



# Local People and Protected Areas

**The Ban of NTFP collection for commercial use and effects on cash incomes and livelihoods of the Soligas in BR Hills, India.**

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Temple junction, BR Hills, Karnataka, India 2007 (Photo: Pernille Sandemose)

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**DECLARATION**

I, Pernille Sandemose, declare that this thesis is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

Signature.....

Date.....

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## **ABSTRACT**

Millions of forest dwellers in India extract Non-Timber Forest Products (NTFP) from the forest for both commercial and domestic use. For centuries the Soliga tribe have dwelled in the forests of Biligiri Rangaswamy Temple Wildlife Sanctuary (BR Hills). After the Wildlife Protection Act of 1972 they have engaged in NTFP collection for commercial use. Various studies show that the poorest rural people are the most dependent on NTFPs to sustain their total livelihood needs. In several protected areas in India, their cash income livelihood strategy was effectively rendered illegal after an official memorandum banning NTFPs collection for commercial use. This study examines the Soligas NTFP dependence before the ban was implemented in 2006, their cash income constraints after the ban, and their present attitudes towards conservation.

A total of 124 households were selected in a household survey using convenience sampling in 9 settlements inside the Sanctuary. Dependence on NTFP collection for commercial use was measured by its share of cash income to total cash income before the ban. Regressions and Gini coefficients were used to investigate the impact of different qualitative and quantitative variables on NTFP dependence.

The study reveals that the ban has had a great impact on the Soligas' cash incomes and general livelihoods. The Soligas lost more than half of their cash income after the ban was implemented in 2006, in addition to losing a substantial source of products for subsistence use. This has further lead to a larger cash income inequality among the Soligas. Cash income from NTFP collection constituted 85.2 % of their total cash income before the ban, and the Soligas have few other options to sustain their livelihoods. They are highly dependent on NTFPs to sustain their livelihood needs and to supplement their daily requirements. Eighty-one per cent of the Soligas own land, and coffee production is increasing among the Soligas. After the ban cash income from off-farm activities increased from constituting 12.8 % of the total cash income to 71.8 %. The study also found that the ban and the conflict with the Forest Department has had an adverse effect on Soligas' attitudes towards conservation. The Soligas feel alienated from the forest that holds their history of social and cultural heritage and their identity.

This study was carried out a year and a half after the ban, and the Soligas are probably still in a transitional stage of adaptation. Further research is required to comprehend what the full effects of this ban will have on the Soligas livelihoods.

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# 1 INTRODUCTION

*This chapter gives an introduction to the problem of conservation and development. It includes the problem statement and justification, objectives, and the research questions for this study and lastly follows an outline of the thesis.*

## 1.1 Introduction

“The diversity of species is necessary for the normal functioning of ecosystems and the biosphere as a whole. The genetic material in wild species contributes billions of dollars yearly to the world economy in the form of improved crop species, new drugs and medicines, and raw materials for industry. But utility aside, there are also moral, ethical, cultural, aesthetic, and purely scientific reasons for conserving wild beings” (WCED 1987: chapter two).

Forests play an important environmental role, at the same time as they play a vital role for livelihoods, hence the loss of forest is a major concern due to the many functions that it provides. Conservation of protected areas has increased dramatically in the last four decades, and most of all in developing countries where biodiversity, due to geographical location, is richest. At the same time the objectives of protection has changed from only concerning itself with biodiversity to including human welfare. Cost and benefit of conservation has been asymmetric, where the cost has been borne by local communities and the benefits have been reaped on a national and global level (Arjunan et al. 2006). Several case studies have documented the effects of conservation, evictions and forced resettlements, access to forest resources reduced or lost (Campese et al. 2009). This has led to a growing concern for indigenous people and their rights.

According to the Food and Agriculture Organization (FAO) (2006) the worlds' forest area covers about 4 billion hectares (ha), that is 30 % of total land area on Earth. The annual loss of forest is about 13 million ha, but due to planting and natural expansion (mainly in Europe) the net forest loss from 2000 to 2005 was 7.3 million ha per year, 0.18 % loss of total forest area. This is disturbingly high, but the deforestation rate is decreasing. From 1990 to 2000 the loss of net forest was 8.9 million ha per year, 0.22 % of total forest area (FAO 2006).

Asia has 14.5 % of the world's forests, and India is on the top ten list of countries with largest forest cover with almost 76.5 million ha , which amounts to 23.3 % of the land area (GoI 2005b; Nanjundaiah 2008; Raja 1996). If India is going to reach its national goal of 33 % forest cover, (GoI 2005b; GoI 2007a) plantation and protection of forests is important. India's forests are under pressure from the growing population, grazing livestock, fires and the commercial need for forest products (Bhattacharya and Hayat 2004). Another threat to India's forests is the climate changes which could lead to altered forest productivity, resilience and biodiversity (GoI 2007a).

India occupies 2.4 % of the world's land area with its 297.3 million ha land (328 723 600 ha total) but supports over 17.5 % of the world's population. It is the world's second largest populated country with its estimated 1.15 billion people (UNDP 2009), and a growth rate of 1.58 % (Chape 2003; World Bank 2008). Seventy-one per cent of the population in India lives in rural areas (The World Bank 2008). India is therefore one of the most densely populated countries in the world with 336 people per square km (GoI 2007b). This amounts to seven times the average of the world's population density (GoI 2007b; Long et al. 2001).

In 2005 the estimate was that 25 % of the world's population lived below the poverty line of \$1.25 a day (Chen and Ravallion 2008), and almost half the world's population of 2.8 billion, and 800 million people (70 %) in India, live on less than \$2 a day (World Bank 2004; WRI 2005).

More than 1.6 billion people around the world depend on forests to some degree to sustain their livelihoods (Vedeld et al. 2004). One billion people depend on drugs obtained from forest plants, around 60 million indigenous people are almost entirely dependent on forests (The World Bank 2004), and half a billion extremely poor people need the forest to sustain their livelihoods (The World Bank 2009). In developing countries 75 % depend on traditional medicine (Nanjundaiah 2008). In India more than two million tonnes of non-wood forest products are extracted every year to a value of almost \$1.8 million (FAO 2006).

For between 100 and 140 million forest dwellers the Indian forests are their main source of livelihood (Bhattacharya and Hayat 2004; Nanjundaiah 2008; Vedeld et al. 2001). Of these about four million are living in India's protected areas (Kothari 2004). The high population density in India implies that the wilderness in India is just as much about plants and animals as it is about people. Non-timber forest product (NTFP) collection in India has contributed to

about 40 % of total official forest revenues and 55 % of forest-based employment (Tewari and Campbell 1996).

12,3 % of the total terrestrial area on earth is officially recognized as some form of protected area (UNEP-WCMC 2008). India has, since the Wildlife Protection Act 1972, established over 600 protected areas, which amounts to almost 5,3 % of the country (World Bank 2008).

“A country can develop meaningfully only when ecological sustainability and social equity are guaranteed, and a sense of respect for, and oneness with nature, and fellow humans is achieved” (Kalpavriksh 2008).

In 1872 the World saw its first National Park, Yellowstone<sup>1</sup> in United States. Other countries would soon follow and the protectionist paradigm dominated. The idea of protected areas was built on the western approaches with the assumption that humans had to be separated from the forests. This ‘fortress approach’ was dominant until the 1980s (Vedeld 2002). Protection in developed countries is mainly about protecting what is left in nature, but in developing countries most areas are inhabited by people whose livelihoods are dependant on its resources. By the 1990s a new conservation narrative stressed the importance of local people and their participation (Hutton et al. 2005). But this approach left too little revenue locally and it did not result in a better relationship between local people and authorities (Vedeld 2002). So neither the ‘fortress approach’ nor the ‘participatory approach’ has given the desired effect, witch is a protection of nature and a sustainable livelihood for the poorest.

Appeals to human rights concerns and an agreement to address local communities’ concerns had made a shift towards a more human-centred paradigm (Hulme and Murphree 2001; Naughton-Treves et al. 2005). So in the last three decades conservationists have gone from the ‘fortress approach,’ thinking that local people are the major cause of forest destruction to the notion that there is a major link between rural poor’s livelihood and the forest and that they are not responsible for deforestation (McNeely and Ness 1996; World Bank 2002).

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<sup>1</sup> It is generally accepted that Yellowstone was the first modern protected area, although forest and hunting reserves were found centuries ago (Bishop et al. 1995).

## 1.2 Problem Statement and Justification

“Apparently, in India the rights of people living in and around national parks and sanctuaries are ignored, while the rest of the world moves towards policies that reconcile wildlife conservation with human rights and justice” (Kothari 2004).

The relationship between people and protected area is challenging because many people are dependent of the forest for their livelihood. In developing countries it is often the poorest people without land rights who depend most on forests for their livelihood, and when they lose their rights to use state or communal forests, they are left with little or no compensation.

These are recurring problems all over the world. and they are particularly pronounced in developing countries. Two of the Millennium Development Goals set by the United Nations Development Program (UNDP) (2009) are to “Eradicate extreme poverty and hunger” and “Ensure environmental sustainability”. There is a need to combine the protection and the productive use of nature and if we solely focus on the protection of nature we neglect the plight of the poor people. Protected areas can help reduce poverty if managed right, but can also increase poverty by restricting access (Svarstad 2007). In this aspect it is important and necessary to find out how to protect and conserve nature, not only without harming poor people, but in a way that empowers them and gives them a sustainable livelihood. There is a clear link between conservation and development, and cooperation to find good solutions for both parties are essential. Alienating local communities from their main sources of livelihood leads to extensive forest degradation and conflicts between locals and authority (Hazra 2002).

There is a need for knowledge about both the economic and the ecological aspects of rural development (Holmern et al. 2003) and this study focuses on the impact the conservation has had on the Soligas’ cash economy.

Biligiri Rangaswamy Temple Wildlife Sanctuary (BR Hills) is the home for the semi-nomadic Soliga tribe. In addition to being engaged in subsistence agriculture, a majority of Soliga households gather (NTFP). They gather both for domestic consumption and for sale outside the forest. They sell their produce to government-run cooperative societies called LAMPS (Large-scale Adivasi Multipurpose Societies), and hence avoid middle men (Bawa et al. 2007; Kothari et al. 2007).

Since the Wildlife Protection Act 1972 all hunting and forest fires were banned, but the Soligas was allowed, as a concession, to collect NTFPs for both domestic consumption and for commercial use. Such collection has been occasionally disrupted on “official whim” (Pers.Comm. Raj 2007) and they have been subject to the shifting power constellations of local administrations. In 2004, a national ban was introduced on collecting NTFPs for commercial use, but in BR Hills the use was seen to be crucial to their livelihood and they were allowed to continue (Kothari et al. 2007). In 2006, however, the District Forest Officials decided to revoke this concession and several new conflicts have arisen. The Soligas, already on the margins of existence, have lost between 30 and 60 % of their income (Hegde et al. 1996), forcing them to seek other means of generating income, increasing conflicts between the Soligas and the Forest Department (FD).

### **1.3 Objectives of the Study and Research Questions**

This work aims to explore what impacts the recent ban on NTFP collection for commercial use has had on the Soligas’ livelihood and their livelihood strategies, and to what extent the Soligas depend on NTFP collection. It also investigates their perceptions and attitudes towards forest conservation and Government policies. Ideally the findings will provide useful information to the Government and Non-Government Organisations (NGO) on the livelihood challenges facing the Soligas, how best to protect the forest and at the same time the livelihoods of the Soligas, and how to improve the relationship between the Soligas and the Forest Department.

- 1) To assess present livelihood and estimate household cash income from different activities before and after the ban on NTFP collection for commercial use
  - (i) What were the livelihood adaptations for the Soligas before the ban?
  - (ii) What are the present livelihood adaptations for the Soligas?
  - (iii) What are the key constraints for improved livelihoods?
- 2) To measure the Soligas’ dependence on NTFPs
  - (i) What is the percentage contribution of cash income from NTFP collection to the total cash income before the ban?
  - (ii) Which factors influence the dependence on NTFP collection?

- (iii) What is the distribution pattern of NTFP cash income among different household groups?
- 3) To identify perceptions and attitudes towards conservation
  - (i) What are the Soligas' perceptions on NTFP collection and forest degradation?
  - (ii) What are the Soligas' perceptions of the ban on NTFP collection?
  - (iii) What are the Soligas' perceptions on forest conservation?
  - (iv) What are the Soligas' attitudes towards the Forest Department

## **1.4 Thesis Structure**

This thesis consists of six chapters. Chapter two presents the framework for sustainable livelihoods, the theory on people and parks issues and research done on the area of conservation and development. Chapter three gives a description of the study site, and describes data sampling, collection, and methods used during the field work. In chapter four follows a history of conservation and policies in India, and a literature review. In chapter five I present my results and discuss them according to the objectives, and conclusions will follow in chapter six.

## 2 THEORY

*This chapter presents the theoretical frameworks and common definitions on the themes used in this study.*

### 2.1 Framework for Sustainable Livelihood Analysis

The sustainable rural livelihoods framework was prepared by Scoones (1998) and was further developed by Ellis (2000) for a better understanding of rural livelihoods and the outcomes from strategies chosen. The framework used in this study is based on the UK Department for International Development (DFID 1999) approach (Figure 1). One of the strong features of this framework is that instead of focusing on the poverty line and what poor people don't have, it focuses on assets, that is what people are able to do with what they already have (Adato and Mainzen-Dick 2002). It is dynamic and people-centred. Livelihood analyses using this framework consider processes and interacting components that influence rural livelihoods, these analyses contribute to identifying changes and livelihood strategies by considering the network of assets, trends, shocks, activities, institutional and policy context and outcomes (Ellis 2000; Ellis and Freeman 2004; Scoones 1998).

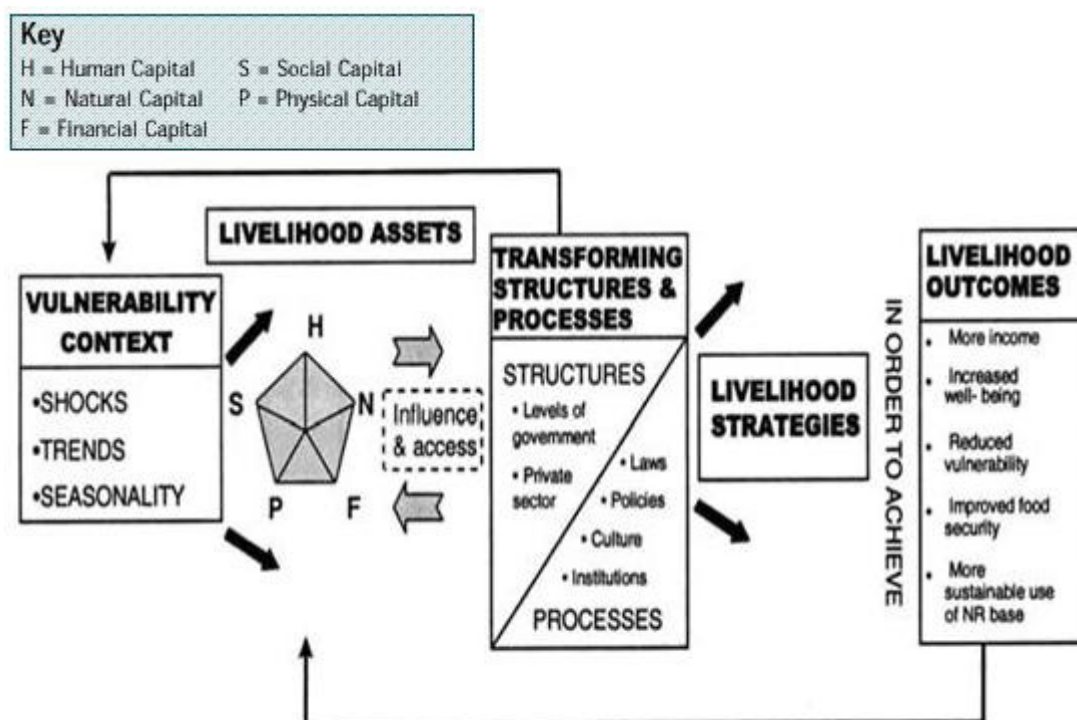


Figure 1. Sustainable livelihoods framework {DFID, 1999}

Assets owned, controlled or claimed in this context form the basis of the framework (Ellis 2000), and these describe the opportunity each household has for resisting shocks and stress. There are different categories identified as assets, but the most common ones are natural capital, human capital, physical capital, financial capital, and social capital (DFID 1999; Ellis 2000; Kamanga et al. 2009; Scoones 1998). Human capital refers to knowledge, skill, available labour and health, which make up the primary assets of the poor. Natural capital consists of natural resources available to the poor. Social capital is based on reciprocity between households and the community. Financial capital is savings, access to loans, livestock or foodstock. Most poor people have no savings or access to loans, but a few have livestock, and this serves as a financial capital that can be sold at any time. Physical capital includes land, buildings, roads, machines, and tools.

## **2.2 Rural Livelihoods**

“A livelihood comprises capabilities, assets (stores, resources, claims and access) and activities required for means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term” (Chambers and Conway 1992).

