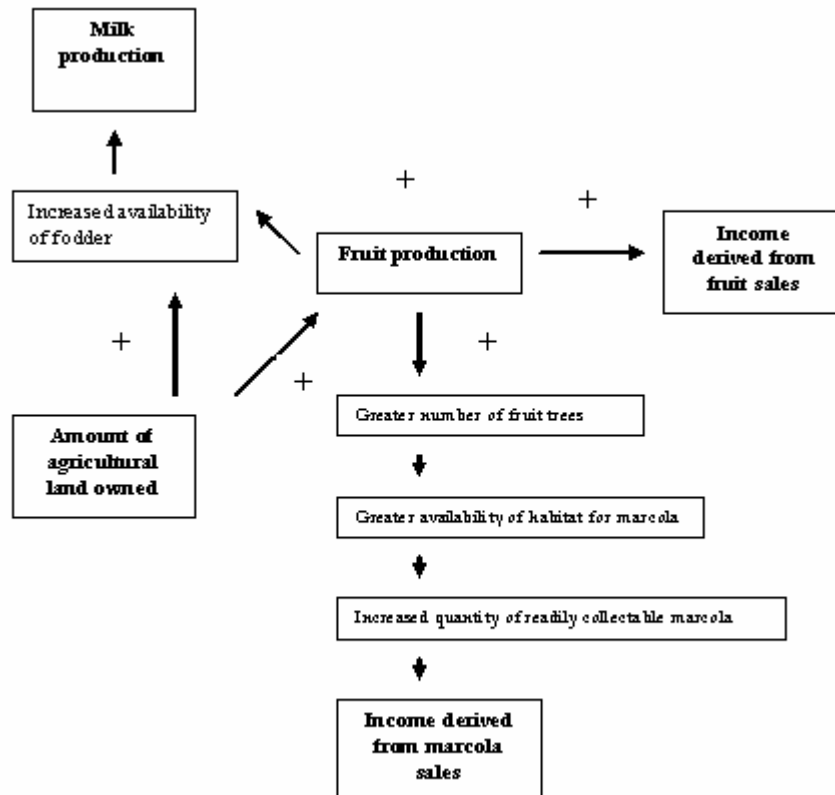


Figure 9: Diagram explaining the hypothesised relationship between agricultural land, fruit production and income, milk production and income derived from marcola sales

- It is only the quantity of marcola collected which correlates to agricultural land. This may be explained by the fact that other wild species collected are only found in forested areas.
- Crop production is not related to wild food collection (other than marcola) or income from natural resources. This supports the above hypothesis that it is the presence of trees on agricultural land which increases the quantity of marcola collected.
- There is a positive correlation between education and wild food collection, but not natural resource income.

6.1.3.3 Measures of consumption

Meat consumption is correlated with income (EI) ($c=0.552$, $p=0.001$), since meat was only bought and not reared, this result suggest that as income increases the amount of meat bought also increases. There is an association between meat consumed and wild food collection. There is no further evidence as to the cause of this correlation; it may simply be an artefact of the complex relationship hypothesised in Figure 9.

Other suggested measures of consumption, such as electrical items, were not significantly correlated with income (EI).

6.1.3.4 Differences between Tolma and Lata

Agricultural land, fruit production and income, milk production and income from marcola vary significantly between the two villages: agricultural land ($w=268.0$, $p=0.001$), fruit production ($w=235.0$, $p=0.025$), fruit income ($w=279.5$, $p=0.000$), milk production ($w=257.5$, $p=0.005$) and marcola income ($w=232.0$, $p=0.043$). These factors were also those correlated through the hypothesized relationship in Figure 9. In all factors Tolma had the greater average value. Below are the results of a within village correlation analysis of these factors with income (EI) (Table 4).

Table 4: Correlation and probability values from a correlation analysis between income (EI) and factors differing significantly between Tolma and Lata. Significant correlations are highlighted in bold.

Factor	Village			
	Tolma		Lata	
	Correlation	Probability	Correlation	Probability
Land	0.513	0.13	0.214	0.305
Fruit prod.	0.432	0.213	0.485	0.014
Fruit inc.	0.689	0.027	0.507	0.036
Milk	0.365	0.3	0.507	0.01
Marcola inc.	0.763	0.01	-0.078	0.71

The results indicate that although agricultural land is a determinant of wealth in general, this is not the case within villages, which may be due to more homogenous land holding patterns within villages with significant differences between villages (see 6.1.4.3). Milk and fruit production only appear to be a determinant in Lata, whereas fruit income is a determinant in both villages. Marcola income, however, is only significant in Tolma.

There are only two wild species which are sold: marcola and pharan (a vegetable and medicinal plant species). These have a high average market value of 2533.33 +/- 516.40 Rs and 68.57 +/- 35.32 Rs respectively. Pharan is also cultivated by six of the ten households in Tolma and by four of the 25 households sampled in Lata. Two households in Tolma also cultivate a wide range of medicinal species, but these are only used to fulfil village requirements and are not sold. It was not established what the level of medicinal plant cultivation was in Lata.

Total wild food collection in Tolma was 178.78 kg/yr whilst 25 out of 80 households in Lata collected a total of 290.2 kg/yr. The descriptive statistics (Table 5) suggest a difference between the two villages in collection and sale of wild foods and medicinal plant species, with Tolma collecting and selling greater quantities; however, the only significant difference is in income from marcola ($w=232.0$, $p=0.043$).

Table 5: Descriptive statistics of usage of wild foods and medicinal plants in Tolma and Lata

	Village					
	Tolma			Lata		
	Mean	Std. Dev.	No. households	Mean	Std. Dev.	No. households
Marcola collected (kg/yr/hh)	1.40	1.43	6	0.25	0.35	12
Marcola income (Rs/yr/hh)	3546.70	3622.25	6	542.12	784.68	11
Pharan collected (kg/yr/hh)	3.01	9.48	2	5.56	13.78	8
Pharan income (Rs/yr/hh)	137.10	433.55	1	83.64	411.17	2
Wild food collected (not inc. marcola) (kg/yr/hh)	17.73	26.90	8	8.88	14.62	14
Pure medicinal species (kg/yr/hh)	0.82	1.29	6	2.08	10.21	1
Total wild food and medicinal species (kg/yr/hh)	19.53	30.88	8	11.61	19.39	17
Income from natural resources (Rs/yr/hh)	3683.80	3913.48	6	625.76	831.29	12

6.1.3.5 Wealth relations within Tolma

Looking at Figure 8 it appears that there are two groups of households in Tolma: those which have a wealth ranking similar to households in Lata and those which are much wealthier (Figure 10).

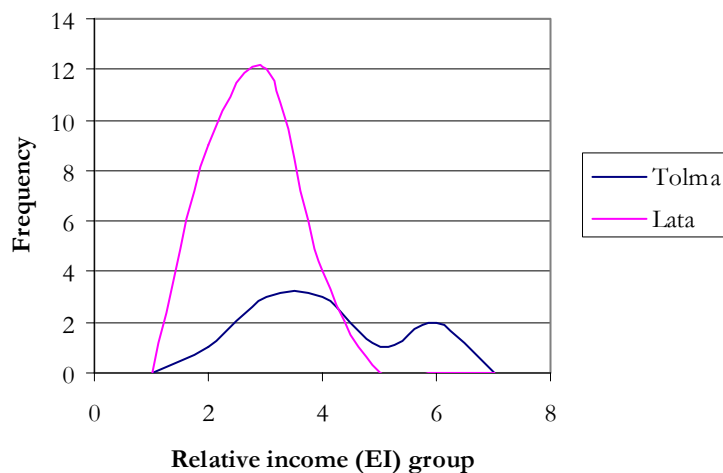


Figure 10: Graph to show the presence of two household income groups in Tolma in comparison with one observed in Lata.

The two groups differ significantly in income (EI) ($w=22.5$, $p=0.033$) and there were also significant differences between marcola collected ($w=22$, $p=0.019$) marcola sold ($w=22$, $p=0.019$), fruit production ($w=23$, $p=0.043$) and fruit income ($w=21$, $p=0.013$) which further supports the hypothesis illustrated in Figure 9. Marcola collected and derived income is correlated to both fruit production ($c=0.640$, $p=0.046$, $n=10$) and fruit income ($c=0.757$, $p=0.011$, $n=10$).

As discussed, EI is correlated with income derived from marcola in Tolma but not Lata (Table 4) suggesting that the overall correlation between EI and income from marcola, as observed during the analysis of wealth indicators, is explained by Tolma alone.