Livelihood diversification include farm income, off-farm income, and non-farm income and the definition of rural livelihood diversification is defined by Ellis (2000) ‘as the process in which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living’.

## **2.3 Access to Assets**

From the framework above, we see that choice of income activity depends on access to assets. The different households will have access to different assets, and their livelihoods will be influenced by the diversity and amount of access and the balance between assets. Assets vary by processes (decision-making, social norms, caste, and class), policies (non-governmental organisations (NGOs) and different levels of government) and institutions (judicial institutions, organisations, laws, politics, and civil society) (Ellis 2000).

## **2.4 Livelihood Strategies**

Livelihood strategies are the choices people make in pursuit of income, safety, and well-being and can consist of a range of activities (Adato and Mainzen-Dick 2002), which produce the means of household survival. It is a dynamic process which provides livelihood outcomes like income, food security and sustainable use of natural resources; it can also make assets stronger and reduce vulnerability (Adato and Mainzen-Dick 2002). The asset status of households, influenced by social factors and trends or shocks, leads to the adaptation of livelihood strategies (Ellis 2000). A change in assets may advance or hold back other livelihood strategies depending on the policies and institutions at work. Assets interact with policies, institutions and processes and forms the options of livelihood strategies for people. The strategies influence the livelihood outcome which in turn can provide new assets.

In BR Hills, the Soligas have been forced to adopt new coping strategies after the ban on Non-timber forest product (NTFP) collection was implemented in the Sanctuary in 2006. In this study Ellis' framework (2000) is used to describe the Soligas' choices and abilities to reach their goals under such shifting pressures. Assets and capacity for change vary among households, and policies, institutions and processes will also be instrumental in deciding the outcome of these strategies. When households have less potential for substituting their activities, they are more vulnerable to shocks, hence income diversification is crucial to poor people (Ellis 2000).

## **2.5 Diversification**

According to Ellis (2000) diversification of rural households is a process in which the household engage in several different activities and assets, to maintain and improve their livelihoods. Ellis (2000) further states that diversification in income activity is beneficial for poor households, and typical motivations for diversifications are "safety nets, insurance, consumption support, income maximization, and capital accumulations" (Vedeld et al. 2004: 38).

## **2.6 Household Constraints**

Also influencing livelihood strategies are external factors like forest conditions, access to NTFPs, and land tenure and restrictions (Angelsen and Kaimowitz 1999; Ndoye and Kaimowitz 2000; Vedeld et al. 2007).

Stresses and shocks lead to changes in livelihood strategies. In this context, stresses are defined as predictable factors, such as decline in work available, population pressure, declining yields, while shocks are sudden and often unpredictable factors, such as floods, fires, illness and collapse of market (Chambers and Conway 1992). In this study, the shock is represented by the sudden ban of NTFP collection for commercial use. Strategies are employed to reduce vulnerability, and these may consist of migration, diversification in work activities, intensive farming, reducing consumption, accumulation and storage of food, seeking other sources of food, begging and political action (Chambers and Conway 1992).

## **2.7 Rural Households Dependence on Natural Resources**

There are many different estimates on how many people are dependent on NTFPs, but the Government of India (GoI) (2007a) states that more than 80 % of the forest dwellers are dependent on NTFPs for their basic needs and that to 30 % of rural people NTFPs contribute considerably to the income.

The term sustainable development is defined as “The ability to meet the needs of the present without compromising the ability of future generations to meet their own needs” (WCED 1987). The growing demand for NTFPs has improved the Soligas’ economy and turned them towards a more modern way of living. The Ministry of Environment and Forest (GoI 2005a) recognises that people who live in or around protected areas are dependent on its resources for their livelihood. However, the Government's concern is that the increased NTFP extraction is not sustainable (Ninan 2006), and so the ban on NTFPs for commercial use was implemented in protected areas. There is a shift among tribes in India from a subsistence economy, where people spend their time and resources on producing food, shelter and security, towards a cash based economy, where people specialise on the activity that provides the highest income (Belcher et al. 2005).

## **2.8 Attitudes and Perceptions**

The effects conservation have on local people affect their perceptions and attitudes to conservation management. The prevailing theories in ethical conservation perspectives have been that protected areas and local people cannot coexist. This is now shifting towards a more interdisciplinary development/conservation paradigm, and a more dominant school of thought is now that lack of involvement from local people is detrimental to conservation and development alike.

“Policy decisions for state intervention in management of forests have excluded local communities without giving them a stake in conservation and management of forests for meeting their bonafide needs. These causes influence people’s interaction with forests, as well as their access to forests and their valuation of forests” (Nanjundaiah 2008: 281).

Fishbein and Ajzen (1975: 6) describes attitude as: “a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object”. Social norm is defined as an accepted behaviour, based on shared beliefs on behaviour, which then causes prescribed behaviour (Fehr and Gächter 2000).

## **2.9 Participation and Conflicts**

To include participation in conservation as part of development work has become more popular with development agencies (Pimbert and Pretty 1995). Participation can be seen as a means to efficiency or as a goal in itself. The involvement of local people to make them feel involved will make conservation and management effective, but participation can also be a goal in itself towards empowerment and institution building (Pretty 1995). Where there is a lack of distributed benefits to local people, compared to costs of living in or near conservation areas, biodiversity resources will not be secured and local people will not participate (Vedeld 2002). Hence, people's support is important to conservation, but it may also slow down processes and be less controllable, and this creates a dilemma for the conservation authorities (Pimbert and Pretty 1995).

When local people get hostile towards park authorities it can result in several serious outcomes like refusal to help fight forest fires, illegal activities such as timber cutting or even firestarting, and violence against officials (Apte and Kothari 2000: 10).

## 2.10 Poverty and Forest Degradation

Poverty is a relative concept, and there is a distinction between peoples' own perception of well being and the researchers' standardised, internationally accepted, poverty line<sup>2</sup> (Angelsen and Wunder 2003). Coudouel et al. (2002) defines poverty as “Whether households or individuals have enough resources or abilities today to meet their needs”.

Until recently, there has been a trend towards identifying the poor and their increasing numbers as the major cause of forest degradation, reflecting the neo-Malthusian view that a growing population leads to an overuse of natural resources (Dove 2006; Vedeld et al. 2004). It is also recognised that the protection of forest areas has had a positive effect on many areas; the restriction on extraction and exploitation of forest resources has caused conflict in the short term, but restrictions in use might be the reason for the resources available now (McNeely and Ness 1996). Murali et al. (1996) suggest that the conservation authorities in India have neglected the management of NTFPs and that this might have lead to a degradation of the forests.

Now, however, the trend has turned towards recognising that the problem is far more complex than this. The population increase and poor people are no longer solely blamed for degradation of forests (Angelsen and Kaimowitz 1999; Badola 1999; Nanjundaiah 2008; Sethi 2007), and it is recognised that rich people are more likely to exploit the forest (Angelsen and Kaimowitz 1999). This means that reducing poverty will not automatically bring forest degradation to an end. Thus, we need to find the causes of degradation and also learn to what extent poor people contribute to this degradation (Sunderlin et al. 2005; Wunder 2001). Nanjundaiah (2008) claims that failure in market, policy and institutions, along with population pressure and agricultural expansion are the main causes of deforestation in India. Hence, “The non-participation of people in forest conservation and management owing to authoritarian forests and wildlife policies, which have scant respect for community management of forests, is considered to be the most important reason for fast depletion of forests resources” (Nanjundaiah 2008). According to Chambers (1995) poor people are not as short sighted as first thought, in food shortages poor people will eat less in order to protect

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<sup>2</sup> The international poverty line is set at \$1.25 a day.

their livelihood assets, outsiders on the other hand are more likely to be short sighted and exploit resources.

Ostrom (1990) argues that when states found their policies on the basis of metaphors like Hardin's 'Tragedy of the commons'<sup>3</sup>, it leads to insufficient management. People dependent on natural resources have managed these resources sustainably for generations, and problems arose when privatisation and expropriation was implemented by the state to secure the resources (Jewitt 1995). What was previously a sustainably managed 'common resource', became an 'open access resource' because of unclear rights and corruption on the part of forest officers (Berkes 1989; Ostrom 1990).

Where local people benefit from conservation, we also find a more positive attitude towards conservation (Hegde et al. 1996; Sekhar 2003). In the Biligiri Rangaswamy Temple Wildlife Sanctuary (BR Hills) the Soligas are positive to participatory monitoring in their forest, the incentive being their future right to collect NTFPs (Bawa et al. 2007).

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<sup>3</sup> The term 'common resource' is actually a form of private property, so the proper term here is 'open access resources'.

### **3 STUDY AREA AND METHODOLOGY**

*The first part of this chapter describes the study area where the research was conducted and gives a brief description of the State of Karnataka, the BR Hills and the Soliga tribe.*

*The second part describes the data collection, sampling, and methods used in the study.*

#### **3.1 Study Area**

##### **3.1.1 Karnataka**

Karnataka is one of India's southernmost states with a population of almost 53 million and an area of 191,796 square km, 5,83 % of India's total area. Major cities in Karnataka are Bangalore, Mangalore and Mysore, and 34 % of the population is found in urban areas (GoK 2009). The population density is 275 per sq. km, and the proportion of Scheduled Tribes<sup>4</sup> in the state is 6,55 % (GoK 2005).

The deforestation in the state has been traced back to the colonial times, when the British started the exploitation of timber for construction of ships, ports, and railway sleepers (Nanjundaiah 2008). The forests of Yelandur, Chamrajnagar, Nanjangud and Kollegal, in the southern Karnataka, are inhabited by almost 20,000 members of the Soliga tribe, spread out in the BR Hills and MM Hills, (Pai 2008). These, and all other forest-dependent tribal people, have been allowed to collect NTFPs and the produce have been distributed through the LAMP society (GoK 2003b).

The diversity of climate, topography and soils forms the basis of a rich biodiversity in Karnataka (GoK 2003a). The Western Ghats is one of the 25 global priority hotspots for conservation and one of the two on India's subcontinent, the other one being the Himalayas. Ghats means mountains, and there is a chain of mountains along the south-west coast of India, covering an area of 54,000 sq. km (Gokhale 2004), and another chain, the Eastern Ghats, on the eastern part of south India going north. Sixty percent of the Western Ghats are located in Karnataka, and 18,38 % of the state is covered by forest (GoK 2009), from the evergreen forests of the Western Ghats to the scrub jungle of the plains. The state also supports 20 % of

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<sup>4</sup> The term Scheduled Tribes is an administrative term used to administrate privileges, protection and benefits. The lists of scheduled tribes were notified for the first time under the Constitution (Scheduled Tribes) Order, (Indian District Database 2000) the Constitution prohibits discrimination, provides the right to equality, to freedom of religion and to culture and religion.

India's elephant population and 20 % of India's tiger population (GoK 2009). Karnataka has five National Parks and 21 Sanctuaries, 15 % of the forest area is protected area. This amounts to nearly 3,5 % of the geographical area of Karnataka being protected<sup>5</sup> (Reddy 2007).

Around 30 % of the forests in the state are degraded<sup>6</sup> (GoK 2003b), with problems like mining and quarrying, livestock grazing, fuelwood collection, fragmentation of habitats, unsustainable management practices, illegal activities such as poaching, and logging. Population growth is also part of the forest degradation challenge. The Government of Karnataka (GoK) (2003c) also affirms that around 40 % of the state has soil degradation problems.

According to the Department of Ecology and Environment in the Government of Karnataka (2003b), there has been a paradigm shift from the 'traditional approach'<sup>7</sup> to a more participatory approach. Through the Joint Forest Planning and Management (JFPM) Policy of 1993, the state has tried to involve the people in protection, development and management, and in the last few years the efforts have been modified to give better economic incentives to local people.

### **3.1.2 BR Hills**

Biligiri Rangaswamy Temple Wildlife Sanctuary (BR Hills) is situated in the Chamrajnagar district in the southern part of Karnataka (Figure 2), 90 km from Mysore and 180 km from Bangalore<sup>8</sup> (Kothari et al. 2007). The district, which is one of 27 in the state, is known for its forest resources and has a high population of forest-dwellers. The proportion of Scheduled Tribes in this district is 11 % (GoK 2005) and about 12 500 Soligas (2403 families) in 57 forest villages, called Podus, are dwelling inside the Sanctuary (Kothari et al. 2007; Madegowda 2009; Setty et al. 2008).

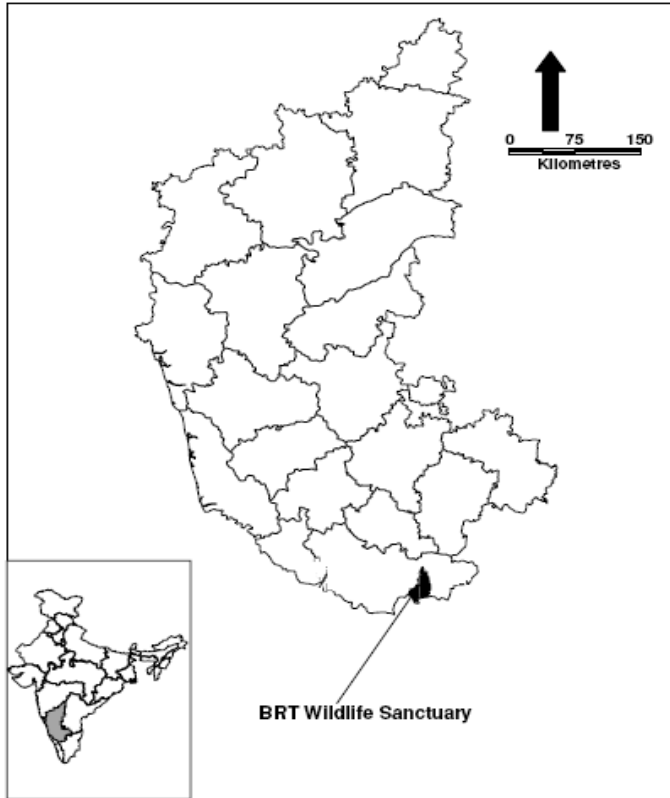
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<sup>5</sup> This is less than the national average on protected areas, which is 5,3 % of the geographical area protected (World Bank 2008). Still, Reddy (2007) claimed that conservation in Karnataka was better than a lot of other states, because people here were more aware and positive towards conservation.

<sup>6</sup> Degradation should not be confused with deforestation. Degradation of forest means a reduction in optimum productivity while deforestation is often an irreversible process (GoK 2003b).

<sup>7</sup> Meaning 'fortress approach' or 'top-down'.

<sup>8</sup> The Sanctuary is located between 11°43' and 12°08' North latitude and 77°01' and 77°15' East longitude (Kothari et al. 2007).



**Figure 2. Map over study site in South India. Source: (Shaanker et al. 2004).**

The Sanctuary was created in 1972, covering an area of 322.4 km<sup>2</sup>, and expanded in 1987 to its current size of 540 km<sup>2</sup> (Kothari et al. 2007), with elevations ranging from 600 to 1800 metres above sea level. The ridges of the hills run in a north-south direction and the Sanctuary lies between the Eastern and the Western Ghats, providing an important corridor for wildlife, connecting the largest populations of elephants and tigers in southern India (Kothari et al. 2007).

Being situated in the junction between the Western and Eastern Ghats, the Sanctuary gets rainfall from both the monsoons coming from west and north lasting from June to November (Setty et al. 2008). The shallow and gravelly soil covering the hills is rich in iron and aluminium and is suitable for production of coffee, tea and coconut (Murali et al. 1996)

The name Biligiri, meaning white, derives either from the white rock cliff that the temple of Lord Rangaswamy lies on, or from the mist and clouds that cover the hills great parts of the year (Kothari et al. 2007; Morab 1977).

### **3.1.2.1 Biodiversity**

The Sanctuary contains a total of 38 mammal species, 278 bird species, 22 reptile species and 116 butterfly species, and there are several endemic and endangered species as well (Kalpavriksh, 2007). The diversity of fauna is supported by a large diversity of vegetation types like scrub, woodland savannah, dry and moist deciduous forest, evergreen forest, shoal forest, and high altitude grasslands (ATREE 2005; Kothari et al. 2007). There are also 399 species flowering plants, and more than half of these are used as medicinal plants (Kothari et al. 2007).

Major threats to conservation is encroachments, quarrying, constructions, industrialisation, coffee plantations and habitat fragmentation (Kothari et al. 2007; Reddy 2007).

### **3.1.2.2 Management**

The forest resources in BR Hills are owned by the state (Setty et al. 2008) and are managed by the Forest Department (FD) of Karnataka. The Department is situated in Bangalore where the administrative head of the Department is Principal Chief Conservator of Forests (GoK 2004). The Principal Chief Conservator of Forests (Wild life) is the Chief Wildlife Warden of the state, and is responsible for the management of National Parks and Sanctuaries and all the wildlife matters of the state (GoK 2004).

### **3.1.3 The Soligas**

“In the deep forests of Biligiri Rangan where the Western and Eastern Ghats forests meet [...], the Soligas have lived for ages amidst deep woods, elephants, tigers, leopards and other wild animals” (Bose 2006: 564).

As Bose states in the above quotation, the BR Hills have been home to the semi-nomadic Soliga tribe<sup>9</sup> for thousands of years. The Soligas, which literally means “people of the bamboo” (Karuna Trust 2006), have been harvesting forest products, and been engaged in hunting and shifting cultivation (Poojar 2005). They speak Soliganudi, an ancient form of Kannada, the official language of the Indian state of Karnataka, influenced by Tamil. The Soligas have strong kinship structures and a highly spiritual culture, and they have sacred sites around the forest where they worship gods and goddesses (Madegowda 2009).

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<sup>9</sup> The Soligas are recognised as a Scheduled Tribe.

### **3.1.3.1 Local Knowledge**

According to Khotari et al. (2007) researchers have recorded that the Soligas have extensive knowledge about the forest and its content, like tree species, grasses, creepers, fibers, birds, snakes, insects and other animals. They have their own medicinal system and their concern for nature and sustainable way of living has sprung from their long relationship and coexistence with the forest. The forest is the school and children learn about harvesting and cultivation; by the age of 12 a Soliga child will identify about 269 different plant species (Poojar 2005). The Soligas have traditional songs which contains details on the forest's flora and fauna, and are used to impart indigenous knowledge to new generations (Madegowda 2009).

### **3.1.3.2 Indigenous People**

The Soligas used to be engaged in shifting cultivation for subsistence in the interior forest, cultivating land for about three to four years and then moving somewhere new, never returning to previously cultivated land, hence shifting cultivation (Morab 1977). NTFPs were collected for domestic use and the Soligas were living in harmony with nature, clearing patches and removing weeds and pests by use of small, controlled fires (Bose 2006; Karuna Trust 2006; Morab 1977; Setty et al. 2008). Their Podus would easily be overlooked by non-tribes because their huts would merge with the surroundings. A Soliga settlement was known as a 'Podu' and given a name when established, and they would vary in size according to the number of households when the community was formed. To avoid dangerous animals they would not build their podus near bodies of water, where animals came to drink, and they would not wash themselves too often, so that their smell would keep animals aware of their presence in the forest (Morab 1977).

### **3.1.3.3 Influence from Non-tribal People**

As early as the 1960s, some of the Soliga household were given 1-2 hectares (ha) of land if they voluntarily resettled from the interior forest to a permanent settlement constructed by the FD (Hegde et al. 1996; Morab 1977). This required some of the Soligas to adopt to modern economics, and instead of cultivating and collecting NTFPs for domestic use only, they would now start to collect NTFPs for commercial use as well.

In 1972, the Wildlife Protection Act 1972 was implemented, and shifting cultivation, hunting and seasonal fires were prohibited (Hegde et al. 1996). Because of the ban on shifting cultivation, all the podus now became permanent settlements. They were still allowed to collect Non-Timber Forest Products (NTFPs) for domestic and commercial use, and by selling their produce to the government-run cooperative society called Large-scale Adivasi Multipurpose Societies (LAMPS)<sup>10</sup> (Bawa et al. 2007), they have been known to generate up to 60 % of their income from NTFP collection (Hegde et al. 1996; Kothari 2007).

In 1995 Ashoka Trust for Research in Ecology and the Environment (ATREE) and Vivekananda Girijan Kalyana Kendra (VGKK), two local NGOs, collaborated to start an enterprise, participatory resource monitoring, to increase the Soligas' income from NTFP collection, and to discuss the importance of sustainable harvesting and regeneration levels of certain products (Setty et al. 2008).

The Soliga households who own or rent land usually grow several types of crops for subsistence use, and 40 % of them also grow coffee for commercial purposes (Bawa et al. 2007).

## **3.2 Methodology**

### **3.2.1 Sampling Process**

The data collection was done in Biligiri Rangaswamy Temple Wildlife Sanctuary in Chamara Nagar district located in Southern Karnataka from October to December 2007. The Sanctuary is inhabited by Soligas, a Scheduled Tribe<sup>11</sup>, and there are about 6000 people in 2600 households distributed in around 57 villages in the Sanctuary. They were until the ban on NTFPs in 2006 collecting NTFPs for domestic and commercial use, and this study aims to examine the effect the ban had on Soligas' overall livelihood options and outcomes.

Nine villages were chosen and a total of 124 households were interviewed, and this represents approximately 5 % of all the households in the study area. The number of households per village in my samples varied from 1 to 26. Villages and households were chosen by

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<sup>10</sup> "LAMPS are cooperatives societies consisting of tribals, set up and supervised by the state government to act as intermediaries between extractors and the contractors who take away the forest produce to urban centers for marketing or processing" (Shankar et al. 1996).

<sup>11</sup> Scheduled Tribes are described in chapter four.

convenience sample<sup>12</sup>, and were either adjacent to the main road or a few kilometres off the main road into the interior forest. This means that it is not a fully representative sample since the number of respondents is not enough to make general assumptions about the Soligas' livelihoods, but it does give grounds for further study.

### **3.2.2 Data Collection**

The primary data collection includes both quantitative and qualitative research methods and use of the sustainable rural livelihoods framework. The quantitative data were collected using a household questionnaire (Appendix I) that assembled information on cash income, activities and assets. The qualitative data on coping strategies, migration, forest protection, perception to policies on conservation and relationship to the forest authorities were collected through the questionnaire, through observation and by using key informants/experts working in the area.

Information from households were collected from adult members of the family, preferably the head of the household, but where he/she was absent the spouse was interviewed. An interpreter assisted the household interviews, since very few of the Soligas speak English. Before each interview the interviewer and interpreter would introduce themselves and explain the background of the interview. Each interview lasted between 15 and 45 minutes. Often spouses, kids and neighbours would attend, listen and interfere. The interview consisted of a semi-structured questionnaire, and the questionnaire contained open-ended questions where there were no alternative answers to choose between. This made it possible to add further questions in response to answers. This type of interview was also used on the Chief Conservator of Forest, in the Forest Department's headquarters in Bangalore. Conversations with local experts and observation was also used to assess the major economic activities, available resources, infrastructure, settlement patterns, and attitudes of local people and park authorities.

In addition to interviews a review is included of official statistics, census material, and other published materials found through the Library of the University of Life Sciences, supervisors and professionals in the study area, and through government and NGO web sites.

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<sup>12</sup> A convenience sample is a sample collected on the basis of its availability to the researcher, a form of non-probability sample (Bryman 2004).

### 3.2.3 Data Analyses

The data was analysed using JMP7 and figures presented using Microsoft Excel 2003, to analyse both qualitative and quantitative data. Data from the household interviews were analysed by running simple regressions, multiple regressions, correlations, binary logistic regression and One-way ANOVA. Running a multiple regression on socio-economic variables would not give a complete picture of the situation, due to lack of variables. The Gini coefficient was determined to show cash income inequality before and after the ban, and can be calculated as in Figure 3, where  $n$  is the sample size,  $\mu$  is sample average, and  $I$  is total annual cash income per head. For this calculation STATA SE 10 was used.

$$G_I = \frac{\sum_{i=1}^n \sum_{j=1}^n |I_i - I_j|}{2n^2 \mu}$$

Figure 3. Gini-coefficients. (Modified from Vedeld et al. 2004).

The Sustainable Livelihood Approach by DFID (1999) was used to analyse the Soligas' assets and the strategies undertaken after the ban. The total household cash income in a year was measured through the economic activities conducted by the Soligas before and after the ban.

The measurement of subsistence income was not part of this study due to time constraints. The uncertainty of estimating and valuing collected products for subsistence use of the past would weaken the accuracy. Hence the focus on cash income.

This study classifies cash income activities using the following categories: environmental cash income, farm cash income, non-farm cash income and off-farm cash income.

Environmental cash income in this study are cash income from NTFPs collected for commercial use before and after the ban. Farm cash income is derived from agriculture and livestock activities. Off-farm cash incomes are all income-generating activities performed by a member of the household outside own land. Non-farm cash income is migration to plantations or farms outside the BR Hills and old age pension from the government.

### **3.2.4 Household Factors**

Internal factors in a household are controlled by the household and are represented by the access to assets; physical, human, financial and social capital. Age, gender and education is not accounted for in this study.

Land is an important physical capital for rural people. Access to land influences the ability to generate income from farming and makes households less dependent on other activities. Human capital is knowledge and skills, and it influences the ability to carry out different income activities such as labour. Households are represented by the number of members in a household sharing its resources, and the number of working members in a household contributing in generating income for the household. Financial capital is defined as assets such as livestock owned by the household. Livestock can be sold and generate cash to meet financial needs, and hence gives a more stable livelihood.

External factors in a household are important determinants of forest dependence (Vedeld et al. 2004). These include access to a good market, distance to market, legal frameworks, tenure rights, and local social institutions and NGOs.

### **3.2.5 Variables**

Total household cash income was calculated through the sum of annual cash income from NTFP collection, agricultural activity, off- and non-farm activity. Each household would estimate their annual cash income from each of these activities.

Cash income from NTFP collection was calculated through the sum of all products collected from the forest and sold to the LAMPS. After the ban the cash income from the collection of firewood was added to the “cash income from NTFP” column.

Cash income from agriculture included cash crops, livestock and milk sold by a household during a year. Common cash crops were coffee and citrus fruits, and livestock were cows, goats or fowl.

Off-farm cash income was calculated through the sum of cash income a household received annually from casual labour, fixed employment, and self employment. Non-farm activity only consisted of old age pension from the State.

### **3.2.6 Validity and Reliability**

The validity is the strength of the conclusion, i.e. to what extent the research is accurately measuring what it is supposed to. The reliability is the consistency of the measurements, i.e. the repeatability of the research. This is estimated by testing and retesting, and by internal consistency. Examples of validity problems in this study might include neglecting relevant information, skewed interpretations of the answers, misunderstanding the interpreter or the interpreter misunderstanding the question, or the interpreter being biased. Examples of reliability problems in this study might include respondents giving inaccurate information because they wanted to appear poorer than they were in order to get advantages, or richer because they were ashamed of their situation, or because they would lack information on annual cash income.

### **3.2.7 Representativity**

A total of 124 households were interviewed in nine settlements with the population of around 230 families. In the Sanctuary there are 59 settlements and approximately 2403 families. The nine settlements were chosen to represent the Soliga tribe, and settlements were chosen with difference in proximity to the main road and the Temple. Five of the settlements were situated close to the Temple and seven close to the main road. In each settlement every household available was interviewed to ensure that different wealth ranges and activities were represented. Limitations include households' unwillingness to participate, unavailability of households or time constraints on our behalf. However, we believe this study can be generalised to include all the settlements within the Sanctuary.

### **3.2.8 Limitations and Biases**

Due to time constraints the sample size could not be increased. Most of our sample villages were close to the field station because to reach villages farther away we were dependent on transportation. In order to visit the distant villages we would have to adjust our day according to the availability of the public transport or the field station vehicles. Some villages were far

from the main road as well and we would need permission to use the field station vehicles there or we would go by foot. Where we needed the field station vehicles we would cooperate with workers from the field station and choose our villages according to their work schedule and they would give us a lift.

My interpreter was only available during the day and hence not all households in a village would be available for interview since, in some households, all would be away working. Households where all members had migrated seasonally could not be accounted for in this study.

Before each interview we would explain the scope of the study and who I was and where I came from. The respondents were told that they would not benefit from the interviews, still most were happy to help me do my research. Respondents who were employed by the local Forest Department would not agree to be interviewed for the reason that they were afraid to lose their jobs. Others would not admit to collecting NTFPs after the ban, or would give inaccurate information on livestock, but my interpreter was well known and trusted by the Soligas and so most felt safe to tell the truth about their cash income activities.

I was aware that my topic for this study was sensitive in this area and the local officers from the Forest Department were sceptical to me. They were also not allowed to give out interviews and so I had to interview the Chief Conservator of Forest, in the Forest Department's headquarters in Bangalore.

However, none of these problems are likely to influence the findings significantly.

## 4 BACKGROUND AND LITERATURE REVIEW

*This chapter looks at the policy on, and history of protected areas in India, including a short history of tribal people. It also provides a literature review on conflicts between local people and protected areas.*

### 4.1 Introduction

By 2007 4,8 % of India's geographical area, 16 million hectares, was protected in 659 Protected Areas. This includes 100 National Parks, 514 Sanctuaries, 41 Conservation Reserves and 4 Community Reserves (GoI 2007a). India has substantial diversity in ecosystems; 8 % of the world's animal and plant species (UNDP-India 2008) and two of the internationally recognized global biodiversity hotspots are found in India (Conservation International 2007).

India is one of the largest democracies in the world with 650 million voters. In addition, India also has a bad reputation for corruption (OneWorld 2008). This makes politics and law enforcement difficult to follow, hence protection of nature and development work is difficult in such an environment.

Some of the Government's global objectives include reversing the loss of forest cover, improving the livelihoods of forest-dependent people, increasing the area of protected forests, and increasing development assistance for sustainable forest management (GoI 2007a).

On the national level, the Prime Minister of India is the head of the National Board for Wildlife, managing wildlife and biodiversity conservation issues. The Indian forest administration consists of a staff of more than 90,000 people (Blaikie and Springate-Baginski 2007).

Because 98,4 % of Indian forests is under public ownership (FAO 2006), it gives the Forest Department the authority and the possibility to manage almost all forests in India. The Indian forest administration can be shaped by individuals at all levels (Blaikie and Springate-Baginski 2007) hence the execution of policies may vary between individuals in different positions. Without a proper forest management policy, forests, with its wildlife and forest dwellers, are at risk. With the amount of people living in protected areas estimated to between

3 and 4 million people (Bhattacharya et al. 2003; GoI 2005a; Kothari 2004), the need for a good forest policy and a better relationship between FD and forest dependent people is urgent. On several occasions throughout history of protection indigenous people and/or villagers have fought the establishment by civil disobedience, armed fights and by starting fires in the forests as a reaction (Gadgil and Guha 1992; Kothari et al. 2007).

## **4.2 History of Protection / Policies in India**

### **4.2.1 Colonisation**

Jewitt (1995) reveals a ‘golden age’ prior to the British colonisation in forest management, where it appears that people benefited from unrestricted use and access to forest land. Anyone could get what they needed from the forests without any hindrance in this pre-colonial time (Guha 1983; Hazra 2002).

Between 1806, when Captain Watson from the East India Company was appointed the first conservator of forests, and 1823, when the conservatorship was brought to an end due to conflicts, all land except private land was under the control of the conservator (Agrawal 2005b). As soon as the British saw the commercial value of the forests, recognised the fact that forest resources in India was not inexhaustible (Gadgil and Guha 1992), and acknowledged that there were competing uses (Agrawal 2005b), control and land rights became important, and they introduced state property rights in the 1860s (Hazra 2002). In 1864 the Imperial Forest Department was established and in 1865 the first Indian Forest Act was passed, based on ‘scientific forestry’ (Gadgil and Guha 1992) where the economic value and statistical measurement and use of the existing forest was in focus. With this act the colonial government appropriated forest land for commercial use, the forest dependent people were restricted in access and use, and their rights were degraded to ‘privileges’ (Jewitt 1995; Pathak and Kothari 1998). A revised Forest Act came in 1927 with only minor changes to the previous Act 1878; the main focus was still on timber, and there was no mention of conservation issues (Hazra 2002).

## 4.2.2 Independence

After India's independence in 1947, the forests continued to be subject to state property rights and the Forest Department continued to exploit the forest for commercial use (Gupta 2002). There was increased pressure on the forests, with severe implications for peoples' livelihoods. This led to local people being alienated and detached from the forest (Jewitt 1995). The main objective of the Forest Policy was now 'national development', which in this case meant timber extraction, so the state forest was expanded by nationalizing them through notifications (Blaikie and Springate-Baginski 2007). The rights of the rural communities had gone from 'rights' in the policy of 1894 to 'rights and privileges' in the Indian Forest Act 1927 to 'rights and concessions' in National Forest Policy 1952 (Hazra 2002). Now there was even less focus on forest dependent people and more on 'national needs' (Blaikie and Springate-Baginski 2007). Because of local peoples' disassociation from the forest, and also severe corruption and illegal felling of trees by forest officers, the villagers also started to exploit the forest.

Since the 1960s the forest department has been criticised for anti-tribal policies, corruption and exploitation, for its top-down approach and for not preventing degradation of the forest (Gupta 2002). In combination with the growing environmental awareness in the 1970s, this led to the Wildlife Protection Act 1972. The Act led to a prohibition against hunting, harvesting and picking endangered animal and plant species (Vedeld et al. 2001), and in protected areas logging, hunting, and shifting cultivation became illegal (ATREE 2007). Nanjundaiah (2008: 12) asserts that the Wildlife Protection Act 1972 has, in addition to establishing National Parks and sanctuaries, "produced more insidious effects rather than conservation of biodiversity". Even though the main critique of the Act has been the exclusion and alienation of local people, Pathak and Kothari (1998) claims that this act was important for conservation, in that a number of forests and wildlife habitats would have been deforested if it had not been for this act. They even suspect that it has helped some tribal communities by preventing projects that could have destroyed forests and hence the livelihoods of the local people. Other wildlife conservation projects included Project Tiger in 1973, Project Elephant in 1992, and the Biological Diversity Act 2002 (GoI 2007a). In the Indian Forest Act 1980, more restrictions were imposed on the forest users and stricter punishment for forest offences were introduced (Jewitt 1995).