6.1.4 Lifestyle

6.1.4.1 Income

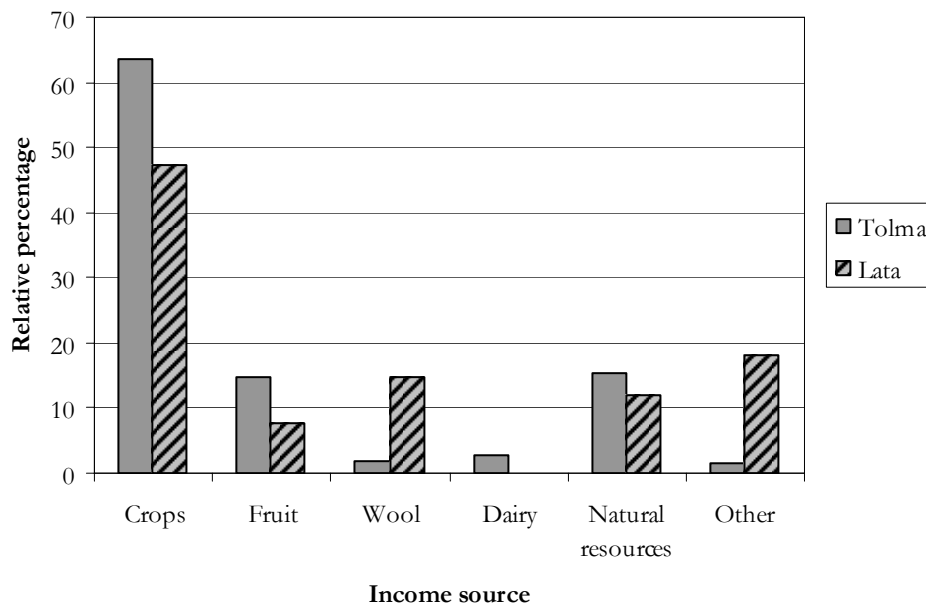


Figure 11: Relative percentage contribution of different income sources to annual income

Figure 11 illustrates the relative percentage contribution of different income sources to annual income. Crop production is the highest contributor in both villages, although slightly lower in Lata, as is fruit production. Other sources of income, such as occasional labour and metal work, play a much greater contribution to annual income in Lata than Tolma, as does the production of woollen goods.

6.1.4.2 Occupation

The main occupation in Tolma is farming. Although no women in Tolma stated their occupation as a farmer, agricultural work is carried out by both males and females in Bhotiya society. In Lata the recording of women farmers is in those households where the male head is no longer present. There is a much greater range of occupations in Lata, although farming is still the major means of earning a living. The percentage of unemployed men is small; however, all members of society help their elders either in the fields or at home depending on their sex. The absence of unemployed males in Tolma is likely to be due to the lack of alternative employment other than farming. The percentage of unmarried women is similar in both villages, being around 10 percent (Table 6)

Table 6: Percentage employed in different occupations in Tolma and Lata

Occupation	Village (% people in each type)			
	Lata		Tolma	
	Men	Women	Men	Women
Farmer	55	19	13	0
Housewife	0	71	0	17
Labourer	12	0	0	0
Govt. Service	4	0	0	0
Shopkeeper	4	0	0	0
Tailor	3	0	0	0
Taxi Driver	1	0	0	0
Metal Work	1	1	0	0
Carpenter	1	0	0	0
Wool work	0	11	0	0
Guide	3	0	0	0
Porter	4	0	0	0
Doctor	1	0	0	0
Teacher	1	1	0	0
Forest guard	1	0	0	0
Children's development	0	1	0	0
Retired	1	1	0	0
Unemployed men/unmarried women	3	18	0	4
Studying	80	57	10	15
Too young	16	9	6	6

6.1.4.3 Landholding Pattern

50 percent of households in Tolma have landholdings of <5 acres, with the other half owning between 5 and 25 acres. In Lata 100 percent of households sampled owned less than 5 acres. These illustrate differences in land holding patterns between villages but a more homogenous and continuous landholding pattern within villages.

6.1.4.4 Livestock

The number of livestock owned in Tolma has halved since 1999, the fall mainly being accounted for by a dramatic decrease in the number of goats and sheep owned. The figures suggest a slight fall in the number of cows and a significant decrease in the number of goats with only two households out of the 25 sampled owning four animals between them. It is impossible to calculate a trend in the number of sheep owned, however, the 26 recorded animals were owned by only three of the sampled households.

Table 7: Number of livestock owned in Tolma and Lata in 1999 (FDGI, 1999) and 2005 (this study).

Livestock	Village			
	Tolma		Lata	
	1999	2005	1999	2005 (average per household to nearest whole number)
Cows	35	42	195	3
Bulls	42	39	188	3
Sheep	150	35	50	1
Goats	30	9	198	0
Mules	0	0	6	0
Horses	0	0	0	0

6.1.4.5 Production

The production of income generating crops is high with an average of 74 percent of total crop production in Tolma and 84 percent in Lata. There is no significant difference between the two villages with respect to crop production. Cash fruit production is even higher at almost 100 percent of total fruit production in both villages. Sales of income generating fruits, however, is only 56 percent in Tolma and 52 percent in Lata for crops and 20 percent and 21 percent for fruits in Tolma and Lata respectively. There is a significant difference between villages in total fruit production ($w=283.5$, $p=0.000$), cash

fruit production ($w=282.5$, $p=0.000$) and cash fruit sold ($w=238.0$, $p=0.018$). In all cases Tolma has the greater production (Table 8) and there is also evidence that there are two different production groups in the village, those households with a production similar to households in Lata and higher production households (Figure 12). This correlates to evidence from the previous wealth analysis of the two villages (Figure 10).

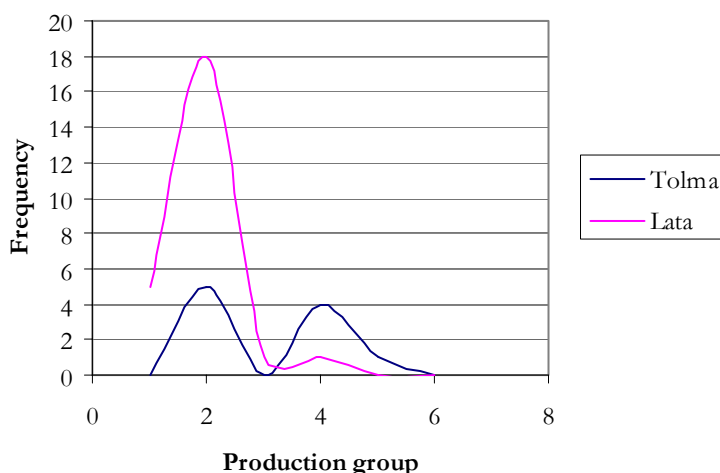


Figure 12: Graph to show the existence of two production groups within Tolma: households with a production rate similar to households in Lata and those with a higher level of production.

Cash crops are razma (beans), cholai (grain), pharan (chive like vegetable), potato, and ogal (grain) whilst fruit species include apple, akhrote (walnut), aru (peach), chuli (apricot) and khumani (apricot).

Table 8: Descriptive statistics of agricultural product measures in Tolma and Lata

Agricultural product measure	Village					
	Tolma			Lata		
	Mean	Median	Std. Dev	Mean	Median	Std. Dev.
Crop prod. (kg/yr)	1233	980	682	1133	1100	790
Cash crop prod. as % crop prod.	74.34	77.5	17.84	84.08	86.62	10.21
% of cash crop sold	55.52	56.47	13.61	52.44	60.66	27.83
Fruit prod. (kg/yr)	2641	900	4659	159.5	75	232.8
Cash fruit prod. as % fruit prod.	97.35	100	4.41	100	100	0
% cash fruit sold	19.7	14.09	24.03	21.39	0	34.79

Only 2 out of 10 households in Tolma produce wool products for sale earning an average income of Rs 4000 +/- 1414.21 per year. In Lata 11 out of the 25 households

sampled made woollen products earning an average of Rs 1338.12 +/- 1975.89 per year. The main products produced are pankhi, dann, asani, chutka, gudma, colin and thulma.

Milk products are only sold in Tolma, where Jersey cows have replaced traditional breeds as part of the ecodevelopment scheme. This breed produces much higher quantities of better quality products. Currently only 2 out of 10 households sell their dairy products earning an average annual income of Rs 6020 +/- 7099.35. Dairy products produced include milk, ghee, curd and mutha.

6.1.4.6 Collection of wild foods and medicinal plants

Table 9: Uses and parts of used of local wild food and medicinal plant species in Tolma and Lata

Local name	Latin Name	Use	Part Used
Marcola	Morchella esculenta	food	mushroom
Pharan	Allium stracheyi/wallichii	medicinal and vegetable	leaves
Chandra	Paeonia enodi	medicinal and vegetable	leaves
Choru	Pleurospermum angelicoides	fruit and medicinal	fruit/root
Chiphi	Angelica glauca	food and medicinal	seeds/root
poanu/puyon	Smilacina purpurea	medicinal and vegetable	leaves
Jamun	Prunus cornuta	fruit	fruit
Ghenu	Viburnum cotonifolium	fruit and seed oil	fruit and seeds
Kenu	Morus serrata	fruit	fruit
Strawberry	Fragaria rubicola	fruit	fruit
Kamathi	unknown	fruit	fruit
Themku	unknown	fruit	fruit
Brahmkamal	Saussurea obvalata	worship	flowers
Katuli	Picrohiza kurooa	medicinal	roots and seeds
Pasnred	Bergenia ciliata	medicinal	root and leaf
Dholu	Rheum memodi	medicinal	root
Atish	Aconitum heterophyllum	medicinal	root
Balchari	Arnebia benthamii	medicinal	root
Hathazari	Dactyloriza hatagirea	medicinal	root
Tantari	Rheum australe	medicinal	root
Mashi	Nardostachys grandiflora	unknown	unknown
Takar	unknown	unknown	unknown
Gogal	unknown	unknown	unknown
Bholya	unknown	unknown	unknown

23 wild food and medicinal plant species were recorded as being collected in the two villages, of which 13 were utilised in Lata and 21 in Tolma. Of the known species 12 were wild food species including seven fruit species (Table 9). Fruits are collected opportunistically purely for subsistence use and are not sold. No wild meat was recorded as being hunted for food or sale (see 6.1.3.4 for further details).

6.2 Local Attitudes

6.2.1 Environment

There is a very close relationship between the villagers and their environment, with all interviewees stating that the forests and natural resources were a gift from God, whilst the mountain Nanda Devi is worshipped as a goddess. In a ranking exercise villagers graded the provision of ‘quality of life’ as the most important that the environment provides. There was a difference in opinion between the two villages as to the second, third and fourth most important, however, income was ranked last by groups of interviewees (Table 10).

Table 10: Average ranking of environmental provisions (Tolma: n=10; Lata: n=25). Individuals were asked to rank environmental provisions on a scale of 1 to 6 where 1 was the most important provision which the environment provided, in that individual’s opinion.

Environmental provision	Ranking		
	Total (Tolma + Lata)	Tolma	Lata
Quality of life	2.4	2.38	2.41
Food	3.08	3.75	2.76
Fodder	3.32	3	3.47
Happiness	3.65	3.13	3.89
Interest	3.92	3.88	3.94
Income	4.36	4.13	4.47

Nine out of ten interviewees in Tolma understood the purpose of the NDBR, in comparison to 16 out of 25 in Lata. It was generally understood that the purpose of the park was to conserve biodiversity, protect wildlife and to prevent pollution, especially from tourists. An understanding of the rules governing the park was much lower, with only six out of ten respondents in Tolma and 10 out of 25 in Lata being able to answer

the question and of these understanding was often very simple. Those who answered the question stated that it was forbidden to enter the park or exploit any of the resources and that the breaking of this rule would result in punishment. They also stated that, in certain cases, such as for scientific research (which is carried out every ten years), permission to enter may be granted from the forest department. In Tolma all ten interviewees understood the definitions of core and buffer zone and could identify the borders on these regions. In Lata, only those who could explain some of the rules could point out these zones.

In general the personal opinion of the NDBR is negative mainly due to the loss of income and grazing land from the closure of the core zone in 1982. This contrasts to the opinion of conservation success in the NDBR, where it is generally felt that the creation of a protected zone has been successful (Table 11). They feel that it is important to protect the environment and its wildlife from pollution, deforestation, exploitation and fire risk. Overall the general attitude of the people is a conservationist one, although in Tolma this has begun to develop into the idea of sustainable use with seven out of ten respondents mentioning the importance of the concept when being asked about the general attitude of the community towards the environment. This may explain the fact that all those interviewed in Tolma understood the concept of ecotourism whilst only 15 out of 25 interviewees in Lata could give an opinion on this subject. Likewise only 18 out of 25 people having an understanding of the principle of ecodevelopment, despite a scheme having been put in place in Lata (this question was not put to the villagers of Tolma). The opinion of both ecotourism and ecodevelopment was very positive (Table 11). It was felt that ecotourism would provide a more reliable income source, increasing their quality of life. It was also hoped that it would increase communication between the villages and the rest of the world. The ecodevelopment schemes set up have provided Lata with water facilities, grassland, land slide barriers, adult education and alternative income sources, such as medicinal plant cultivation schemes and juice making. In Tolma the villagers have been provided with better quality Jersey cows and LPG connections. In both villages it was felt that all these improvements were very useful and made a contribution to improving the quality of their lives.

Table 11: Opinions of key factors put in place to improve conservation and development in Tolma and Lata (1=very good, 2=good, 3=no opinion, 4=bad, 5=very bad)

Opinion	Village	
	Tolma	Lata
Personal opinion of NDBR	4.33±0.5	4.52±1.05
Opinion of conservation success of NDBR	1.89±0.93	1.72±1.02
Opinion of ecotourism in general	1.60±0.52	1.27±0.46
Opinion of ecodevelopment in general	not asked	1.61±1.04

Opinion of the administration of the park was completely divided in Tolma. 50 percent feel that the current management is achieving its aims; however, the other half believe that the system is corrupted and that, although the theory behind the park is good, biodiversity is continuing to decline. Their negative opinion also stems from, what they feel to be, a lack of sufficient compensation for damage from natural disasters and wildlife and income lost from the closure of the park. In Lata the opinion is slightly more positive, with a 64 percent approval of the management in those interviewed. However, there was still a general feeling of that there was corruption going on and anger about the low amount of compensation provided. Table 12 provides summary of management suggestions from those interviewed (see Appendix 6).

Table 12: Management suggestions from interviewees in Tolma and Lata (n=21)

Management Suggestion	No. People
Opening of the park under strict management so villagers can benefit from natural resources and tourism can redevelop	10
Increased employment opportunities from the park	9
Increasing the number of reliable forest guards	4
Increased involvement of the local community in conservation of the park	4
Increased compensation for damages due to wildlife	2
Killing of animals in protection of people/crops/livestock to be permitted	2

In their opinions of the environment, there did not appear to be any differences between individuals in Lata, members from those households in Tolma with an income comparable to households in Lata and those interviewed from the four outlying households.

6.2.2 Future

In terms of the environment, in general interviewees were worried about an increase in pollution, continued loss of wildlife and biodiversity with eight out of ten respondents in Tolma and eight out of 22 people in Lata mentioning these aspects. In Tolma they understood the concept of climate change and were worried about receding glaciers and reduced availability of water. They also feared deforestation and consequently its potential impacts on water availability as well as natural resources. Fire was also mentioned by ten out of the 35 interviewees in both villages as a serious worry. In Lata the main fear besides loss of biodiversity was potential damage from landslides as it was in a landslide risk area, as opposed to the safer position of Tolma. No interviewee in Lata mentioned the idea of climate change.

In both villages the main suggestions for improvements to the village were: electricity, phone connections, road access, irrigation water, toilets for every house, at least one school in Tolma and a secondary school and/or girls' college in Lata, and better medical facilities. Some also suggested a playground, entertainment or meeting area and a library, whilst others wanted wire fencing around the village to protect themselves and the livestock from wild animals. For those of the scheduled caste (lower caste), however, they simply wanted to leave the village to move somewhere safe from landslides (which killed many people in 1996) and with more opportunities for generating an income.

In Tolma, nine out of ten interviewees had dreams of having better, permanent sources of income in the future in order that they might provide their children with an improved quality of life. In Lata, however, only 12 out of 25 interviewees felt that they could answer the question, once again dreaming of a better life in the future for their offspring. Only one individual dreamt of owning a car – he was 25 years old. There were no observable differences between respondents in Lata and members of the two household groups in Tolma regarding the future.

7 Discussion of results

The closure of the Nanda Devi Biosphere Reserve in 1982 has had a disastrous impact on the economy and livelihoods of the communities living in the park. This is a result of the loss of income from tourism and the sale of medicinal plants, the loss of grazing land, restricted natural resource use and increased human-wildlife conflicts (Prasad, 1989; Silori and Badola, 1998; Rao et al, 2000). The aim of this study was to examine the current position of, and trends in, the socio-economic status of Tolma and Lata, in conjunction with an assessment of the current levels of wild food and medicinal plant use in the park. The analysis demonstrates that the closure of the park continues to influence the fortunes of the Bhotiya people of the NDBR and that the effects are, to some extent, village-specific. There are, however, indications that changes in the approach to the management of the park already implemented are beginning to show positive outcomes. The attitudes of the local community towards the park reflect the impacts of the closure as well as the recent alterations in management and highlight the importance of community participation in the future administration of the park.

7.1 Socio-economic trends

7.1.1 Demographics

Since the park was closed migration rates of largely younger males have been very high (Prasad, 1989; Silori, 2004). The 1991 Census showed that between 1986 and 1991 the state of Uttar Pradesh (which includes the new state of Uttaranchal) had the largest net outflow of 911,000 people (Dyson and Visaria, 2004). The comparison of the number of families living in the villages in 1999 and 2005 show that, in Tolma, the number of families no longer living in the village is almost twice as many as in 1999; demonstrating the continuation of this emigrational trend. The fact that there are also twice as many females as males in the 15-58 age group may also indicate that it is the male members, of working age, who have left the village to find work. The population growth rates, however, indicate that this trend may be slowing down.

The populations of Tolma and Lata have grown since 1999 with annual growth rates in both villages being greater than that calculated by Badola et al, 1999 for the Chamoli district. This was given at 0.9 percent on average per year, indicating that population growth had declined since the 1991 Census, which gave a rate of 2.2 percent for the region. Silori, 2004 also records the population in the district as declining by 13 percent between 1991 and 1996. He associates this decline in Chamoli entirely to the loss of tourism due to the comparison in demographic trends between the Bageshwar district, also in the buffer zone of the NDBR and Chamoli. In Bageshwar, the population decline started in 1961 after the ban on trade with Tibet, whilst there was a demographic increase in Chamoli between 1961 and 1981, after which the population began to fall. The apparent reversal of the declining trend since 1999 in Tolma and Lata, as indicated by the results of this study, suggest that ecodevelopment schemes may be beginning to produce results. In Tolma, however, the calculated growth rate is much lower than that predicted for the state of Uttar Pradesh from 2001 until 2026, which is put at between 1.8 and 2.2 percent, one of the highest growth rates in the country (Dyson et al, 2004). Consequently, any socio-economic improvements being made have, as yet, only made slight inroads into halting migration out of the region.

7.1.2 Lifestyle

In the current study average annual income in both villages is less than that which was earned from tourism alone before 1982 when average income, per family, per season was Rs 15660 and Rs 16506 (in actual terms) in Tolma and Lata respectively (Silori, 2004). Since 1999 however, income rates appear to have remained roughly constant. This may be seen as a positive sign, suggesting that ecodevelopment efforts in the region focusing on alternative income from medicinal plant cultivation, government sponsored labour and the growth of ecotourism are proving successful in halting the decline in the regional economy.