Madhusudan (2005) argues that the Governments policies have failed to protect and conserve nature, and because they have disregarded the rights of local people, they have caused a resentment among people, leading them to illegal activities and firestarting.

In the 1980s and with the introduction of remote sensing, data revealed a rapid deforestation, and the forest department realised that afforestation could not be done satisfactorily without help from local people (Gupta 2002). This, combined with pressure from tribal commissioners, anthropologists, and national and international NGOs, led to the National Forest Policy of 1988 where the Government finally recognises rural and tribal people by protecting their customary rights and concessions to basic needs like fuel wood, fodder and timber (GoK 2003b; Gupta 2002; Hazra 2002). The fact that this was a policy and not an act, meant that it was nothing more than a “Statement of intent unaccompanied by legislative changes [...] there have been repeated attempts to bring back commercial focus” (Blaikie and Springate-Baginski 2007: 38).

### **4.2.3 Joint Forest Management**

The new National Forest Policy of 1988 and the Government program for Joint Forest Management (JFM) in the 1990s opened the way for some new thinking where local people were heard and taken into account in management of forests (Blaikie and Springate-Baginski 2007; Gupta 2002; Mahapatra et al. 2005). According to Palit (1996) forest officials realised that both nature and rural people were suffering from the present policies and the participatory management approach was growing world-wide. Thus, JFM was implemented not only as an effort to combine the development and conservation, but also because of the failure of the National Forest Policy.

But good intentions aside, the results of JFM have been lacking. The JFM has been subjected to widespread criticism; Factors like the top-down approach, unequal benefit-sharing and the imbalance of power between the FD and local people have been recognised (Conroy et al. 2000; Hazra 2002; Rishi 2007). Also, the many years of restrictions, punishment from the forest officials, and the alienation from the forest have made it hard for the local communities to see themselves as equal partners (Sarin 1996).

#### **4.2.4 Ban on NTFPs**

In February 2004 an official memorandum was issued, banning collection of NTFP for commercial use, but there was no implementation of the ban in BR Hills until April 2006 (Setty et al. 2008). This was probably due to an ongoing correspondence between the Forest Department of Karnataka and the Government of India, the FD argued that the collection for commercial use by many tribes was considered bona fide use, another reason for the delay might have been that local officers were in charge of implementation (Reddy 2007). The Tiger Task Force report (GoI 2005a) understood that even though the purpose of the ban was to increase the protection on already protected areas, the major consequence so far has been an escalation of the conflicts between local people and the park authorities.

In the Scheduled Tribes and Other Traditional Forest Dwellers (the Recognition of Forest Rights) Act 2006 (GoI 2007b), the forest dwellers will be able to claim; “titles to the lands they cultivate or live on, the right to collect NTFP for both domestic consumption and sale, the right to conserve and manage forest areas that they have been traditionally managing, and the right to access areas of cultural importance, and protect traditional knowledge” (Kothari et al. 2007: 23). At the same time this will include the responsibilities of the forest dwellers to manage the forest in a sustainable manner. But both the conservation community and the Government’s conservation agencies are worried that this bill will inflict more damage to the forests, create conflicts among tribal people claiming their rights, and that wildlife, already on the margins, will be the losers (Madhusudan 2005).

The Ministry of Environment and Forests (GoI 2007a) states that “the traditional lifestyles of tribes and their recorded rights have been respected and embedded in the forest management practices as well as in subsequent policies”, and thus they affirm that the Scheduled Tribes and Other Traditional Forest Dwellers (the Recognition of Forest Rights) Act 2006 will empower the tribes and forest dwellers and give them right to land.

### 4.3 Tribes in India

“Tens of millions of indigenous and tribal people have resided within tropical forests for hundreds, and in some instances, thousands of years” (Lynch 1992: 1).

From pre-colonial times and even today Adivasis<sup>13</sup> are regarded as “lower” than the untouchables<sup>14</sup>, and as uncivilised sub-humans by upper-caste Hindus (Bijoy 2003). There are about 90 million people in the Scheduled list of Tribes under the Indian constitution, making up 8.08 percent of the country’s population, most of whom are poor and live in rural areas. Almost 50 % of Scheduled Tribes in India live below the poverty line and most of these are forest-dependent (GoI 2007b; GoI 2008).

Tribal people all over India were either hunter-gatherers or shifting cultivators, but this changed dramatically after colonialism where the British made hunting illegal and viewed shifting cultivation as primitive and destructive, probably because it competed with timber production for control over the forest (Gadgil and Guha 1992). Even after independence the Indian government has revealed its desire to bring shifting cultivation to an end (Gadgil and Guha 1992).

According to Bijoy 71 % of India’s total forest cover includes Adivasi areas and of these 23 % are Wildlife Sanctuaries and National Parks (Bijoy 2003). Around 70 million tribal people and 200 million non-tribal villagers depend on the forest for their subsistence needs (Bhattacharya and Hayat 2004; GoI 2007a; RCDC 2007), and about 3 million people reside in protected areas in India (Bhattacharya et al. 2003). For indigenous forest-dwelling communities, their dependence on nature is not just an asset but a representation of their freedom and their coexistence with nature (George 2004). “Adivasis belong to their territories, which are the essence of their existence; the abode of the spirits and their dead and the source of their science, technology, way of life, their religion and culture“ (Bijoy 2003).

When the concept of private property was introduced by the British in 1793, this gave feudal lords control over Adivasi territories. The Forest Act 1864 and the Forest Act 1927 left the

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<sup>13</sup> Adivasis are the indigenous people of India and literally means indigenous people or original inhabitants, ‘adi’ = first, ‘vasi’ = people.

<sup>14</sup> Untouchables (Dalits) are people outside of the caste system, or of the lower section of the Shudras (the lowest of the four castes) (Wikipedia 2009).

Adivasis with no rights, only privileges, and in the Forest Policy of 1952, the Wildlife Protection Act 1972 and the Forest Conservation Act 1980 even the privileges were reduced. Roy (1999) found that the number of people displaced by dam projects was calculated to about fifty million, and that of these 60 % were Scheduled Castes and Tribes.

#### **4.4 NTFP**

Non-timber forest products (NTFPs) are literally all products other than timber produced in the forest. NTFPs can include nuts, fruits, medicinal plants, leaves, vegetables, roots, fish and game, grasses, bamboo, bark and in some cases even firewood. There has been an increasing focus on NTFP collection by poor people to increase their income, and this has been particularly important for forest dwellers in protected areas after the Wildlife (Protection) Act 1972 banned shifting cultivation, hunting and forest fires.

There are more than 50 million tribal people dependent on NTFP in India, but people living in or near the forest are not the only ones benefiting from NTFP collection, every year the state earns about INR<sup>15</sup> 2000 million from NTFP trade (RCDC 2007).

#### **4.5 Conflicts Between Local People and Protected Areas**

“As long as the conflict situation continues between the Forest Department and the villagers, one cannot hope to preserve India’s forests” (Hazra 2002: 3).

Protected areas have been established worldwide to preserve forests and to separate humans from other species (Adams and Hulme 2001). Barve *et al.* (2005) states that more than 99 % of protected areas around the world are subject to severe threats like poaching, encroachment and NTFP collection, to mention but a few. Conflicts between local people and civil society over land use rights are common world wide, particularly over forest resources. Over the last century conflicts have become more intense due to several factors, such as population growth, the realization that resources are not infinite, and not least because of colonization and economic growth (Blaikie and Springate-Baginski 2007). There is, however, a growing willingness world wide to see development and conservation as one (Bawa *et al.* 2007; Hegde *et al.* 1996; Lynch 1992; Nanjundaiah 2008; Poojar 2005).

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<sup>15</sup> Indian Rupees

Three million people live inside protected areas in India (Bhattacharya et al. 2003), most of whom depend largely on natural resources for their livelihoods (Vedeld et al. 2001). When local peoples' interests and human rights are not violated, there need not be conflicts between development and conservation (IUCN 2000), but when stakeholders like local people are left out of the management processes, conflicts arise (Barve et al. 2005; Hazra 2002; Pathak and Kothari 1998; RCDC 2007; Shankar et al. 1998; Tewari and Campbell 1996). Restriction on resources, and failure to provide alternative income, generates a strong negative feeling towards management. Often conservation processes which embrace the exclusion of people backfire on conservation (Kothari et al. 2007), and external threats like game hunters and commercial agencies get easier access when local people are relocated and not able or willing to control the area (Kabra 2006).

According to Kabra (2006), there are not enough studies done on the impact of local people on protected areas in India, and there is little pressure on the state to prove that local people is actually a threat to the conservation. There is, however, a positive trend in conservation and development in India to find a successful approach to sustaining both (Agrawal 2005a; Jewitt 1995; Pandey 2008; Sekhar 2003).

Over the past few decades, there has been an increasing focus on people living in and around protected areas and the community-based approach. Benefit-sharing between local people in and around protected areas is more common now, resulting in a win-win situation between conservation interests and poverty reduction (Kabra 2006; Lewis 1996; Svarstad 2007; Xu et al. 2006).

Many now feel that the involvement of local people who live inside or nearby a protected area is essential for the management to work effectively (Agrawal and Ostrom 2006; Hayes and Ostrom 2005; IUCN 2000; McNeely and Ness 1996; Nanjundaiah 2008). Governments and organisations realise that they are dependent on local people to manage protected areas adequately and the importance of combining development and conservation (GoI 2005a; McNeely and Ness 1996; Naughton-Treves et al. 2005; WCED 1987). Kothari et al. (2007: 26) states that “participatory and collaborative protected area (PA) management is now the internationally accepted norm, and India is committed to moving towards it under its obligations to the Convention on Biological Diversity.”

Millions of people in India depend on forest products for their subsistence livelihood (Belcher et al. 2005; Murali et al. 1996), and the poorest forest dwellers are highly dependent on NTFP collection both for commercial and domestic use (Kanti Das 2005; Mahapatra et al. 2005; Morab 1977; Sekar et al. 1996; Shaanker et al. 2004; Shanker et al. 2005; Tewari and Campbell 1996; Vedeld et al. 2004). Studies have shown that people with lower incomes are more dependent on forest income than those with higher incomes, and that people with high incomes were less diversified, meaning they were more specialised (Fisher 2004; Vedeld et al. 2007).

The Regional Centre for Development Cooperation (RCDC) (2007) predicts that the forest has a great potential to sustain the livelihoods of forest dwellers in India. This might be true, as NTFPs have been regarded as sustainable and to have less impact on biodiversity as long as the intensity on the harvest is low, but with increased population, better standards of living, higher demands for products and decreasing forest areas, the impact on the ecology and biodiversity increases (Belcher et al. 2005).

In an interview in the Forest Departments Head Quarters in Bangalore, the Chief Conservator of Forest (Wildlife), Reddy (2007) said that the state government of Karnataka was against the ban of NTFP, but the decision was taken on a national level as an expansion to the Wildlife Protection Act 1972.

Barve et al. (2005) studied the threats to the Sanctuary in BR Hills, and they suggested that forest dwellers move and settle outside the sanctuary and reduce their dependence on the forest, so as to decrease the settlement-related threats.

A number of studies have been carried out in the BR Hills on the extraction of NTFPs and its effect on the forest. Murali et al. (1996) points out that timber extraction may degrade the forest, but timber extraction was banned in protected areas in 1972, and NTFP collection is the only activity. In BR Hills, ATREE<sup>16</sup> (2005), an NGO with a field station in the Sanctuary, has been working with the local tribe to educate them in sustainable NTFP harvesting, diversifying their livelihoods and modifying their agricultural practices to increase productivity (Bawa et al. 2007). It is commonly considered that NTFP production is better for

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<sup>16</sup> Ashoka Trust for Research in Ecology and the Environment.

the conservation than timber or agriculture, but that this mainly depends on the intensity of extraction (Belcher et al. 2005).

Bawa et al. (2007) found no significant changes in the intensively harvested NTFP species they studied in BR Hills and suggests that there might be other factors to the change in biodiversity in the Sanctuary. Murali et al. (1996) points out that the forest has not fully recovered since the commercial logging stopped in the mid 1980s, and even though the poor regeneration for some of the NTFP species in the Sanctuary may be due to anthropogenic pressure, similar results are found all over India. In a study by Ganeshiah *et al.* (1998) it was shown that some species with an abiotic dispersal was actually favoured by anthropogenic disturbance, and if people were evicted from the forest it could result in a negative effect on biodiversity.

## 5 RESULTS AND DISCUSSION

*Results are presented and discussed according to the three main objectives presented. The first section provides information about the livelihood adaptations before and after the ban on NTFP collection for commercial use. The second section assesses the environmental dependency of the Soligas before the ban, and cash income activities among different socio-economic groups. The third section identifies the Soligas' perceptions and attitudes towards conservation.*

### 5.1 Livelihood Adaptations

The first part in this section describes household assets and cash income activities before the ban. The second part describes assets and cash income activities after the ban. The third part identifies key constraint for improved livelihoods after the ban.

Assets are tools that influences the livelihood strategies available for the Soligas in order to improve their livelihoods. Outcomes reflect the effects the assets and strategies have on livelihoods. Livelihood strategies and the Soligas' ability to adapt to changes and shocks are influenced by internal factors. Internal factors are described by Ellis (2000) as livelihood assets, which consist of physical, human, social, natural, and financial capital. The degree of access to these assets affects the Soligas' choices of livelihood activities and their ability to adapt and provide a livelihood.

Diversification can be defined as the cash income-generating activities employed by the Soligas in order to maintain a sustainable livelihood. Distribution is defined in this work as the percentage contribution of the different cash income-generating activities to the total cash income.

#### 5.1.1 Adaptations Before the Ban

##### 5.1.1.1 Assets

###### ❖ *NTFP*

The Soligas have for centuries collected NTFPs for domestic use, and this, in addition to their shifting cultivation, has constituted their way of life. The oldest respondents would talk about the times when they dwelt in the interior of the forest and the forest alone would fulfil all their

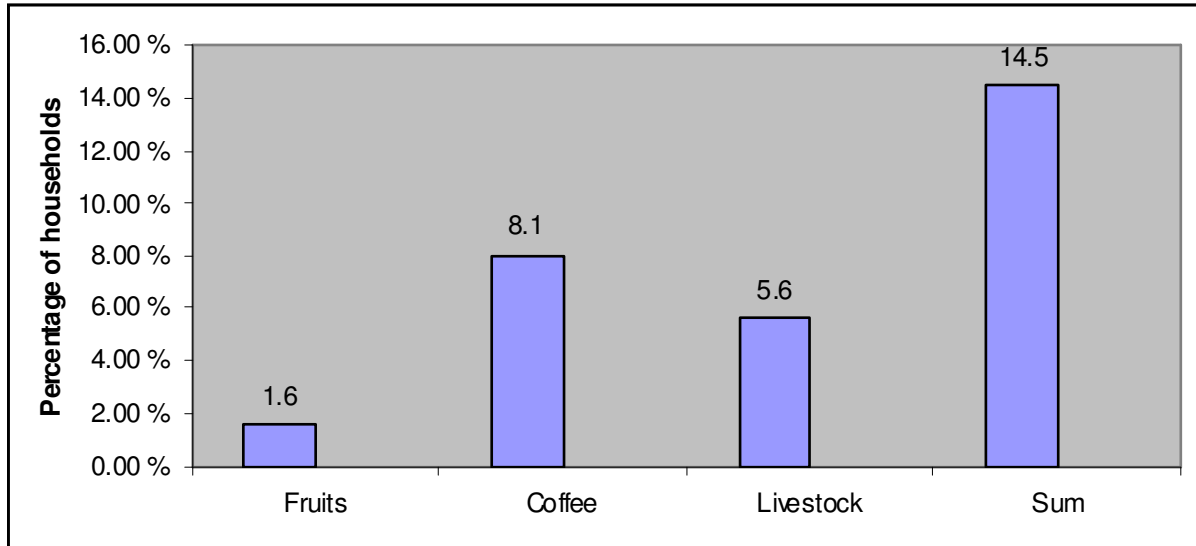
needs. After the Wildlife Protection Act 1972, shifting cultivation and forest fires were banned and different relocations schemes were implemented, and the Soligas were given shelters in permanent settlements. Still NTFP collection was their major activity, and a commercialisation of NTFPs began. NTFPs most commonly collected for domestic use included tubers, greens, honey, medicinal plants and firewood. NTFPs collected for commercial use were processed by LAMPS and included: *Phyllanthus emblica* (amla), honey, *Acacia concinna*, soap nut, *Terminalia chebula*, honey wax, horns of deers, lichens, wild turmeric and ginger, sweeping sticks, tree wax and *Hemides* species. Different NTFPs were collected at different times during the year, and some seasons were more busy than others. Most respondents said that between NTFP collection they would engage in casual labour. Up until the ban on NTFPs for commercial use, almost 97 % of the respondents said they were collecting NTFPs for domestic use and 97 % were collecting for commercial use. This indicates that NTFP collection, both for commercial and domestic use was important for the Soligas, and reflects the Soligas' knowledge about the forest and its resources.