The Bhotiya people have always farmed the land, although the importance of agriculture to their lifestyle has varied throughout the last century with the rise and fall of both trade and tourism (Brown, 1987; Maikhuri et al, 1998; Badola et al, 1999). Currently almost all households are involved in farming in both Tolma and Lata and agriculture is the largest contributor to annual village income. The results also show a high percentage of cash crops and fruit grown in the two villages in comparison to more traditional species

suggesting a shift away from subsistence farming (which has historically been the main style of farming practiced by the Bhotiya) towards a more commercialised form of agriculture. These observations agree with evidence from Singh et al, 1997 who document a socio-cultural change in the region from a subsistence-barter economy to a market based one. This may introduce problems as the cash-crop species cultivated lack fodder value and require substantial manure inputs from livestock and forest litter resulting in soil erosion (Maikhuri et al, 2000). There is also the fear that the gene pool of traditional crops may also be lost (Silori and Badola, 1998).

Animal husbandry has also undergone changes in the last few decades, with a significant reduction in the number of goats and sheep owned in both Tolma and Lata (Nautiyal et al, 2003). Comparisons with the data available from 1999 (Badola et al, 1999; FDGI, 1999) demonstrate that these trends are still continuing. The results of the trend analysis coupled with informal interviews suggest that this is partly due to the loss of grazing land after the closure of the park, as well as the fact that pack animals are no longer required to carry supplies for expedition parties. The study by Nautiyal et al. (2003) also suggests that the current land-use system, produced as a result of these government conservation policies, can no longer support traditional transhumant pastoralism, while growing employment opportunities under government sponsorship has resulted in sedenterisation of transhumant populations. Consequently, remaining grazing areas and forests are becoming under increasing pressure, resulting in reduced productivity.

Although it has been in decline since the Indo-China War in 1962, the woollen industry still formed an important part of the economy of the region as recently as 1999 (Badola et al, 1999 and FDGI, 1999). The results of this study show however that its contribution to annual village income has fallen to 15 percent and 2 percent in Lata and Tolma respectively from its 1999 level. Its decline is probably, once again, due to the closure of the park and also as a consequence in the reduction in high quality breeds after the ban on trade with Tibet after the Indo-China war. The decline of the woollen industry is not only the loss of another source of income but also a further destruction of the traditional culture of the Bhotiya tribal people. Associated with the woollen industry is the indigenous knowledge held by local women on the making and use of natural dyes. This indigenous process has been in decline since the discovery of synthetic dyes in 1856

and the more recent invasion of market forces (Kala, 2003). The loss of the woollen industry would be the final nail in the coffin of this traditional practice.

7.2 Among and within village differences

As shown in their report to the Ministry of Environment and Forests in 1999, Badola et al (1999) demonstrated the variation in socio-economic characteristics in the villages of the Nanda Devi Biosphere Reserve. Other studies, studying other aspects of conservation and sustainable development in the reserve have also noted differences between villages within a single region (Maikhuri et al 2000; Nautiyal et al, 2003; Silori, 2004). Consequently it is not surprising to find marked differences between the villages looked at in this study, despite their geographical closeness.

7.2.1 Situation and demographics

The population of Lata is roughly five times the size of Tolma, although the areas of both villages are roughly similar, which may be the reason for the larger landholdings of villagers in Tolma. Lata is also sub-divided into two caste groups, unlike Tolma; however, this did not appear to influence any of the socio-economic or natural resource use trends. Lata is situated only a short fifteen minute walk from the main road leading away from the biosphere reserve towards Joshimath, the closest market town. Tolma, on the other hand, is much more isolated, being situated a steep four kilometres climb from the road, seven kilometres further along the road. Often the road and/or the path are impassable, due to frequent landslides, storm damage and snow coverage. The winter settlements of both villages are on the road head, although once again Tolma is situated ten kilometres or so further away from Joshimath.

These simple differences may be at the root of some of the other dissimilarities between the two villages. Firstly, the growth rate in Lata is greater than that in Tolma. It is also greater than estimates from 1991, 1999 and the predicted estimate for the region in 2001-26. This suggests that in Lata the general declining population trend has been reversed and that the population is growing faster than the average growth rate for the state. Due to Lata's location and population size it is better placed to take advantage of alternative sources of income without having to migrate from the village. This is reflected in the

analysis of occupations across the two villages, which shows the population of Lata being employed in fifteen different occupations, whilst farming is the sole occupation in Tolma. The proximity to the road may also mean better access to woollen supplies, dyes and markets for woollen products, explaining the greater contribution of the woollen industry to annual village income in Lata.

Literacy in Tolma has increased since 1999 in both males and females. Due to the need to migrate to larger towns to find employment, education, especially of males, is prerequisite. All the parents interviewed in Tolma stated the importance of providing their children with a good education in order that they could gain employment outside of the village, or within the village as a teacher or doctor, if the situation ever arose. In 1999, male literacy in Lata was much greater than in Tolma; however, this has reversed in the last six years with male literacy rising in Tolma and even declining slightly in Lata. It is possible that this switch may have been caused by the difference in inducement to further the education of their children, due to the availability or lack of alternative sources of income.

7.2.2 Income and wild food use

Average annual income in Tolma is greater than in Lata despite the availability of alternative sources of income in the latter. On closer analysis this difference appears to be due to four households in Tolma with significantly higher incomes than all the other households interviewed in both villages. There was strong evidence that these observed disparities in income are related to large fruit sales and the collection and sale of marcola.

The results show a positive association between income and both wild food collection and income derived from natural resources although it is unclear whether this correlation is causative or not. Further, there appears to be a complex relationship between agricultural land, fruit production, fruit income, and income from marcola. Evidence suggests that this is because as agricultural land owned increases, there is an increase in the number of fruit trees owned. Fruit tree plantations provide ideal habitat for marcola and therefore the quantity of marcola collected should increase as the number of fruit trees increases (Figure 9, Chapter Six). Greater use of natural resources by high income groups is an unusual relationship, as a higher dependency on natural resources is often

recorded in the poorer members of society (Adhikari et al, 2004; Cramb and Purcell, 2004; Mukherjee and Borad, 2004).

There are two possible underlying reasons for why high earning households only occur in Tolma. Firstly, the amount of agricultural land owned appears to be the foundation for the association between income and wild food collection/income. Although there is no significant difference between the two groups in Tolma in terms of agricultural land owned, there is a difference between the two villages, probably as the result of the large population size of Lata relative to land area in comparison to Tolma. Thus, the absence of high earning households in Lata may be due to a lower average landholding size.

Secondly, it may be hypothesised that the higher level of education observed in Tolma may be another reason for the appearance of high income households with a high level of marcola collection. There is a positive association between education and wild food collection and education and income and as already stated literacy is significantly higher in Tolma than in Lata. It is possible that a high level of education may have allowed the four high earning households to realise the benefit of exploiting the marcola market. However, it is difficult to imply causation in this case as it is not certain which came first; education or wealth.

It is proposed, therefore, that the advantages of education and a large landholding have been exploited by the four high income households in Tolma allowing them to earn significantly more from a combination of high fruit production and large scale collection and sale of wild mushrooms. This is only a proposal; however, as the pieces of evidence do not appear to add up, a concrete conclusion cannot be drawn.

7.3 Collection and use of wild foods and medicinal plant species

The scale of natural resource use in Tolma and Lata has declined since 1982 due to restrictions imposed after the closure of the park. A ban was imposed on the collection of medicinal plants, fodder and fuel-wood species from the core zone whilst gun licences were revoked and, in some cases, the guns themselves confiscated. Fuel-wood and fodder are still collected from around agricultural land, along with mushrooms and wild

fruit species, whilst there is limited collection of medicinal plant species from the buffer zone and Van Panchayat forest. There are suggestions that poaching and the illegal collection of medicinal plant species from the core zone do occur.

The UAFD (2004) biodiversity monitoring expedition of the Nanda Devi Biosphere Reserve, undertaken in 2003, records a large number of species known for their nutritional and medicinal qualities. The collection of a large variety of plant species and the marketing of 27 of them including five edible fruits, eight vegetables, two edible oils and 13 medicinal species has also been recorded in the Chamoli district (Maikhuri et al, 2000). Silori and Badola (1998), however, only record mushroom as being harvested for commercial purposes. Likewise, this study recorded the collection of 23 species of wild food and medicinal plant species of which only two were marketed. Wild food is collected purely for subsistence except for marcola which fetches a high market price. Pharan, a vegetable with medicinal qualities, was the only other wild resource in this study recorded as being sold.

This study provided no evidence of wild meat being collected either for sale or for subsistence use. However, hunting of large mammals and pheasants is recorded as still occurring in the region (Kaul et al, 2004) whilst informal interviews and group discussions hinted that poaching does occur in the core zone. It is possible, therefore, that wild meat was being consumed or sold but due to the illegal nature of these activities this information could not be divulged to an outsider. The time available to carry out the research also prevented information on wild meat use being obtained through informal observations.

The sale of wild medicinal plant species was once a source of income before the closure of the park. As part of the ecodevelopment schemes being established in the region is the introduction of medicinal plant cultivation and sale as a potential source of income. Although recorded as being successful in some villages in the district (Silori and Badola 2000), medicinal plant cultivation does not yet appear to have reached that level of development in the two villages in this study. This study shows that currently only pharan is cultivated for sale in Tolma and Lata although other species are cultivated for use within the villages.

Overall wild food and medicinal plant use appears to be relatively low, however, it is not apparent why this should be the case given the evidence from other studies within the boundaries of the Biosphere Reserve. It may simply be that information was withheld for legally sensitive reasons and because of a general feeling of mistrust towards a Western outsider. Also, respondents may not have been able to recall, due to the opportunistic nature of the gathering of wild foods, the quantity and number of wild species which they consume on a day to day basis.