#### ❖ *Agriculture*

Access to land is unevenly distributed among the Soligas, due to various relocation schemes in the last century. Those who willingly relocated were given land, and those who were forced later were not given land. Eighty-one per cent of the respondents in the Sanctuary have access to land. Among the landowners, the average household have 0.76 ha of land available. The mean size of land for all the respondents was 0.62 ha. Land sizes varied between 0 and 2.43 ha.

Before the ban, 14.5 % of the households (18.1 % of landowners) were engaged in cash crop cultivation and cash income-generating livestock breeding (Figure 4). Cash crops included coffee and fruits, and cash income from livestock included proceeds from the sale of cattle, goats and fowl, and milk from cows. Food crops for subsistence included grains, millet, maize, mustard and vegetables. Approximately 12 % of landowners (ten per cent of the households) produced coffee or fruits in addition to food crops for subsistence use, which means that 88 % of landowners produced crops for subsistence use only. This number is not accurate; after the ban we see the increased number of households with cash income from coffee production, and when we consider the number of years coffee plants needs to yield, there must have been quite a number of farmers who had already planted coffee saplings before the ban was implemented. Still, the number gives an indication on where the Soligas

are headed, economically, independent of the ban on NTFPs. Livestock cash income were generated in 5.6 % of the households, and cattle was put to graze in the forest even though this was not legal.



**Figure 4. Households participating in cash crop and livestock farming, BR Hills, Karnataka, India, 2007**

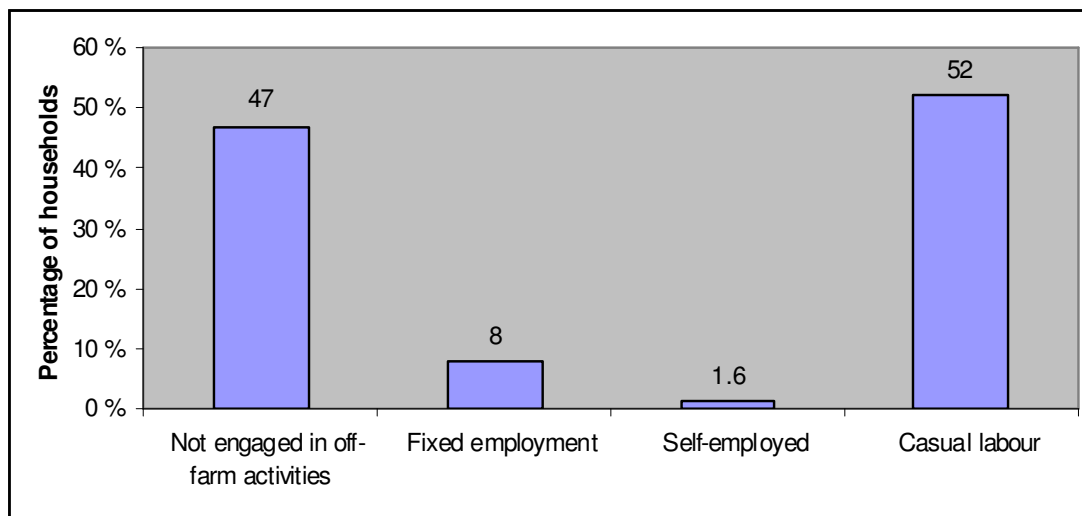
Coffee production was a relatively new activity among the Soliga farmers, and the Soligas, being taught about intensification in agriculture and the possible degradation of the forest by overharvesting NTFPs, have turned to cash crops for increased and more secure cash income. Shifting to cash crops might be the beginning of a trend towards a more intensified cash income than NTFP collection could keep up.

The Soligas' perception of themselves as a people with no other skills than NTFP collectors and subsistence farmers is changing, and they are now learning other forms of farming and see new opportunities of generating cash income than before. Interestingly, the FD prefer the Soligas to grow coffee as opposed to NTFP collection, but whether coffee production is better for the forest than NTFP collection is open to debate.

❖ *Off- and non-farm activities*

The average household has 4.7 members, including 2.1 labourers, which gives a worker/consumer ratio of 0.45. Both men and women in households work when able, and women were the ones most often engaged in NTFP collection.

Off-farm activities included casual labour, self-employment (local shops, guiding etc.) and employment (fixed positions in LAMPS, VGKK, ATREE or the Forest Department). Fifty-two per cent of the households were engaged in casual labour at some point during the year (Figure 5), 8 % had fixed positions and received regular, monthly cash income and less than 2 % were self-employed. Casual labour consisted of sporadic construction work along the roads in the Sanctuary, occasional work for the FD, or help during harvest on farms and plantations outside the Sanctuary.



**Figure 5. Households participating in off-farm activity, BR Hills, Karnataka, 2007**

Labour outside the Sanctuary would require people to leave their family for a period of time, days, weeks or even months. This might have a negative impact on the households as workers cannot participate in social meetings, networking and the everyday life of their family. Transportation is expensive and many people walk great distances every day to save money.

Cash income from non-farm activities consisted of old age pension, and only one of the households in this study received pension from the state.

❖ *Distance*

All the households in this study lived inside the Sanctuary and hence close to the forest, distance discussed here is distance from settlement to the main road and distance to the Temple.

Sixty-four per cent of the households (five of the settlements) in this survey lived in settlements close to the Temple, and hence lived close to the District Forest Departments' offices, ATREEs field station, the school and hospital run by VGKK, and the LAMPS processing facilities. Fifteen per cent of the households (one settlement) lived 8 km away, 10 % (two settlements) lived 15 km away, and 11 % (one settlement) lived 30 km away from the Temple. All households with employment lived close to the Temple. Seventy-three per cent of the households (five settlements) lived close to the main road, while 11 % of the households (three settlements) lived 1 km away, and 15 % of the households (one settlement) lived 3 km away from the main road.

There are no significant differences in cash income sources or dependence on NTFPs correlated to the households' distance to the Temple or the main road before the ban. The households with fixed positions at one of the local NGOs or at Forest Department, were all from settlements close to the Temple, suggesting it might be easier to get employment if the settlement is close to the Temple. However, when it comes to NTFP collection, farming or getting casual labour, living close to the Temple is not crucial. All the households in this study are situated inside the Sanctuary, and to find significant correlation between distances and cash income/dependence we would have to compare settlements both inside and outside the sanctuary. Households in different settlements inside the Sanctuary share more or less the same opportunities when it comes to access to different assets.

#### **5.1.1.2 Cash Income**

The Soligas have over the last few decades shifted towards a more cash based economy and increased their annual cash income, and hence are more dependent on cash income to sustain their livelihoods. According to Bodley (2008), tribes have often been classified as poor because they are outside the monetary system, not because they are necessarily poor. They can be considered wealthy when the term includes values as nature, social and cultural bonds, and the value of human beings (Bodley 2008). The Soligas, before being influenced by non-tribes, got all their resources from shifting cultivation and forest resources, and had no need to be a part of the monetary system. This study's focus on cash income illustrates the sale of NTFPs contribution to the Soligas economy.

Table 1 gives the total cash income from each of the Soligas' cash income generating activities throughout a year before the ban on commercial NTFP collection. The households' average annual cash income was INR 39 968. The share of cash income from NTFP collection to total cash income was 85.2 %, (INR 34 043), thus being the biggest source of cash income for the Soligas. Results from a regression analysis showed a strong relationship between total cash income and cash income from NTFP before the ban ( $p < 0.0001$ ; R-sq (Adj) = 73 %) (Appendix II). A study done by Hedge et al. (1996), BR Hills, showed that the total (cash and subsistence) income from Non-Timber Forest Products (NTFP) in many rural households was between 48 and 60 %. That this study showed even higher dependence (85.2 %) could be due to the fact that this study only focuses on cash income.

**Table 1. Total cash income by activities before the ban, BR Hills, Karnataka, 2007**

Income source	Average cash income per household (INR)	Share of total cash income (%)
NTFP	34 043	85.2
Agriculture	770	1.9
Off-farm	5 125	12.8
Non-farm	39	0.1
<b>Total average cash income</b>	<b>39 968</b>	<b>100</b>

Non-environmental cash income constituted only 14.8 % of the total cash income, divided among agriculture, off-farm and non-farm sources. Most agricultural production was for domestic use and because of small land holdings (averaging 0.62 ha) cash income from agriculture generated only 1.9 % of total cash income. It consisted of cash crops and livestock, where coffee production amounted to 31 %, fruit production to 2 %, and livestock almost to 67 % of the total agricultural cash income. Most production from agriculture was for subsistence use, but coffee production was already starting to play a greater part in many households' land. Coffee is a perennial crop, growing in the shadow of other trees, and saplings take four years to produce berries. The coffee plant can produce berries for up to 15 years and its yield increases over the years, giving a stable income to the household.

Cash income from off-farm sources include employment, self-employment and casual labour, and totals up to 12.8 % of total cash income before the ban (Table 2). Of these, employment constitutes 52 %, casual labour 45 %, and self-employment 2 % of the off-farm cash income. Between seasons for NTFP collection both men and women seek casual labour, and a day's

work generates INR 70 for men and INR 35 for women. Non-farm cash income is here represented by old age pensions received from the government after 65 years of age and only constitute 0.1 % of the total household cash income.

**Table 2. Total cash income through off-farm and non-farm activities before the ban, BR Hills, Karnataka, 2007**

Income sources	Average per household (INR)	Share of total Cash income (%)	Share of Off-farm (%)
<i>Off-farm</i>	5 125	12.8	100
Labour	2 329	5.8	45.5
Employment	2 690	6.7	52.5
Self employment	105	0.3	2
<i>Non-farm</i>	39	0.1	

There is a significant relationship between cash income from off-farm activity and total cash income ( $p = 0.0046$ ; R-sq (Adj) = 5.6 %) (Appendix II), although it does not explain much of the variation. However, when cash income from NTFP collection is excluded in total cash income there is an even stronger relationship to off-farm activities ( $p < 0.0001$ ; R-sq (Adj) = 95.3 %) (Appendix III). There is no significant relationship with cash income from agricultural activity and total cash income with cash from NTFPs excluded (Appendix III). This means that before the ban off-farm activities such as casual labour and fixed employment explains the cash income not derived from NTFP collection.

#### ❖ Household size

Results from regression analyses show that both household numbers ( $p = 0.0005$ ; R-sq (Adj) = 8.9 %) and the number of workers ( $p < 0.0001$ ; R-sq (Adj) = 24.5 %) have significant relationships to total cash income (Appendix IV). This indicates that large households have more members working and thus get a bigger cash income. This does not necessarily mean they are wealthier than smaller households, since they have more mouths to feed. Also, household numbers ( $p < 0.0001$ ; R-sq (Adj) = 12.1 %) and number of workers ( $p < 0.0001$ ; R-sq (Adj) = 28.4 %) have a significant relationship to NTFP cash income (Appendix IV). The higher R-sq (Adj.) for number of workers in a household, indicates that the variation in the sample is better explained than for household numbers. This is because number of workers and cash income are directly connected, while a large household number not necessarily

means that there are many members generating cash income. Cash income from NTFP constitutes such a large amount of the total cash income (85.2 %), so a relationship here is not surprising. Cash income from off-farm, and agricultural activities show no relationship to household numbers or number of workers in a household.

❖ Land size

Results from regression analyses show no significant relationships between land size and total cash income ( $p = 0.185$ ; R-sq (Adj) = 0.6 %) (Appendix V). In Table 3 we see that landless households receive cash income from agriculture as well, this is from selling animals and milk. We also see that the landless have the biggest share of cash income from off-farm activities (37 % of total cash income, average share is 13 %) among the four categories. A regression analysis show a significant relationship between NTFP dependence and land size when ranged in the four categories below, ( $p = 0.0038$ ; R-sq (Adj) = 8.3 %) (Appendix V). Landless households are less dependent on NTFP collection, have more fixed employment and are more engaged in casual labour than households with land. This could be due to the fact that combining agricultural activities and NTFP collection is easier because both activities have flexible working hours, and that both women and children will participate in NTFP collection and farming. Off-farm activity leaves less time for NTFP collection. Yet, landless have on average less cash income than households with land.

**Table 3. Cash income before the ban by land size, in BR Hills, Karnataka, 2007**

Category	Land size (ha)	Total cash income (INR)	NTFP cash income	Agricultural cash income	Off-farm cash income	Fixed employment cash income	Casual labour cash income	Share of NTFP (%)	House-holds
1	Land-less	34 630	21 278	626	12 770	9 287	3 483	67.9 %	23
2	0 to 0.5 ha	39 554	37 202	312	2 040	0	2 040	91.4 %	42
3	0.5 to 1 ha	38 028	35 154	194	2 680	1 161	1 422	87.7 %	31
4	1 to 3 ha	47 121	38 557	2 214	6 179	3 000	2 821	82.1 %	28
	Total average	39968	34 043	770	5 125	2 690	2 329	84.00 %	124

Landowners in category 4 (1-3 ha of land) get most of their agricultural cash income from livestock, as their cash income from crops represent only 24 % of their cash income from agriculture, which indicates that most of crops grown are for subsistence use. In Table 3 we also find that households in category 4 receives around 18 % more cash income than the average household. This cannot be explained by agricultural cash income alone, since they receive above average cash income in all cash income-generating activities, but might also be explained by the numbers of workers in a household. Household numbers were increasing with category of land size, but not found significant. However, there was a significant relationship between working numbers in a household and land size ( $p = 0.0013$ ;  $(R(\text{Adj.}) = 7.4 \%)$ ) (Appendix V). Households with more land tend to have more household members working. This is probably because more land enables households to grow food crops and hence feed more people.

### 5.1.1.3 General Livelihoods

The Soligas have, since the non-tribes settled in the Sanctuary early in the last century, slowly been moving from an isolated and self-sufficient subsistence economy in the interior forest (see chapter 4.7) towards a cash-based modern economy. In a cash-based economy households often specialise in the most economic efficient activities, which implies that the

household will influence and be influenced by the way they use their natural resources (Belcher et al. 2005). This development accelerated after the Wildlife Protection Act 1972, when they were evicted from the interior forest and relocated to permanent settlements, and some were given land for cultivation. They were still allowed to collect NTFPs, but no shifting cultivation or controlled forest fires were allowed in the forest. This induced the Soligas to seek alternatives, and in the last few decades, coffee production and NTFP processing for sale have made them more market oriented. Travelling outside the Sanctuary to work on farms and plantation is also common now. In addition, the Soligas have access to a local school and hospital. The permanent settling, the ban on fires and shifting cultivation has led to much of their knowledge about the forest being lost, or no longer actively used.

#### **5.1.1.4 External Conditions**

ATREE has worked with the Soligas to increase their income from NTFP collection for commercial use, to help them diversify in income-generating activities, and to increase productivity from agriculture (Bawa et al. 2007). This has been done to improve livelihoods, to protect the forest and to decrease the Soligas' dependence on forest resources. VGKK have collaborated with ATREE in monitoring programmes to improve livelihoods and to make NTFP collection sustainable (Setty et al. 2008). There are three LAMPS connected to BR Hills and these help to prepare and sell NTFPs (Setty et al. 2008). The Forest Department has a district office in Chamarajanagar and a local office in BR Hills, where there are, in the latter, local forest officers controlling the Sanctuary.

*Summing up: Cash income from NTFP collection constituted 85.2 % of the total cash income to the average household before the ban, and was thus the most dominant cash income-generating activity in a household. Other cash income-generating activities are agriculture, and off-farm activities.*

### **5.1.2 Adaptations and Impacts After the Ban**

#### **5.1.2.1 Assets**

##### **❖ NTFP**

Income from subsistence use has not been measured in this study, but has decreased as the Soligas lost access to the forest and as most of them are also shifting from food crop farming to cash crop farming. After the ban, access to NTFP collection for commercial use was

banned and most of the cash income from this activity ceased. Collection for domestic use was not banned, but many of the respondents said that they were harassed when entering the forest, because the forest officers believed they would collect for commercial use or start fires in the forest.

The share of households engaged in NTFP collection for domestic use was 97 % before the ban, and 59 % after the ban (Table 4). Only 23 % of the households collect tubers, greens and honey, compared to 95 % before the ban, and 35 % only collected firewood. This means that the share of households not collecting anything from the forest for domestic use after the ban is 41 %. As the Soligas were highly dependent on NTFPs for domestic use, the ban has led to a significant increase in cash dependence, now that they have to spend money on purchasing commercially available equivalents, or if they had no money they would have to manage without the products. Several respondents were complaining that they did not fulfil their basic needs without NTFPs for domestic use.

**Table 4. NTFP collection for domestic use before and after the ban, BR Hills, Karnataka, 2007**

NTFPs	Before the ban		After the ban	
	Households	share of total sample	Households	share of total sample
No collection	4	3 %	51	41 %
Only firewood	2	2 %	44	35 %
Tubers, greens, honey and firewood	117	95 %	29	23 %

Even though collection for commercial use was illegal, eleven households (8.8 %) still reported to receive cash incomes from NTFP collection. Of these, seven households admitted to collect and sell firewood to local people, three collected and sold honey to local people and one said he collected seeds that he sold to non-tribal people. Only women were engaged in firewood collection. They would all hide to collect the products for fear of being caught.

#### ❖ *Agriculture*

Access to land did not change after the ban but more landowners have shifted from food crops to cash crops. After the ban, 52.4 % of the households are engaged in cash crop cultivation

and cash income-generating livestock production (Figure 6). Almost 52 % of landowners (48.4 % of total number of households) grow cash crops (fruits and coffee), meaning 48 % still are engaged in farming for subsistence use only. Many of the landowners that did not report to receive cash income from cash crops said that they were awaiting coffee saplings to yield, so the number of households engaged in cash crop cultivation will increase. Cash income from livestock was registered in 19.4 % of the households, which also is an increase from before the ban where only 5.6 % said to receive cash income from livestock.

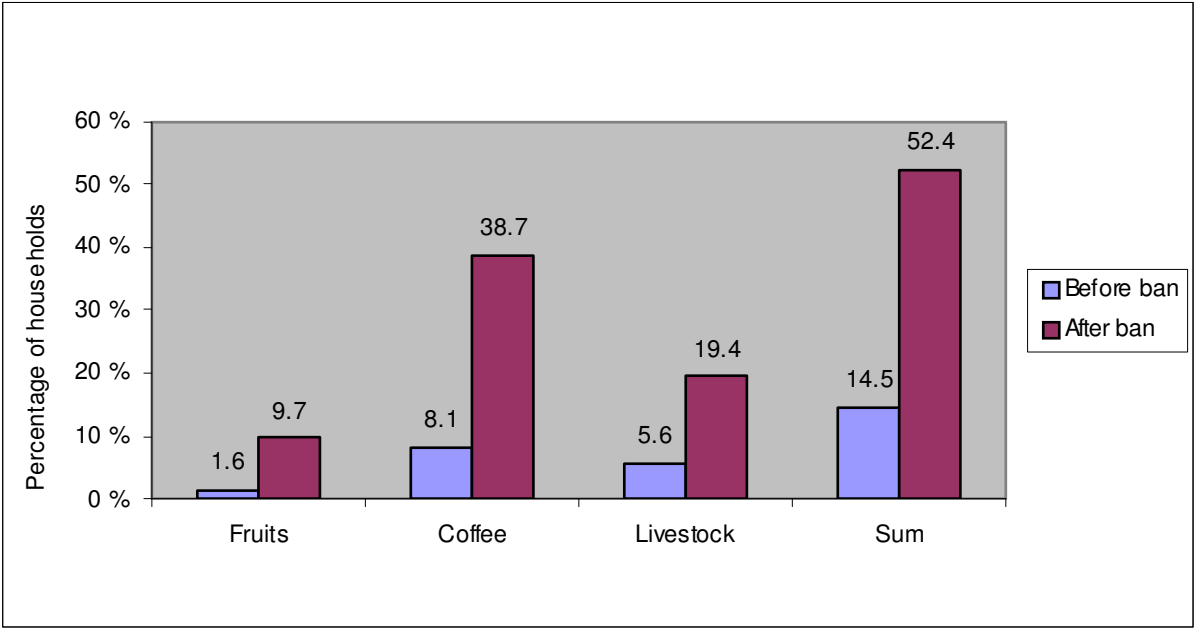


Figure 6. Households participating in cash income activities in farming, BR Hills, Karnataka, India, 2007

❖ *Off- and non-farm activities*

In Figure 7 we see that the diversity in off-farm activities are the same as before the ban, but the distribution has changed. Eighty-six per cent of the respondents said their household was engaged in casual labour, 11 % were employed, and 3 % were self-employed<sup>17</sup>. Four per cent (five households) reported to receive old age pension. From Figure 4 we see that the Soligas are engaging more in off-farm activities as a strategy after the ban, where before the ban 47 % of the households were not engaged in any off-farm activity, now only 13 % of the households report the same.

<sup>17</sup> Several households are engaged in more than one off-farm activity, hence the sum of activities does not add up to 100 % in Figure 4.

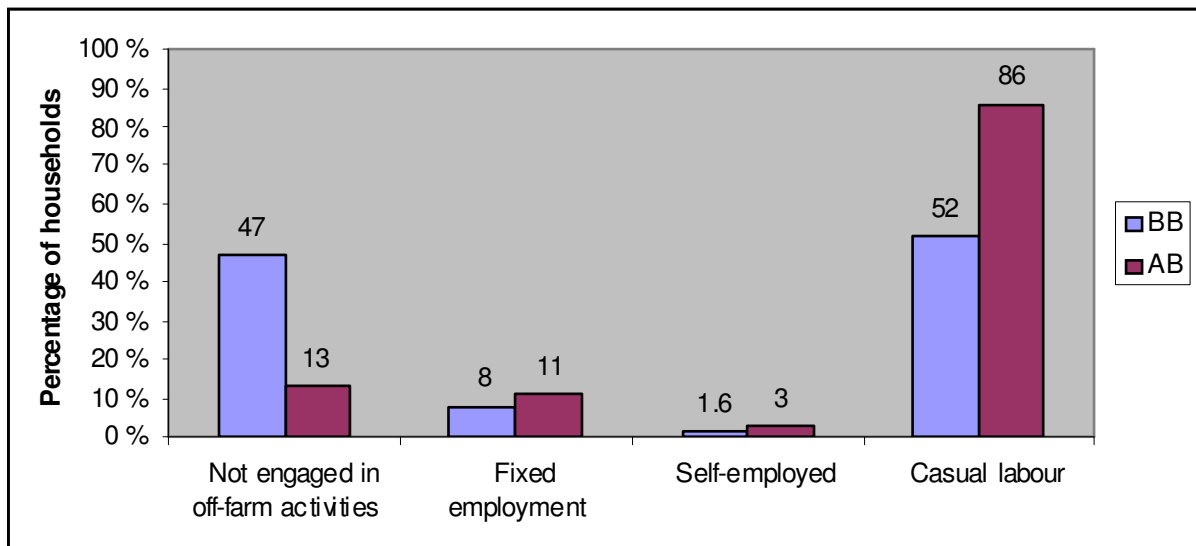


Figure 7. Households participating in off-farm activities, BR Hills, Karnataka, 2007

❖ *Distance*

Before the ban ten households had fixed employment, and they all lived in settlements close (within 1 km) to the Temple. After the ban fourteen households had fixed employment, and three of them lived in settlements far (8 km and 15 km) from the Temple. There were no significant relationships between distances to the main road or the Temple to cash income activities of any kind (Appendix VI).

**5.1.2.2 Cash Income**

The Sanctuary offers few economic alternatives to households apart from NTFP collection, agriculture and some infrequent labour opportunities. Cash income from NTFP collection has decreased from constituting 85.2 % to 4.2 % of total cash income (which would, compared to the total cash income level before the ban, amount to only 2.3 %) (Table 5). Hence the ban on NTFP collection for commercial use made a significant impact on Soliga livelihoods, leaving them, two years after the ban, with their total cash income almost halved. Cash income from agriculture, off-farm and non-farm activities have increased, but still the total cash income from all activities have decreased to an average of INR 21 837. Which means that the Soligas have been able, after losing 85.2 % of their total cash income, to increase their cash income from other sources (total cash income, excluding NTFP cash income) by almost 40 %, after only two years.

**Table 5. Total cash income by activities before and after the ban, BR Hills, Karnataka, 2007**

Income source	<u>Before the ban</u>		<u>After the ban</u>	
	Average cash income (INR)	Share of total cash income (%)	Average cash income (INR)	Share of total cash income (%)
NTFP	34 043	85.2	973	4.5
Agriculture	770	1.9	4 989	22.8
Coffee	240	0.6	3 682	16.8
Fruits	16	0.0	298	1.4
Livestock	515	1.3	1 008	4.6
Off-farm	5 125	12.8	15 682	71.8
Labour	2 329	5.8	9 736	44.9
Employment	2 690	6.7	4 697	21.5
Self-employment	105	0.3	1 249	5.7
Non-farm	39	0.1	194	0.9
Average cash income, all activities	39 968	100	21 837	100

On-farm activities contribute 22.8 % to the households' agricultural cash income after the ban and has a significant relationship with total cash income ( $p = 0.025$ ;  $R\text{-sq (Adj)} = 3.2 \%$ ) (Appendix II), coffee production is the most important contributor (73.8 % of agricultural cash income) (Table 5). Coffee production cannot be said to be increasing solely because of the ban, since coffee seedlings take three or four years to yield and must therefore have been planted before the ban in order to yield crops now. However, the ban has increased the number of farmers growing coffee and several respondents in this study said they were awaiting yield from recently planted coffee seedlings. The cash income from livestock has increased, as 20 % of the households receive cash income from livestock, compared to 5.6 % before the ban. But average cash income from livestock has decreased for the households engaged in this activity. Households that before the ban used their livestock solely for domestic use, are now selling milk, and some have been forced to sell their livestock to generate cash.

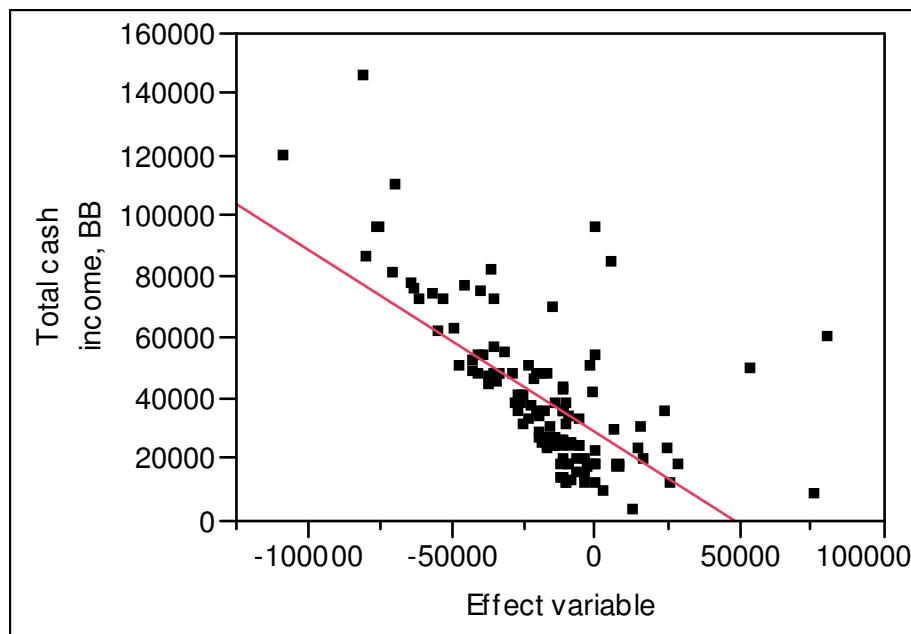
The major cash income activity after the ban is off-farm activities which amounts to 71.8 % of the total cash income, and hence has a significant relationship to total cash income ( $p < 0.0001$ ;  $R\text{-sq (Adj)} = 82 \%$ ) (Appendix II). Of this, casual labour constitutes almost 45 % of the cash income, fixed employment 21.5 % and self-employment 5.7 % of total cash

income. Off-farm activities have increased by sixty per cent, but still there are not enough opportunities for off-farm activities and many see the need to migrate seasonally in order to get casual labour. The Soligas would complain that machines were taking their labour opportunities; previously they were hired for construction work on the main road, but now machines, and even non-tribal people from outside were hired to do the work. Many also felt that the FD should provide more work for them in the forest. For households without land off-farm activity is the only source of cash income, and this makes them vulnerable to shocks and stresses.

Old age pensions received from the government after 65 years of age has increased to 0.9 % of the average household cash income.

Multiple regression analyses on socio-economic variables against total cash income before and after the ban, and on the effect variables (total cash income before the ban – total cash income after the ban) showed significant relationships only on number of workers in a household for total income before the ban and effect variables (Appendix VII). The reason that households with high numbers of workers are more affected than others after the ban is probably because those households received more cash income from NTFP collection.

The average household has lost INR 18131 in annual cash income after the ban, and as expected the households with highest cash income before the ban are the ones with greatest loss of income after the ban (Figure 8 Appendix VII). This is expected since the share of cash income from NTFP collection dominated total cash income. Households already engaged in other activities were able to adapt more quickly to the ban of NTFP collection. However, this might change as households are given time to adopt new strategies.



**Figure 8. Total cash income before the ban and how the ban affected cash income, BR Hills, Karnataka, India**

### **5.1.2.3 Cash Income Inequality Within the Sample**

Results from the regression analyses show a low p-value for household numbers ( $p = 0.025$ ;  $R\text{-sq (Adj)} = 3.2\%$ ) and number of workers ( $p = 0.025$ ;  $R\text{-sq (Adj)} = 3.3\%$ ) to total cash income after the ban (Appendix VIII). This means that there is a significant relationship between large households and total cash income, but the low  $R\text{-sq (Adj)}$  indicates the variation is only partially explained. There is no significant relationship between cash income from NTFP collection and household numbers or number of workers. This is probably because NTFP collection does not constitute a large part of the total cash income after the ban. For cash income from farming there is no significant relationship to number of workers, however the relationship between household numbers and cash income from farming gives a p-value of 0.059, where  $R\text{-sq (Adj)}$  explains only 2% of the variation (Appendix VIII). This might be because members of a household is only accounted for once as a worker, while in addition to be engaged in casual labour, or employment he/she can also be engaged in farming.

After the ban we see a significant relationship between household numbers ( $p = 0.004$ ,  $R\text{-sq (Adj)} = 5.8\%$ ) and number of workers ( $p = 0.04$ ,  $R\text{-sq (Adj)} = 2.6\%$ ) to cash income from off-farm activities (Appendix VIII). This is expected as the share of cash income from off-farm activities has become the major source of total cash income.

Table 6 shows that households with access to land have more cash income from agriculture ( $p = 0.0014$ ; R-sq (Adj.) = 7.3 %) and coffee production ( $p = 0.0022$ ; R-sq (Adj.) = 6.7 %), but that total cash income and NTFP collection has no significant relationship with the size of land (Appendix V). Before the ban there was no significant relationship between coffee production and land size, because not many farmers were engaged in coffee production (or at least had yielding coffee plants yet). The cash income from off-farm activities is decreasing with increasing size of land, but is not significant ( $p = 0.194$ ). The landless (6.1 %) and farmers with less than 0.5 ha of land (7 %) were more dependent on NTFP cash income than the other two categories. This could be because the landless have no opportunity to generate cash income from agriculture (other than livestock) and those with land holdings less than 0.5 ha have less opportunity to generate cash income from their land than those with bigger land. However, there was no significant relationship between the two. Landless receive the less than the average household before the ban, but they manage to generate more than the average household after the ban. This might be because they were already engaged in off-farm activity before the ban. Also they are probably more likely to spend time away from the households than landowners, since they have no land to cultivate.

**Table 6. Average cash income after the ban by land size, in BR Hills, Karnataka, 2007**

Category	Land size (ha)	Total cash income (INR)	NTFP cash income	Agricultural cash income	Off-farm cash income	Fixed employment cash income	Casual labour cash income	Share of NTFP (%)	Households
1	Landless	24 729	2 304	957	21 468	9 497	7 433	6.10 %	23
2	0 to 0.5 ha	21 951	969	5 029	15 839	6 095	8 886	7.00 %	42
3	0.5 to 1 ha	17 635	161	3 613	13 551	581	12 970	1.10 %	31
4	1 to 3 ha	23 945	786	9 764	13 053	3 214	9 320	4.80 %	28
	Total average	21 895	930	4 989	15 783	4 697	9 736	4.90 %	124

#### **5.1.2.4 General Livelihoods**

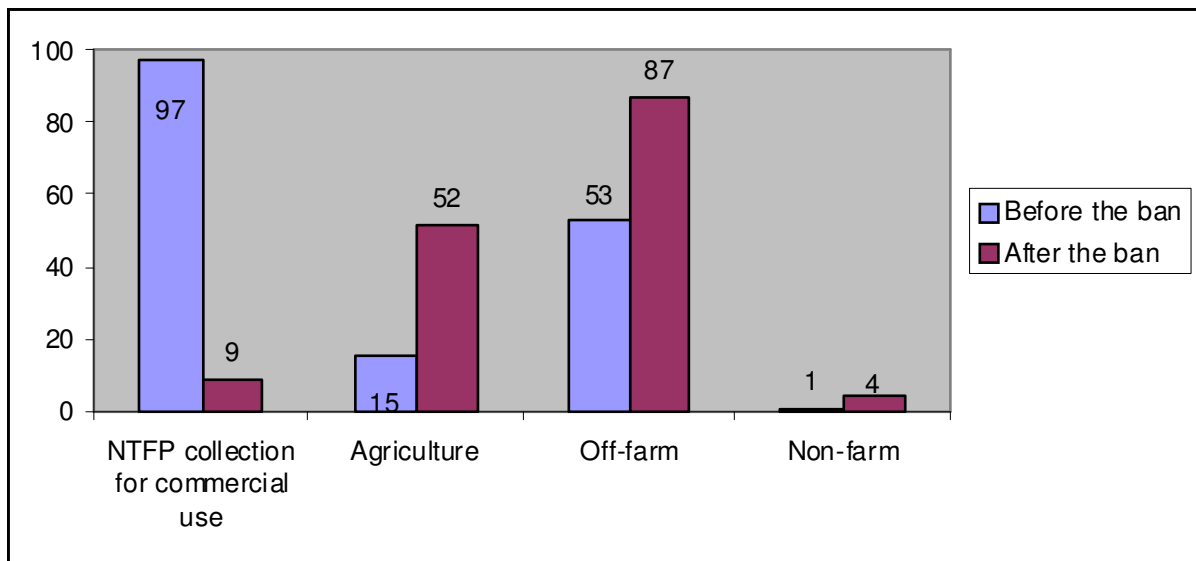
From a subsistence-based livelihood in the interior forests, the Soligas are now facing a more modern cash-economy-based way of living. Where they previously did not need anything but what the forest could provide for them, they are now dependent on cash, transport, electricity, farm tools, schools, hospitals, new skills in farming, processing and labour. This might be viewed as development, or a conservation policy gone wrong.