There is still sufficient evidence, however, to suggest that the local communities do depend, at some level, on wild foods and medicinal plants. As previously discussed in section 7.2.2 there is also evidence of a correlation between income and wild food collection and the sale of marcola, a relationship which is very important to the annual income of some households. The use, by local communities, of wild foods and medicinal plants should therefore not be ignored when developing management plans for the NDBR.

7.4 Local attitudes towards conservation and the NDBR

The worship of Nanda Devi as a goddess, combined with a strong relationship with the environment, has given the Bhotiyas a fundamentally conservationist viewpoint. This is reflected in both their general attitudes towards the environment and in their understanding of the need for some form of conservation in the region. They also rank the provision of 'quality of life', above food and income, as the most important provision that the environment provides. The support for the concept of forest conservation is not restricted to the Nanda Devi region but is has also been observed throughout the Himalayan region (Badola, 1998).

The conservation purpose of the NDBR was generally understood and the underlying basis for its construction supported. However, those interviewed did not appear to be aware of the founding concept of biosphere reserves, as a means of reconciling conservation with sustainable use of natural resources (UNESCO). Most respondents were also unclear about the rules governing the park; and in Lata only 10 out of 25 respondents were able to identify the borders delineating the core and buffer zones.

Both of these facts highlight a failure in communication between the local community and the park management resulting in an estrangement between the two parties. This is supported by a study carried out in the park by Rao et al (2003), which reported indications of an infrequent interaction between the local people and the park management.

7.4.1 Negative attitudes

Despite a positive view of conservation in general, attitudes towards the park and the administration of it were overwhelmingly negative. This pessimistic viewpoint and its causes are well established (Badola, 1998; Badola et al, 1999, Maikhuri et al, 2001; Rao et al, 2003) A series of studies calculating the economic costs of the ban on adventure tourism (Silori, 2004) and crop and livestock damages from wildlife (Maikhuri et al, 2001), demonstrate the enormity of the economic damages. The problem of corruption within the forest department and local NGOs has simply served to augment this negative attitude.

These negative attitudes are dangerous to the future of the NDBR and threaten to undermine the achievements of the last two-and-a-half decades. Many studies have shown that the costs of conservation result in negative attitudes whilst benefits create a positive outlook (Fiallo & Jacobsen, 1995; Nepal & Weber, 1995). Successful conservation therefore depends on the extent of local support and the positive attitudes of residents of the community towards conservation policies (Rao et al, 2002).

The importance of a reliable source of income is reflected in the responses of interviewees to questions regarding their hopes for the future. Of those who were able even to imagine the future all stated the importance of a better, permanent income. In particular it was important that their children were able to obtain this, even if they could not. These results illustrate the importance of financial security and provide some indication of the impact that the closure of the park must have had on the local community and consequently on their attitudes towards conservation. Unfortunately the improvement in rural economy, although the main concern of residents, has not received as much attention as legal enforcement of protection by reserve management (Maikhuri et al, 2001). This is a failure of the NDBR to realise its founding principles of combining conservation with development.

7.4.2 Attitude differences between the villages

Those interviewed in Tolma appeared to have a more in-depth understanding of the principles of conservation. Ninety percent of the people interviewed in Tolma understood the purpose of the NDBR in comparison to 64 percent in Lata and interviewees also appeared to have a greater understanding of the rules governing the park. All interviewees in Tolma, which included both men and women of varying ages, also understood the concepts of core and buffer zones and could identify these regions on the ground.

In Tolma, seven out of the ten respondents mentioned the idea of sustainable use of natural resources when discussing the general opinion of the community towards conservation. When asked about suggestions for changes to the way the park is currently managed many of the respondents talked about being able to use natural resources in the buffer and core zones under controlled limits. In contrast, in Lata, the idea of sustainable use was never explicitly mentioned or the principle discussed indirectly when asked about management changes.

These differences between the villages may be a result of the higher level of education in Tolma in comparison to Lata. A study by Hedge and Enters (2000), found that people's reliance on forests decline with increasing education. However, this could result in an indifference towards conservation as dependency decreases, and hence the relationship between people and the environment breaks down. In this study though, it appeared that the collection of wild foods was positively correlated with education. In Tolma, due to the four high income households, the collection of marcola was significantly greater than in Lata. Therefore, a possible alternative explanation is that the higher use of wild foods increases the awareness of the need to use the resources in a sustainable manner in order for a continual benefit to be felt. The collection of wild foods will also mean an in-depth understanding of the actual borders of the core and buffer zones and maybe a better awareness of the legal rules surrounding the collection of wild species. No difference in attitudes between the two groups of households in Tolma was observed, although this may have been due to the small sample size. It was not possible, therefore, to test these explanations further.

7.4.3 Future management of the NDBR

Understanding people's perception of the management of natural resources and utilising this knowledge from the inception of a project and throughout its management has been recognised as one of the most important tools in the participatory approach to natural resource conservation (Berzetti, 1993; Fiallo & Jacobsen, 1995). It is vital, therefore, that people are involved from the inception of a project. The absence of community participation in the creation of management plans also results in a divergence in opinions on options preferred by the local community and those incorporated into the management plan (Mehta & Kellert, 1998). Although the NDBR has already been established for 20 years, it is important that future management plans take the opinion of the Bhotiya people into account. This will help dissipate the negative attitude previously discussed ensuring conservation is sustainable in the long-term.

The key management suggestion by local people was for the core zone of the park to be opened, with some respondents being aware of the need for this to be done under strict management. It was also considered important that alternative sources of income were provided, which respondents felt would encourage community participation in conservation of the reserve. They also wanted to be allowed greater opportunities to be involved in conservation. These points highlight that, despite the negative attitudes towards the park, there is still an underlying conservationist attitude and the desire to protect their environment.

Local preferences for management may not always fall in line with the goal of conservation and may require moderation (Maikhuri et al, 2001). However, in the case of the NDBR, ecodevelopment schemes, which have been established in a number of villages including both Tolma and Lata, have been generally welcomed by the local communities. These schemes have provided high quality livestock, LPG connections, water facilities, grasslands to replace lost grazing land, protection against landslides and alternative sources of income, one of which is the concept of ecotourism. Once again this has been welcomed. Although currently only in the early stages of its implementation, it is hoped that it will develop to provide a permanent source of income. Respondents also felt that it would encourage participation in conservation due to the benefits being realised from a well protected, un-damaged park.

8 Recommendations for integrating protected area management and sustainable development

The main impact of traditional protected area management is that the indirect and opportunity costs of conservation are borne almost entirely by local communities (Moore et al, 2004). Community-based conservation, ecodevelopment and buffer zone management are all attempts to address the conflicts between people and protected areas by being based on the principles of benefit sharing and recognising the role of local communities in conservation (Budhathoki, 2004). It is important, however, that these benefits are realised in the short-term for local communities to agree to the implementation of policy measures (Saxena et al, 2001). It is also important to ensure that local communities are not condemned to a life of poverty by tying them to a declining, mismanaged resource base through ill-focused efforts to promote the sustainable use of natural resources as a means to development in inappropriate settings (Brandon, 1997). Resolving the conflicts inherent within current protected area management must therefore aim to create sustainable solutions to achieving equitable benefit sharing among all stakeholders.

8.1 Recommendations in the NDBR

8.1.1 Increased community participation

As discussed in the previous chapter, the level of community participation in the management of the NDBR is limited, and by ignoring the needs of the local community the management has endangered the conservation success achieved in the reserve. Ecodevelopment schemes established in the reserve are a step in the right direction. However, community participation is still limited with ecodevelopment micro-plans in some areas of India being prepared largely without community involvement (Ravindranath et al, 2004). As observed in this study, attitudes towards the NDBR are still largely negative whilst a number of respondents felt that the management required increased participation from the local community.

A key recommendation, therefore, is for the State and Forest Department of India to increase the level of community-participation, beyond the level of simple integrated conservation and development projects. Suggestions from the local community should be considered and applied, where appropriate. It is clear that current situation in the NDBR is not unique. The neighbouring country of Nepal has also adopted a community-based approach to conservation management which includes increasing the sharing of revenues from protected areas with those living in the buffer zones. However, there are still inconsistencies between the vision of this policy and its application in practice. For example, many local resource user committees are not able to use their allocated budget because of inadequate support from the park staff causing some local communities to see the buffer-zone initiative as another broken government promise (Budhathoki, 2004). It is also important for management staff of protected areas to take local differences within communities into account. The results of this study indicate that the perception of conservation in Tolma and Lata are distinct from each other and therefore the application of increasing community participation in the two villages will vary. This may also be the case in protected areas in other developing countries.

8.1.2 Ecotourism

The Nanda Devi Biosphere Reserve, with its dramatic combination of snow-capped peaks, alpine meadows and forests combined with a rich cultural diversity make it ideal for the development of ecotourism. As discussed in the history of the region, uncontrolled tourism lead to the destruction of the environment and resulted in the ban on adventure tourism. However, a study by Maikhuri et al (2000) found no justifiable reasons behind the ban and they felt that it should be possible to develop a sustainable, well-managed ecotourism programme benefiting both the local community and the environment.

Some steps have been implemented towards achieving this goal: the introduction of homestays within local villages and the opening up of nine kilometres of the core zone up to Dharansi to allow tourists to view the Nanda Devi valley and the mountain itself. These measures have been welcomed by the local community as reflected in the attitude analysis. Ecotourism in the reserve is only in the early stages, however, and needs to be developed further if it is to become a real alternative source of income to the Bhotiya

people. Ecotourism is not a solution specific to the NDBR and if implemented correctly could be a useful option to resolving people-policy conflicts in other protected areas.