The FD wants the Soligas to be less dependent on the forest, and turning from subsistence farming to commercial farming leads to a decline in dependence on NTFPs (Senaratne et al. 2003). On the other hand Fu et al. (2009) states that “ a certain degree of dependence on NTFPs may motivate local people to preserve a certain amount of natural forest”.

According to the Soligas, the forest is in a worse condition now than ever before. Lantana (*Lantana camara*), an invasive species, has taken over the forest floor, repressing regeneration of other plants species (Hegde et al. 1996) and both animals and humans have a hard time moving around in the forest. This has increased the danger of fires in the forest, since Lantana have climbing stems and is highly flammable (Hiremath and Sundaram 2005). The Soligas used to have small, controlled, seasonal forest fires to remove undergrowth and clear the vegetation for pest and weeds, but due to a ban on fire in 1972, when the area was declared a Wildlife Sanctuary, these have stopped. Even so, the Soligas are known to start forest fires, which now have severe detrimental effects on the forest, leading to huge areas of the forest being burnt down (Sinha and Brault 2005).

#### **5.1.2.5 Diversification**

Figure 9 shows that the Soligas have not many options for diversification, and before the ban there was not much need for it, after the ban however, more households are engaged in different activities within both on-farm and off-farm activities. Some of the Soligas expressed concern that they had no other skills than farming and collecting NTFPs, and so they could not engage in other activities. The trend, however, shows an increasing diversification in cash income-generating activities among the Soligas, from shifting cultivation and NTFP collecting for domestic use to 87 % participation in off-farm activities after the ban.



**Figure 9. Diversification in cash income-generating activities, BR Hills, Karnataka, 2007**

*Summing up: Cash income from off-farm activity is now the most important cash income source, constituting 72.1 % of total cash income for the average household. Losing 85.2 % of their cash income, have, including increase in other cash income-generating activities, left the Soligas with their average cash income almost halved.*

### 5.1.3 Key Constraints for Improved Livelihoods

The Soligas have extensive knowledge about the forest, but expressed concern that they had no other skills than farming and harvesting NTFPs. They fear eviction from the Sanctuary and are worried about the lack of options in income activities.

When asked what they needed to improve their livelihoods, 37 % of the respondents replied that they needed more land, 25 % said NTFP collection, 24 % said loans to buy agricultural equipment, and 13 % said irrigation (Table 7). After the ban on commercial NTFP collection, farming has become very important and in Table 7 we see that 74 % (land, loans and irrigation) of the respondents identified farming as their main opportunity for improving their livelihood.

**Table 7. Soligas' expression of need to improve livelihoods, BR Hills, Karnataka, India, 2007**

To improve livelihood	Total
Land	68 (37%)
NTFP	45 (25%)
Loans	44 (24%)
Irrigation	24 (13%)
Employment	2 (1%)

The figures represents respondents. Figures in parentheses are percentage contribution to total respondents.

What we see from Table 7 is that the attitudes to engage in alternative income-generating activities are not all negative: almost 77 % of the respondents said they needed other things than NTFP collection in order to improve their livelihoods. This may be because they have given up hope on NTFP collection for commercial use.

Seventy-four per cent of the respondents said that they could not fulfil their basic needs like food and clothes after the ban. Twenty-six per cent said they had no difficulty covering their basic needs. As we could expect there was a significant relationship between total cash income after the ban and lack of basic needs ( $p = 0.002$ ; R-sq. (Adj.) = 6.8 %) (Appendix IX). Households with less income were more likely to say they could not fulfil their basic needs.

Eighty-three per cent of the households in this study had less cash income after the ban than before the ban, 13 % had more cash income and 4 % had the same cash income. Sixty-nine per cent of the respondents that had less cash income after the ban said they did not fulfil their basic needs, and 14 % said that they did fulfil their basic needs. This might be due to savings (not accounted for in this study), a lowered consumption, migration and hence fewer mouths to feed, or that they had not lost very much of their cash income (although, on average among those who fulfilled their basic needs and still had less cash income, the loss was 52 % of the total annual cash income before the ban). Six of the households (5 %) reported that their basic needs were not fulfilled, but still had an increased cash income. This might be because they,

before the ban, collected NTFPs both for domestic and commercial use, and now collected nothing for domestic use. Thus the products they previously collected for domestic use they must now purchase or do without. An alternative explanation might be that they did not tell the truth, because they thought that this would give them some benefits later. Eight per cent of the respondents were content; they had increased their cash income after the ban and had no trouble fulfilling their basic needs.

The average farm size in these households were larger than the average of the total sample size, and in addition, the average cash income before the ban was lower than the total average (INR 25 240 and 39 968), but higher after the ban (INR 46 066 and 21 837). In addition, these 8 % had an average cash income from NTFP collection of INR 13 280 before the ban, which is a lot smaller than the total average cash income from NTFP collection (INR 34 043). This could show that those already engaged in other activities had an advantage when exposed to an external shock like the ban on NTFP collection for commercial use. All those who reported to have the same cash income before and after the ban also reported not to have any problems to fulfil their basic needs.

Lack of cash income-generating opportunities for the Soligas increases the dependence on forest resources. Through education, economic growth and labour industries, off-farm opportunities can increase (Angelsen and Kaimowitz 1999; Angelsen and Wunder 2003; Godoy et al. 1997).

*Summing up: After the ban 83 % of the households have less cash income than before, 74 % said they had difficulties covering their basic needs. Seventy-four per cent of the respondents identified farm activities to be the most profitable way to improve their livelihoods*

#### **5.1.4 Subsistence Income**

Event though subsistence income is not accounted for in this study, participation in NTFP collection for subsistence use after the ban indicates that there has been a considerable loss of income here as well. The Soligas, with their indigenous knowledge of the forest, have been extracting forest produce for subsistence use for centuries, but because of fear of entering the forest they have to find other alternatives. Shone and Caviglia-Harris (2006) claims that when food can be purchased it leaves more time to focus on income-generating activities, Delang (2006) however, argues that purchasing cultivated vegetables is less efficient than gathering

wild plants. One consequence of purchasing products instead of collecting them is that valuable traditional knowledge of forest plants will be lost.

Households shifting to cash crops might still be able to produce crops for subsistence use, whereas landless households have no other option than to purchase or manage without products previously collected in the forest.

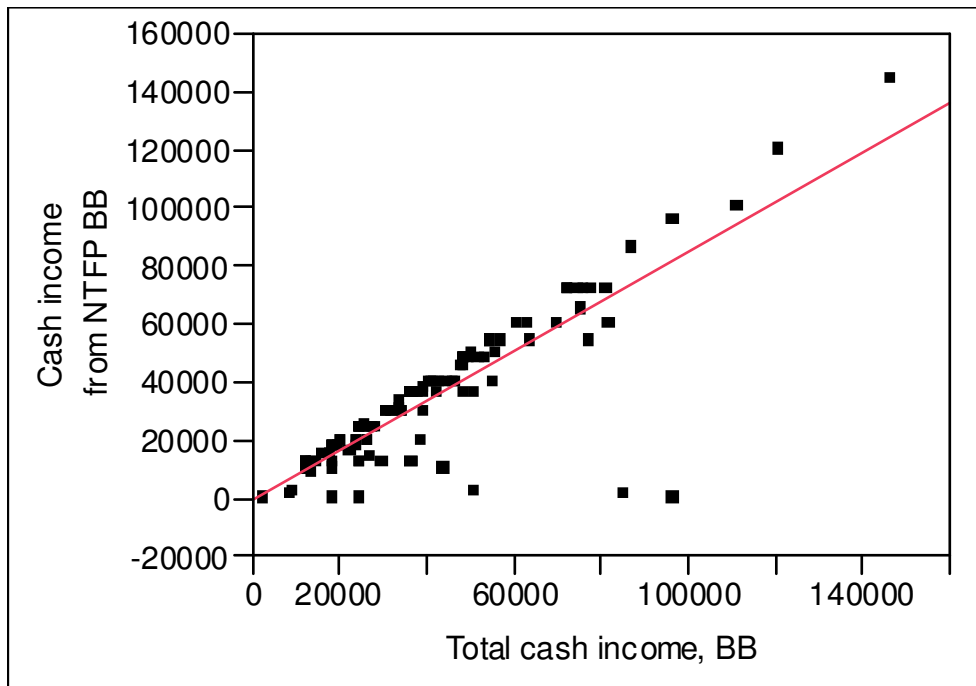
## **5.2 Dependence on Cash Income from NTFP Collection**

The first part in this section compares the share of cash income from NTFP collection for commercial use to total cash income (NTFP dependence). The second part looks at the distribution pattern of cash income from NTFP collection among different household groups, and the third part identifies factors influencing NTFP dependence.

### **5.2.1 Relationship Between NTFP Cash Income and Total Cash Income**

A household's total cash income is the sum of NTFP, agricultural, off-farm and non-farm cash income. The different cash income-generating activities contribute differently to total cash income in a household, and relative cash income from each activity expresses the household's dependence on each activity. The results are shown above, in Table 5. Dependence is expressed through the distribution of cash income generated from different cash income-generating activities to the total cash income. According to the World Bank (2004) there are about 60 million forest dwelling indigenous people almost completely dependent on forest resources.

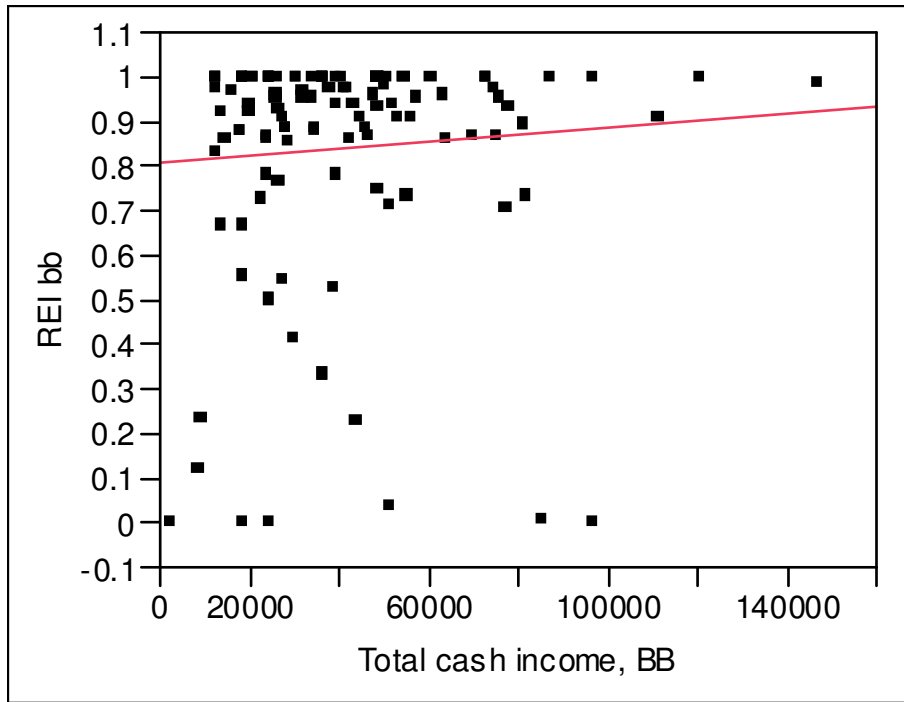
There is a significant positive relationship between NTFP cash income and total cash income, the plots and regression lines are found in Figure 10 (Appendix II). As we have seen, the average share of cash income from NTFP collection was 85.2 % before the ban, varying between 0 and 100 % dependence, where 81.5 % of the households depended 80 % or more on NTFPs for cash income. The results show a clear pattern of high NTFP dependence, and where NTFPs also constitute a larger share of total cash income in the wealthier households than in the poorest households. It is widely believed that rural people are highly dependent on environmental resources (Angelsen and Wunder 2003; Fisher 2004; Mamo et al. 2007; Nanjundaiah 2008; Vedeld et al. 2007), which is confirmed in this study.



**Figure 10. Relationship between total environmental cash income and households total cash income, BR Hills, Karnataka, 2007**

Distance to the main road and NTFP dependence also indicate a relationship, although not significant, ( $p = 0.089$ ,  $R\text{-sq (Adj)} = 1.5\%$ ) (Appendix VI), indicating that people living close to the main road (less than 1 km) are slightly less dependent on NTFP collection than those living further away from the main road. This is probably due to the fact that living close to the main road makes off-farm activities, like fixed employment and casual labour outside the settlements, easier. There were no relationship between distance to the Temple and NTFP dependence.

There is no significant relationship between relative environmental cash income and total cash income ( $p = 0.416$ ) (Figure 11, Appendix X). Performing a second-degree relationship did not improve the relationship. Together with Figure 9 this may indicate that NTFP collection for commercial use is a preferred cash income-generating activity to other activities.



**Figure 11. Relationship between the share of environmental cash income and household total cash income per year, BR Hills, Karnataka, 2007**

In Table 8, the respondents have been grouped into quintiles based on total cash income, and shows the average households' cash income from NTFP collection. What is interesting is that for all the quintiles, none of them are much above or below the mean level of dependence, hence grouping households according to wealth does not understate the importance of NTFP collection for the Soligas. Cash income from NTFP collection increases from the lowest 20 % to the top quintile, where the wealthier households receive more cash income from NTFPs than the poorest household. Mahapatra et al. (2005) found similar results showing that wealthier households received more cash income from NTFPs than poorer households. However, in their study the poorest household depended proportionally more on cash income from NTFPs, which is not the case in this study. The dependence on NTFP collection, however, increases from the lowest to the fourth quintile and then decreases for the top quintile, and varied between 82 and 88 %. The top 20 % get more than the others from other sources, one explanation being that the top quintile have more land and hence, more cash income from cash crops. So there is no significant relationship between total cash income and dependence on NTFP, as seen in Figure 10.

**Table 8. Annual cash income from NTFPs before the ban by wealth groups, BR Hills, Karnataka, 2007**

Variable	Range	Total cash income (INR)	Cash income from NTFP	NTFP dependence (%)	Hectare
Lowest 20%	Less than 20000	14 572	11 960	82	0.57
20-40%	20000 - 28000	24 284	20 216	83	0.57
40-60%	28000 - 41000	34 910	30 436	87	0.70
60-80%	41000 - 54000	47 812	41 920	88	0.50
Top 20 %	54000 - 146000	79 858	67 000	84	0.77
Average		39 968	34 043	85.2	0.62

A common finding is that the poorest people depend more on environmental income than others (Byron and Arnold 1999). This is true for the Soligas as well, if we consider them all to be poor, but looking at inequality or distribution among the Soligas, there are no significant differences in dependence between the wealthiest and the poorest households. In Table 8 we see that of the quintiles, the lowest 20 % are the least dependent on NTFP collection, and this can be explained from the fact that the Soligas are all relatively poor and that the poorest lack the necessary labour, time or health to be engaged in NTFP collection (Kamanga et al. 2009). Another explanation could be that this study only focuses on cash income, and does not account for the subsistence use, which might have made the dependence outcome different.

In literature there is a common belief that NTFP collection for commercial use is used by the poor as their last option for income, since it is time consuming and does not give much income (Belcher et al. 2005; Vedeld et al. 2007). But in most of the cases this is due to weak marketing and this has not been so in BR Hills because of LAMPS. Hedge et al. (1996) found that income from NTFPs is more stable and more reliable than other income-generating activities the Soligas engage in, which is in line with this study.