8.1.3 Medicinal plant cultivation

Before the closure of the park there was a small market for medicinal plants which was exploited by some members of the community living in the NDBR. Current prices fetched for pharan, the only medicinal plant cultivated and sold in the study villages demonstrate that there is a profitable market available. If this can be developed to ensure that the Bhotiya people are not deprived of their intellectual property rights or exploited by middlemen, the global demand for new drugs may ensure that such a scheme should provide long-term economic benefits. However, the pharmaceuticals market is very unreliable with many failures and few large successes.

Medicinal plant cultivation is also efficient as not only do medicinal plants have high monetary value but they can be produced on very little land, are easily protected from weather and wildlife (reducing people-wildlife conflicts) and are non-perishable (Rao et al, 2000). Current cropping patterns, as a result of the change from a subsistence-barter economy to a market-based economy, are inefficient for the region. This, combined with recent sedenterisation has decreased the productivity of the land (Nautiyal et al, 2003). Consequently, a shift to a more suitable cropping system, evolved to suit the region (wild medicinal plants being native to the NDBR) should provide benefits over and above economic ones.

Other suggested benefits of medicinal plant cultivation include the conservation of these species and the preservation of traditional ethno-medicinal knowledge among local people (Silori and Badola, 2000). The conservation of indigenous knowledge is an important aspect of community-based resource conservation (Batisse, 1982, Dobhal 1999). If ecotourism is successful, the retention of indigenous cultural practices is important if the Bhotiya are to retain a sense of their identity as they enter the globalised world. Medicinal plant cultivation thus provides a means of incorporating the use of indigenous knowledge into management plans in order to integrate the need of the local community to see immediate benefits from conservation with global concerns about the environment (Alteri & Masera, 1993; Saxena et al, 2001).

8.1.4 Resolving people-wildlife conflicts

The socio-economic consequences of people-wildlife conflicts were not a focus of this study; however, through group discussions, informal interviews and the attitude questionnaires the scale of the issue became apparent.

Suggestions for the resolution of the conflict, put forward by the local people, included:

- compensation for crop and livestock losses as well as for injuries sustained by humans from attacks
- a wall or a fence around the village protecting people, livestock and crops
- a review of the hunting policy to allow local people to kill in defence only

A review of the hunting policy in the NDBR would be difficult to achieve as a renewal of gun licences for the shooting of wild animals in defence alone would be difficult to monitor and enforce. Likewise a wall or fence surrounding each village would be a managerial nightmare. Compensation is rarely received due to a combination of corruption and bureaucracy, therefore although this appears to be a reasonable suggestion it is not clear that it functions well in practice. The system needs to be upgraded so that disbursement is fair and quick (Rao et al, 2002). In the Sariska Tiger Reserve in Rajasthan, also in India, the settlement of rights to collect fuel-wood and fodder within the reserve appeared to be one acceptable measure to compensate for losses besides an immediate review of hunting policy (Sekhar, 2003).

It is clear, therefore, that compensation in some form or other needs to be received, although it is not apparent from this study whether this should be in the form of money, rights to collect certain natural resources or the provision of alternative sources of income, reducing dependency on livestock and crops. Further attitude surveys requesting detailed suggestions from the local community are needed, combined with a review of the forest department, to develop a workable plan.

8.2 General recommendations

8.2.1 Resolving people-policy conflicts

8.2.1.1 Increased community participation

The benefits of a community-based approach to sustainable resource management have been recognised due to the acknowledgment of the limitations of state intervention (Balland & Platteau, 1995). However, simply putting the entire management of a resource into the hands of local users is not a robust solution (Milner-Gulland & Mace, 1998); and, as discussed in Chapter Two, integrated conservation and development projects have often failed due to a lack of community participation and communication between stakeholders. Consequently, the idea of community-based management has evolved in recent years into the idea of co-operative or participatory management. In this case the State retains ownership of natural resources whilst devolving the power to manage and control the resources to the stakeholders (Berkes et al, 1991). This, as a result, necessitates a greater level of community participation.

One of the key challenges facing current conservation policies in developing countries relate to inadequate community participation particularly of the poor, landless, lower caste and class and women (Ravindranath et al, 2004). Women are important stakeholders in natural resource use policies in the Himalayas, and in many rural areas of developing countries, as they are the main collectors of natural resources (Gupte, 2004). Consequently, the impact of conservation policies on different sectors of society varies, with the women and female children of poor rural households being most adversely affected by the establishment of protected areas (Agarwal, 1997). In a study of the impacts of the closure of the NDBR, 100 percent of women stated that the main impact was the loss of subsistence needs, whereas 60 percent of men stated economic losses as the most important (Rao et al, 2000). With such differing opinions, the exclusion of marginalised groups from participation makes the outcomes meaningless with reference to how natural resources should be managed.

8.2.1.2 *Alternative sources of income*

If the local community are to be encouraged to reduce their dependence on natural resources they must be provided with alternative means of sustaining their livelihoods. Suggestions for alternative income sources should bear differences between communities in their use of natural resource in mind and be aware that reducing dependency on natural resources will only be successfully achieved if the alternatives suggested are both practical and provide immediate economic advantages.

As discussed, ecotourism is one method of encouraging people to become involved in the conservation of natural resources as a reliable source of income will only be maintained if the environment retains its 'untouched' characteristics. It is important, however, that the relationship between tourism and environmental conservation should be a symbiotic one by ensuring the establishment of linkages between tourists, local people and biodiversity conservation (Batisse, 1982). Ecotourism not only provides economic opportunities but also helps to preserve cultural traditions, whilst the documentation and dissemination of information on natural and cultural resources helps to generate awareness among local people as well as tourists (Silori, 2004). It is possible, however, that tourists may result in the loss of local culture and traditional livelihoods.

Although, not suitable for all protected areas, the development of industries, such as the cultivation of medicinal plants, which involve the truly sustainable use of natural resources is an effective way of linking the local community and conservation. Although, as previously stated in the Chapter Two, the definition of 'sustainability' itself is a woolly topic (Lesser et al, 1997) and determining whether a use is truly sustainable may not be possible.

8.2.2 **Institutional changes**

Current Indian conservation policy is centred on the establishment of local community institutions to collaborate with the forest department at the grassroots level. However, local institutions in the form of *van panchayats* were created as a response to the people's movement against forest reservation at the beginning of the twentieth century, due to the State's efforts to take over and exploit forests that belonged to the people before the British came (Ballabu et al, 2002). The actions of the forest department, as illustrated by

the manner in which JFM is implemented, do not demonstrate recognition of the robustness of these local community institutions or the institutional capacity at the local level (Bingeman et al, 2004). These new formal institutional frameworks also do not appear to be as effective as the existing informal system (Maikhuri et al, 2000). For protected area management to be effectively married to sustainable development it is important for these traditional institutions to be awarded the power and capacity to carry out policies at the grassroots level.

In general, developing countries lack the resources to effectively implement environmental policies (Rowcliffe et al, 2004). Consequently, a key reason for the continued lack of success of ecodevelopment and JFM approaches to conservation within protected areas is the lack of capacity within the forest department to carry out and integrate their new responsibilities with the old (Ravindranath et al, 2004). This is due to chronic understaffing, low wages and insufficient staff training (Badola, 2000). Developing the capacity of the forest department to effectively implement these policies is therefore vital to their success in promoting community participation and integrated conservation and development within India.

The problem of land tenure insecurity results in reducing the incentive of local communities to invest in land improvement and conservation. The experience of a number of developing countries suggests that where local communities, dependent on natural resources, are ensured of their tenurial rights protection of the environment may follow (Khare, 1998). Without resolving the issue of land tenure insecurity it will be impossible for the sustainable integration of conservation and development to proceed further in India or in other developing countries with similar land tenure problems.

8.2.3 Alternatives to integrated conservation and development schemes

Direct payments for conservation may prove more efficient than indirect ICDP schemes by: providing a clear incentive to protect the environment; being easy to target; limiting the honey pot effect; achieving results both in the short and long-term (Kiss & Ferraro, 2002). It has been suggested by Ferraro (2001) that 80 percent of the forest in Madagascar could be protected by direct payments as opposed to twelve percent if indirect methods were used. It is often agreed that the West should pay for such schemes as it is ultimately for our benefit that conservation is carried out. Costa Rica

however is in the process of implementing a scheme which may be paid for through fuel taxes or sale of carbon emission reduction rights on the international market (Malavasi et al, undated). Other possibilities include environmental legislation, such as the Environmental Code enacted in Sweden in 1999. Sweden also implements a forest certification scheme and eco-labelling in agriculture to provide incentives to conserve. (Terstad, 1999) However, such schemes would make developing countries susceptible to international consumer markets and would require the establishment of a locally strong consumer force in order to be successful in the long-term. It has also been suggested that there could be an international park service which would provide real local benefit without the problems of management at the local scale (Chapman, 2003). Once again, such a scheme would leave a developing country open to the mercy of international markets.

9 Summary of results and future work

The study as a whole illustrates how a conservation policy, implemented without the participation of the local community, has failed to fully appreciate the economic costs of the policy as borne by the local community. This impact has had long-term effects on the socio-economic status and lifestyles of the Bhotiya people resulting in their alienation from the management of the park, reducing their support for conservation. Consequently, although established as a UNESCO Biosphere Reserve, the NDBR has so far failed to achieve its aim of combining development and conservation, the core principle on which it was constructed

The results also suggest that the impacts of the establishment of the NDBR vary significantly between the two study villages as a result of differences in location, village structure, education level and resource use. Any future changes in the management of the park, development initiatives and attempts to increase local participation in conservation must take these differences (and any other dissimilarities between villages in the NDBR) into account in order for both conservation and development in the region to be sustainable in the long-term.

There are some indications of positive results from changes in the way the park is managed. Ecodevelopment schemes and associated ecotourism have not only begun to improve the developmental status of the Bhotiya people but are enabling them to support and participate in conservation. These indications are only the beginning and a much more concerted effort to involve the local communities in the future of the NDBR is required.

Time considerations and difficulties obtaining access to the villages being studied meant that the number of households interviewed and the number of villages studied was limited. This made it impossible to draw more detailed comparisons between the villages, and to explore further how differences in situation affect the socio-economic position and wild food use of the residents. Additional research is required to investigate the differences observed between the two groups of households in Tolma and to explore

whether there are other dissimilarities among other villages in the region. This would help to clarify and/or provide support for the complex hypothesised relationship between agricultural land, fruit and marcola.

As an outsider, it was difficult to gain the trust of the local communities in the short time available for fieldwork, making it harder to obtain honest and reliable responses. The fact that permission from the forest department was also required to carry out research in the park meant that any responses from questions concerning the park management are likely to have been censored. Translation problems also resulted in simplified responses from interviewees being recorded, often with the consequent loss of meaning. Finally, the limit on time spent in each village also meant that the attitude analysis could only be a brief summation of how the local community perceived conservation and the NDBR itself. Consequently, the attitudes recorded in this study can only be used as a guideline as to the perception of the local communities in Tolma and Lata. More detailed analyses would have to be undertaken if the results were to be used towards increasing community participation in the management of the park.

The recommendations made in the preceding chapter, regarding the need to resolve people-policy conflicts through increased community participation and alternative sources of income combined with institutional changes, are not novel. Most have been previously discussed in other literature on the subject of creating sustainable solutions to achieving equitable benefit sharing among all stakeholders within protected area management.

There have been significant changes in Indian conservation policy in the last two decades, with an important shift towards integrating conservation and development through community participation. Currently, these changes appear more advanced than in comparison with many African countries; however, JFM and the ecodevelopment process to date, as well as ICDPs in developing countries in general, highlight the ongoing problems of integrating conservation and development in a developing country. The heterogeneous nature of the environment and resident local communities means that there is no universal solution to reconciling protected area management with sustainable development. The future of the management of the NDBR must therefore be tailor-made in order to preserve this unique habitat and culture of the Bhotiya people.

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Appendix 1: General household questionnaire

Date:

Name of head of family:

Caste:

Community:

1. Does any member of your family live outside the village (not live with you)? yes/no

a. What do they do?

b. Do they send you any money? yes/no [if possible] c. How much/month (Rs)?

2. Demographic structure: how many members of your family are living in the village with you?

Name	Relation to head	Age	Sex	Education [for how many years were they at school? Any certificates/exams?]	Occupation

3. Residential pattern: can you tell us about your home? what facilities does your household have?

a. Do you own this house and any attached buildings? yes/no

b. [If possible] If no: how much do you pay/month (Rs)?

c. Number of rooms?

d. Number of other buildings? And what type are they?

e. Electricity?

f. Toilet?

g. Drinking water?

h. Electrical equipment? And what type?

4. Land holding pattern:

How much land do you own (nali)?

How much land do you rent (nali)?

5. Average annual income: summer

winter

6. Cropping pattern: what crops do you grow?

Crops	Cropping	Pattern	Marketing of crops		
	Season	Av. Yield/nali	Quantity sold/yr (kg)	Rate (Rs)	Total income (Rs)

7. Fruit production: do you own fruit tress?

Species	Production/Yr (kg/#)	Marketing Of Fruit		
		Quantity sold/yr (kg)	Rate (Rs)	Total income (Rs)

8. Livestock population & meat economy:

How many livestock do you own? Do you market your own meat?

Type	Number Owned
Cow	
Cow calf	
Bull	
Bullock	
Sheep	
Sheep immature	
Goat	
Goat immature	
Mule	
Other	

9. Dairy economy: do you sell milk or milk products?

Milk/Milk products	Quantity produced/month	Quantity sold/month	Cost/litre or /kg (Rs)	Total income (Rs)

10. Wool economy:

Animal	Quantity produced per season (kg)			Quantity sold (Kg)	Rate/kg (Rs)	Total income (Rs)
	Summer	Winter	Total			

Cost of raw wool (Rs/kg)?

Items	Quantity of wool required (kg)	# Prepared		# Sold	Price (Rs)	Total income (Rs)
		Own use	For sale			

11. Diet patterns

a. Meat: how much meat do you eat? [*meat is defined as both wild and domestic, birds, fish and mammals*]

Type of meat	Source [bought/given/caught?]*	How often do you eat this meat?	Rank in order of preference (1 is best)

* If caught from wild: Buffer zone of NDBR/Core zone of NDBR/Van Panchayat?

b. Wild meat [*if included above*]

Species	Source * (<i>see above</i>)	Season	Reason for use	Quantity sold (Kg/#)	Rate (Rs)	Total Earnings (Rs)

c. Do you eat any or collect any other wild food species [*e.g. plants, mushrooms, eggs, fruits*]

Species	Source* (<i>see above</i>)	Season	Reason for use	Quantity sold (Kg/#)	Rate (Rs)	Total Earnings (Rs)

12. Extremes

a. What quantity of crops/fruit/number of livestock are lost each year to bad weather?

b. What quantity of crops/fruit/number of livestock are lost each year to wild animals?

Appendix 2: Attitude Survey

Name

Age

Sex

Education

Occupation(s)

1. How are the forest and mountains viewed in your religion/philosophy?

2. Do you feel that the general attitude of the community is:

- a. conservationist
- b. exploitative
- c. natural

3. What do the natural environment provide you with personally [*e.g. the forest, mountains, animals, plants*]? Please rank the following with 1 being the best.

- a. Source of happiness
- b. Source of interest (you want to learn about the natural environment)
- c. Source of food
- d. Source of income
- e. Source of fodder
- f. Source of quality of life e.g. clean water and air

4. Do you understand the purpose of the NDBR?

Can you explain it?

5. Do you understanding the legal rules governing the biosphere reserve and the national park?

Can you explain them?

6. What is your opinion of having the Nanda Devi area as a biosphere reserve and national park from a personal point of view?

1. Very good 2. Good 3. No opinion 4. Bad 5. Very bad

Why?

7. What is your opinion of having the Nanda Devi area as a biosphere reserve and national park from a conservation point of view?

1. Very good 2. Good 3. No opinion 4. Bad 5. Very bad

Why?

8. What is your opinion on how the Nanda Devi area is administered?

9. What changes would you suggest?

10. What is your opinion of ecotourism?

1. Very good 2. Good 3. No opinion 4. Bad 5. Very Bad

Why?

11. What is your opinion of ecodevelopment and the microplan scheme?

1. Very good 2. Good 3. No opinion 4. Bad 5. Very Bad

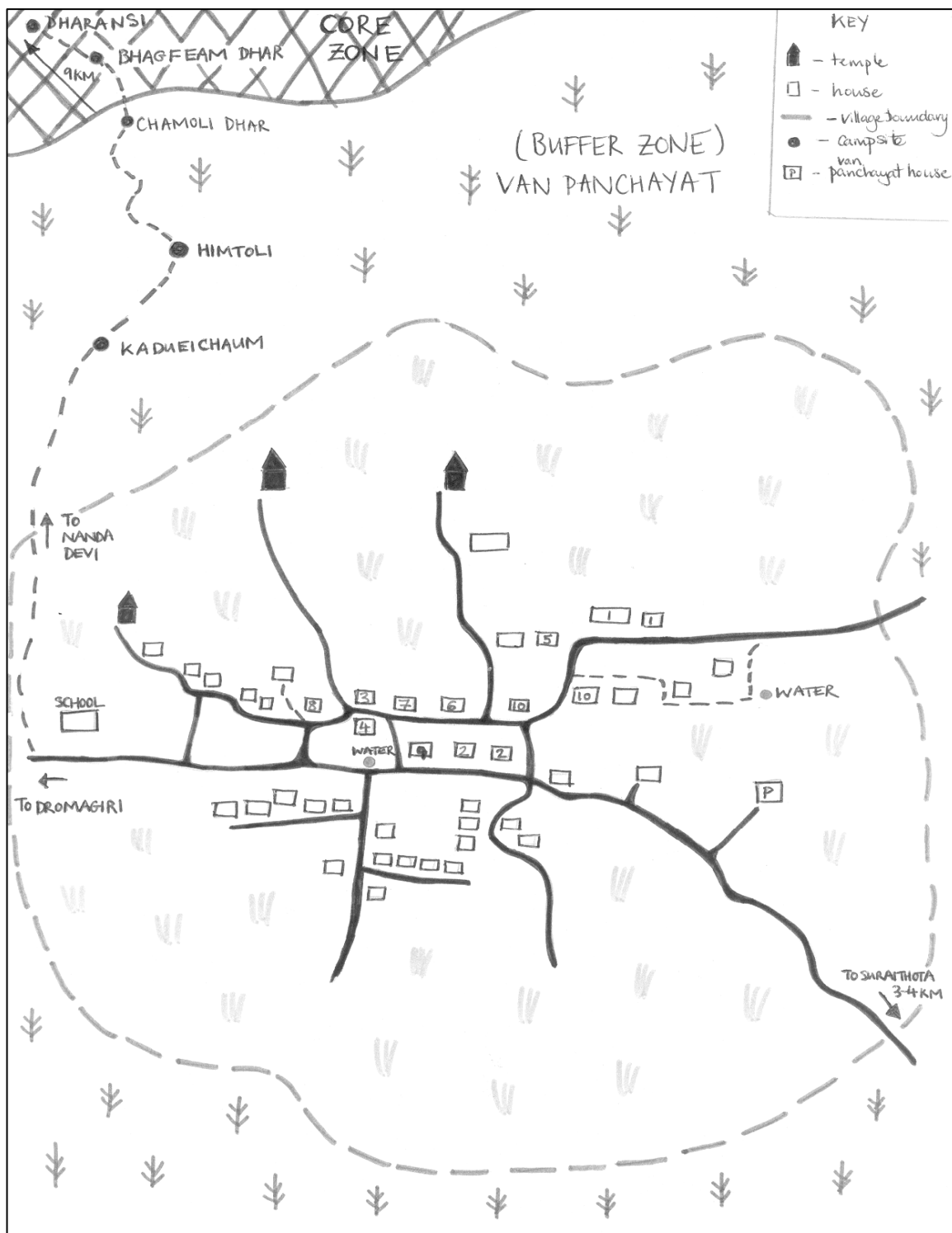
Why?

12. What changes are you worried about that might happen to the natural environment (forests, mountains, water, plants, animals) in the future?

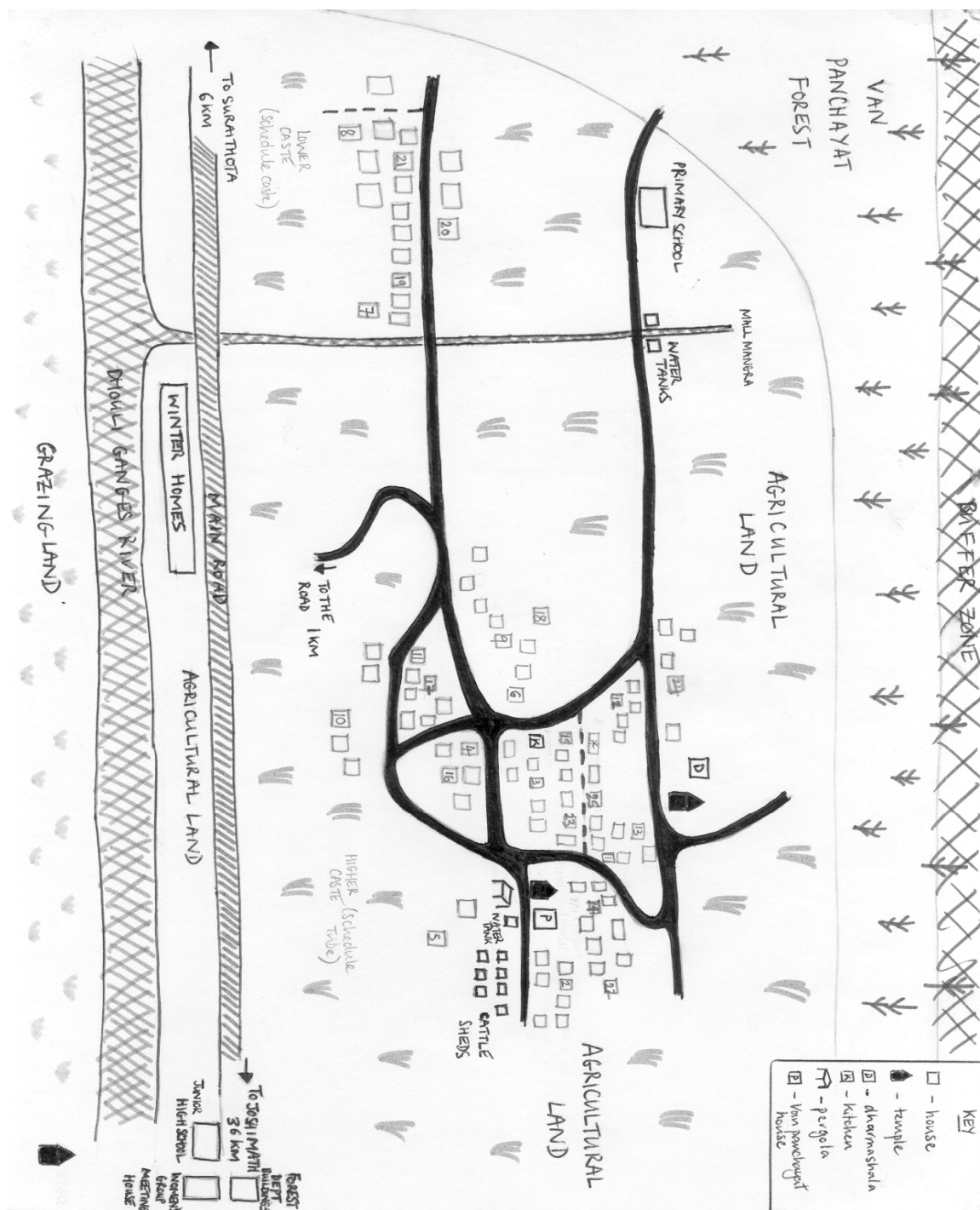
14. What improvements do you think are urgently needed in your village?

15. Where do you see yourself in ten years time?

Appendix 3: Map of Tolma



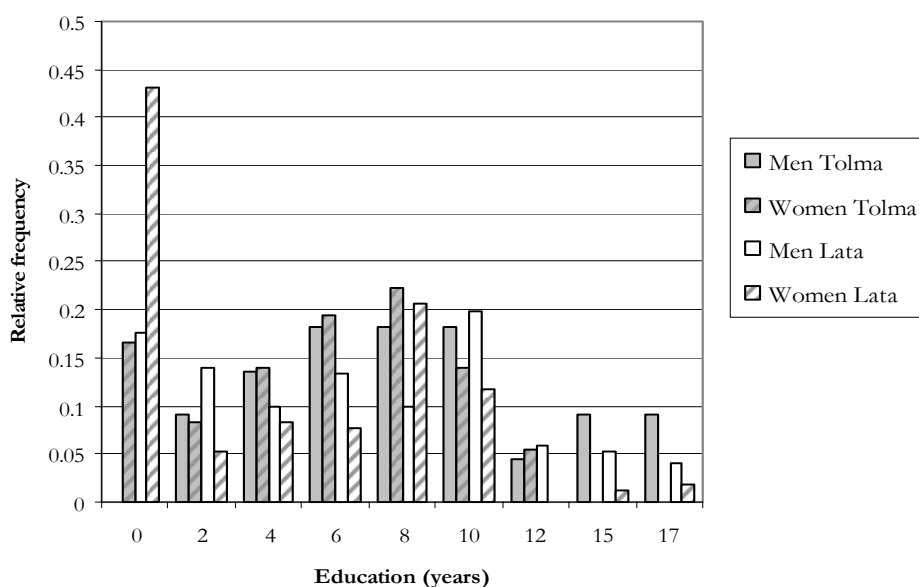
Appendix 4: Map of Lata



Appendix 5: Literacy

Literacy in Tolma and Lata in 1999 (FDGI, 1999) and 2005 (data collected during population survey)

Year	Village	Literacy Rate			Av. No.Years Education			% with a degree	Average age of starting school
		Males	Females	Total	Males	Females	Total		
1999	Tolma	79.17	68.81	74.38					
	Lata	83.20	69.08	73.28					
2005	Tolma	95.65	83.33	88.14	7.96	5.25	6.60	7 (4 men and 0 women)	6 (youngest 4, eldest 9)
	Lata	81.03	56.14	68.70	6.01	3.98	5.01	18 (16men and 5 women)	7 (youngest 4, eldest 9)



Relative number of years of education in males and females in Tolma and Lata

Appendix 6: Management suggestions from interviewees in Tolma and Lata

Village	Management suggestions
Lata	<ul style="list-style-type: none"> • Permission should be given to tourists so they can enter only in limited numbers Any revenue from the park or from tourism should benefit the villages. • The compensation that is being provided is not sufficient. Employment in conservation in the park should be provided to the villagers • The forest guard should go into the forest daily and the number of forest guards should be increased • Tourists should be allowed in limited numbers. Whoever goes in the forest should be told that the forest should not be polluted, burned and wildlife should be protected We should be allowed to graze our livestock as they help to increase the medicinal plants etc by spreading seeds • Trishul, Hanuman, Chunkbunk, Dronagiri mountains should be opened for tourists so that we can get employment. These NR are our property and therefore conservation is our first and most important duty. • Villagers should be allowed to help in conservation and should be benefited by the park • Permission should be provided for villagers to go into the forest to protect wildlife. For example they can control the numbers of harmful animals which eat smaller animals and also watch out for people collecting medicinal plants illegally • The park should be opened • For the government to open the park for tourists and for us • Employment as a guide and porter should be provided to the villagers. After that they will be encouraged to help in conservation • Forest guard should live in the forest so that nobody can exploit the forest • The government should follow the same rules with all people. For example when some people's child does labour work they don't get full pay whereas other people's children do
Tolma	<ul style="list-style-type: none"> • The core zone should be opened under proper management • They want to be able to use both the core and the buffer zone but under management limitations, if someone uses it too much they should be punished • The number of forest guards should be increased • Employment should be provided to villagers as forest guards, guides etc. The rules of the park should be made clear • The NDBR should be opened but under good management. Employment should be provided to the village so that the villagers feel they are benefiting from the NR and then they will want to protect it • Natural resource use should be limited • More staff should be recruited that are more conservationist minded and also villagers should be compensated for crop losses and also benefit from employment opportunities • Rules should be made taking local people into account • Compensation for crop loss should be provided and local people should be allowed to kill wild animals which are harmful. Tourists should be able to get permission more easily