*Summing up: There is a strong relationship between cash income from NTFP collection and total cash income. This is not surprising when we know that NTFP collection constitute 85.2 % of total cash income. NTFP dependence is relatively equal among the different wealth groups, contrary to other studies where the poorest households seems to be most dependent*

*on forest resources. Though it is important to remember that this study focuses on cash income alone and does not consider subsistence income.*

### **5.2.2 Cash Income Inequality**

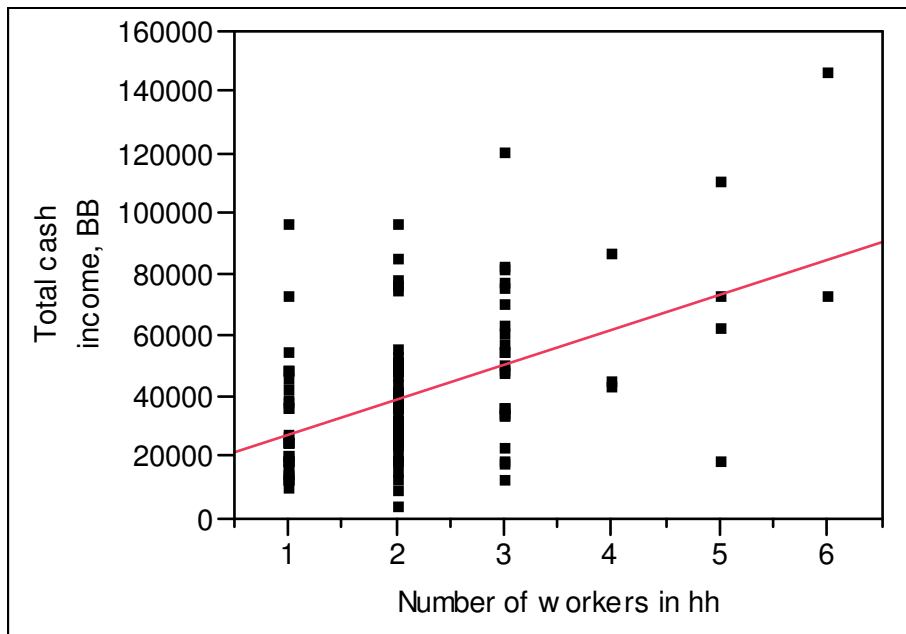
Environmental resources have been shown to be important for rural people and forest dwelling tribes in particular. To find whether access to NTFP collection for commercial use reduces the cash income inequality within the sample population, Gini coefficients were determined before and after the ban. The Gini coefficient reflects the degree of inequality in a sample population, where 0 indicates no inequality and 1 indicates complete inequality (one household has all the cash income). Since this study is focusing on cash income, it does not give an indication on NTFPs for subsistence use, and thus gives not the full picture on inequality among the Soligas. Before the ban the Gini coefficient was 0.326 and after the ban it was 0.448 (Appendix XI). These values indicate that the ban on NTFP collection for commercial use might be a factor in increasing the inequalities in the Sanctuary. However, including NTFP collection for domestic use might have reversed or reinforced the degree of inequality, but this study only focuses on cash income.

*Summing up: When NTFP collection for commercial use was banned the cash income inequality among the respondents increased. This suggests that NTFP collection has an equalising effect.*

### **5.2.3 Factors Influencing Forest Dependence**

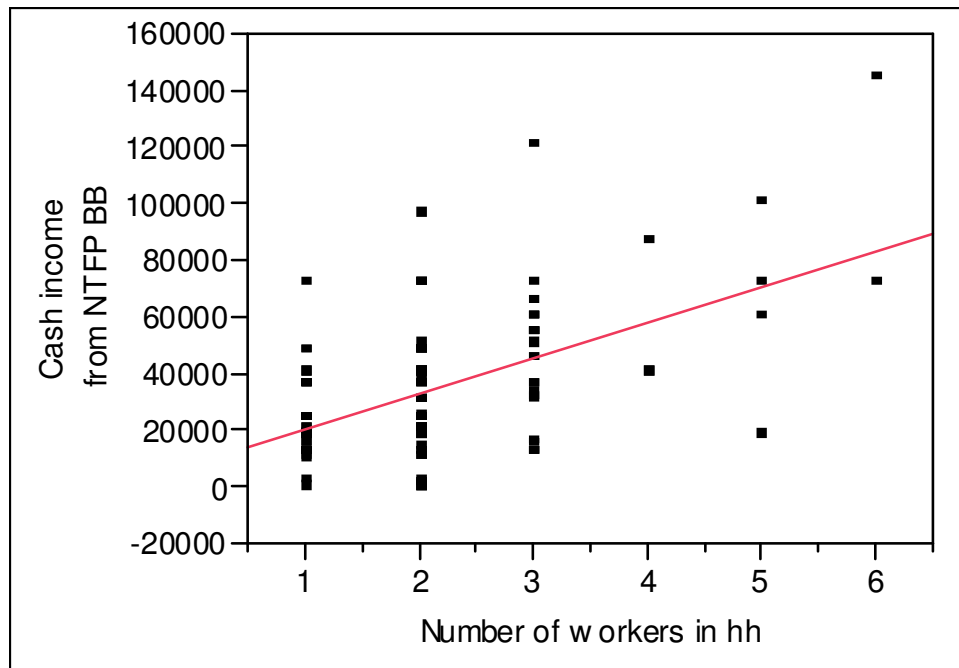
In a study done by Mamo et al. (2007) in Ethiopia, they found that among rural people the average contribution from forest resources was 39 % to total income, and that the dependence increased with household size. In this study, there is no significant correlation between household size or number of workers, and dependence on forest resources before the ban (Appendix IV). However, the difference in total cash income before the ban among the households can be explained by the number of workers in each household, where the results showed a significant relationship ( $p < 0.0001$ ; R-sq (adj.) = 24.5 %) (Figure 12, Appendix IV). This is not unexpected as we see that the relationship between household size and numbers of workers in a household is significant, larger households have more people working, hence higher cash income. However, results from regression analyses on the

relationship between household numbers and number of workers in a household were not significant to dependence (relative environmental cash income) (appendix X).



**Figure 12. Total cash income and number of workers in households, BR Hills, Karnataka, 2007**

The relationship between number of workers and cash income from NTFPs before the ban was also significant ( $p < 0.0001$ ;  $R\text{-sq (adj.)} = 28.4\%$ ) (Figure 13, Appendix IV). Since larger households have more workers, and cash income from NTFP constitute on average 85.2 % of the total cash income, we expected the results shown in Figure 12.



**Figure 13. NTFP cash income and number of workers in households, BR Hills, Karnataka, 2007**

Results from regression analyses on NTFP dependence against agriculture , ( $p = 0.048$ ; R-sq (Adj) = 2.4 %) and off-farm activities ( $p < 0.0001$ ; R-sq (Adj) = 49.9 %) showed a significant negative relationship (Appendix X). This indicates that those least dependent on NTFP collection are those who receives most cash income from off-farm sources. The settlements' dependence varied between 74 % and 97 %, where settlements far from the main road were more dependent than those close to the main road. This might be because it is easier to be engaged in casual labour and employment when you are closer to the main road and transportation facilities, hence less dependence on NTFP.

The size of the household or the number of workers in a household gave no significant relationship to NTFP dependence, but there was a slight increase, where larger households and households with large numbers of workers were more dependent on NTFP than other (Appendix X). However, high p-values and low R-sq (Adj.)-values indicates insignificance and does not explain the variation in the sample.

*Summing up: Dependence on NTFP collection did not increase with household size or number of workers in a household. However, cash income increased in larger households, probably because larger households have more workers and higher cash needs.*

### **5.3 Attitudes and Perceptions Towards Conservation**

This section will identify the Soligas' perceptions and attitudes on the effect of NTFP harvesting and forest degradation, on the ban on NTFP collection for commercial use, on forest conservation, and of the Forest Department.

“The colonial approach to managing protected areas, carried on by the Indian state, resulted in two things - firstly, it severely restricted the access of locals to resources on which their livelihoods were based; and secondly, it effectively removed all responsibility of the villagers to look after their natural surrounds” (Apte and Kothari 2000: 9).

Infield (1988) found that according to some conservationists, all rural people in developing countries are negative to conservation of nature. However, he did not share their view: his findings showed that people who received benefits were more likely to have positive attitudes towards conservation. Local people's perceptions towards forest conservation are dependent on their net cash and benefits of the conservation, of the degree of participation in the conservation, and their dependence on forest resources (Pimbert and Pretty 1995; Vedeld 2002; Xu et al. 2006). Attitudes and social norms of local communities are important when conserving nature.

#### **5.3.1 Perceptions on NTFP Collection and Forest Degradation**

The collection of NTFPs in BR Hills has moved from subsistence collection to large-scale commercial collection (Sinha and Brault 2005). The effects this has had on the forest have not been sufficiently studied, although NGOs in the area have started monitoring use and taught the Soligas about sustainable harvesting (ATREE 2005; Ganesan and Setty 2004).

When the Soligas were asked if the NTFP collection for commercial use were degrading the forest, 81 % replied no (Table 9). They would then explain their knowledge of the forest and how they have been living off the forest resources for generations without degrading it. They also said that ATREE staff had been teaching them about sustainable harvesting, since they only 'recently' had started collecting NTFPs for commercial use. Nineteen per cent of the respondents said they thought NTFP collection for commercial use was degrading the forest. In Table 9 we see that settlements' distance to the Temple affects the perception that NTFP collection for commercial use is degrading the forest. Almost 96 % of the respondents who

said that NTFPs degrade the forest were living close to the Temple. This divergence might be due to the fact that people living close to the Temple and hence to non-tribals gradually develop new perceptions and attitudes towards the forest. Other reasons for this difference in perception among settlements could be that the forest around the Temple has been more exposed, and hence is more degraded than other parts of the forest. The high density of settlements around the Temple, in addition to the fact that non-tribal people settled in the forest are also living close to the Temple, may have inflicted more pressure on this part of the forest.

**Table 9. Perception on NTFP collection and distance to the Temple, BR Hills, Karnataka, 2007**

		Is NTFP collection degrading the forest?		
Distance to the Temple	Count	Yes	No	Total
	Total %			
Less than 1 km		22	57	79
		17,74	45,97	63,71
More than 1 km		1	44	45
		0,81	35,48	36,29
Total		23	101	124
		18,55	81,45	100

(Chi square = 15.89; prob. < 0.0001)

There was a slight relationship, however not significant ( $p = 0.055$ ;  $R\text{-sq (Adj)} = 2.2\%$ ), between size of the land of households and their perception of NTFP collection degrading the forest (Appendix XII). Landowners with bigger land tended to say that NTFP collection was degrading the forest, and landless or households with smaller land tended to say that NTFP was not degrading the forest. This could indicate that landowners with more land were less dependent on NTFP, however we have seen that this is not the case (see Table 3). Still, since subsistence use is not accounted for in this study, it might be because landowners with more land are able to produce both cash crops for sale and food crops for subsistence use, and thus are not critically dependent on NTFPs for domestic use.

The elephants in the Sanctuary are increasingly destroying crops for farmers, both inside and outside the forest. The Forest Department blames the Soligas' NTFP collection and says that the Soligas are taking all the animals' food. The Soligas, on the other hand, are blaming the Forest Department's protection policy; the ban on forest fires has led to increased

undergrowth in the forest and an explosion of the invasive Lantana, and this again has led to food shortage for the biggest animals in the forest and is also hampering these animals' movement.

During my research households with members employed by the Forest Department did not wish to be interviewed, and all the Soligas employed by the Forest Department lived in settlements close to the Temple. Seventy-four per cent of the respondents who said that NTFP collection for commercial use was degrading the forest, were living in the same settlement, Yerakana Gadde, which is one of the settlements located close to the Temple. Why most of the respondents with this perception was from the same settlement could be explained by the notion that they adopt a common perception within their settlement. This reflects the reciprocal development of social norms, and how they are based on socially shared beliefs. It shows how social values and common norms develop.

A one-way ANOVA analysis of cash income from different sources after the ban gave a significant relationship between high agricultural cash income and the view that NTFP degrades the forest. Livelihood concerns are often associated with attitudes, and people who are dependent on forest resources are often opposed to forest conservation (Arjunan et al. 2006) when forest conservation means restrictions. There were no significant relationship between the Soligas dependence on NTFP collection for commercial use before the ban and their perception of NTFP collection ( $p = 0.118$ ;  $R\text{-sq (Adj)} = 1.18 \%$ ) (Appendix XII). Contrary to expectations, those who said NTFP collection was degrading the forest were slightly more dependent on NTFP collection.

Increased population and development will eventually affect wildlife negatively, but the major threats to BR Hills are the quarries and coffee plantations outside the Sanctuary (Reddy 2007). Ganesan and Setty (2004) found that sapling mortality on *Phyllanthus emblica* was caused by anthropogenic disturbances, but that in BR Hills the main factor was fire, not NTFP collection or grazing. More research and monitoring of ecological impacts is needed to sustain biodiversity and livelihood (Karanth et al. 2006).

In a study in Bhadra Wildlife Sanctuary Karanth (2006) recognised three major factors influencing disturbance from NTFP collection: village size, distance from village, and distance between villages (overlapping areas of collection). Population growth is a factor

when discussing the NTFP collection and its sustainability. In an interview with the Chief Conservator of Forest in Bangalore, Mr. Reddy (2007) said that the government of Karnataka was against the national ban on NTFPs in cases like the BR Hills, but that they had to follow the law. He did not think that NTFP collection for commercial use by the Soligas was degrading the forest, however, it was not realistic, in the long run, to combine people and wildlife. “Now it is ok, but 20-30 years from now you will find that they have developed, there are so many people speaking for the tribes, some have to talk for the wildlife, we need to have a bias for wildlife” (Reddy 2007).

*Summing up: Eighty-on per cent of the respondents did not think that NTFP collection for commercial use was degrading the forest. Almost all of those who thought that NTFP collection was degrading the forest lived close to the Temple. Most came from the same settlement.*

### **5.3.2 Ban on NTFP Collection**

The Soligas were not given information from the Forest Department on why there was a ban. This may have led to further alienation from the forest and hence a decrease in their feeling of responsibility towards conservation of the forest. When asked why there was a ban on collection of NTFPs for commercial use 31 % of the respondents had no idea, and 48 % thought it was because the forest officials were afraid that the Soligas would start fires or destroy the forest. The reason for banning the NTFP collection was due to new restrictions in the Wildlife Act, and 21 % of the respondents knew this. Other suggestions as to why there was a ban were; a) that the forest officials wanted to relocate the Soligas, b) that the Soligas were claiming insurance from injuries while collecting NTFPs, c) that the forest officials wanted to control the forest, d) because of the increasing population in the forest, and e) because of conflicts between the LAMPS and the forest officials. Most respondents were simply guessing when asked about the reason for the ban. The lack of information on the reasons underlying the ban might lead to an increased sense of powerlessness. This may lead to further alienation between the Soligas and the forest, and to more hostility towards the FD, and hence less interest in protection.

*Summing up: Thirty-one per cent of the respondents had no idea why there was a ban on NTFP for commercial use, and only 21 % knew the real reason for the ban. This shows that*

*the flow of information to the people most affected by the ban is unsatisfactory. When considering the attitude most of the Soligas have towards the Forest Department, the lack of information is not helping to improve the relationship.*

### **5.3.3 Perceptions on Forest Conservation**

“There is a positive linkage between peoples’ willingness to participate in forest conservation and access to forest resources for meeting their livelihood needs, in case of conservation of reserved forests” (Nanjundaiah 2008: 289).

The Soligas are positive to protecting the forest, but they are sceptical to the way it has been done and they do not agree that they (the Soligas) are what the forest needs to be protected from. When asked how the forest could be best protected 7 % said they had no idea how to protect the forest, 37 % meant that by helping the forest officials fight forest fires, and 56 % said that by giving the Soligas the responsibility for the forest would be the best way of protecting it.

There was a relationship, although not significant, between total cash income before the ban and the view of how to protect the forest ( $p = 0.054$ ;  $R\text{-sq (Adj)} = 3.2 \%$ ) (Appendix XIII). Respondents who had no idea how to protect the forest had cash income below average, and those who said that the Soligas should be given responsibility to protect the forest had the highest cash income. After the ban cash income from agriculture showed a weak relationship with the view of how to protect the forest (again not significant) ( $p = 0.058$ ;  $R\text{-sq (Adj)} = 3 \%$ ) (Appendix XIII). This time those who had no idea how to protect the forest were the ones with highest cash income and those who thought the Soligas should be given responsibility to protect the forest had below average cash income from agriculture. Results from a variance analysis between perception on protection and the effects the ban has had on cash income ( $p = 0.042$ ;  $R\text{-sq (Adj)} = 3.6 \%$ ) (Appendix XIII) shows a significant relationship where those most affected by the ban wants the responsibility to protect the forest. Those least affected have no idea how to protect, and those in favour of the FD protecting the forest are between the two.

This shows that most of the Soligas are engaged in and positive to the concept of conservation. However, the Soligas' attitudes towards protection of the forest fluctuate

between several variables. Other studies have shown that when local people are participating and receive benefits from conservation, they have positive attitudes towards conservation (IUCN 2000; Nanjundaiah 2008; Vedeld 2002). Many respondents said that they were the only ones who knew how to protect the forest. There was also a common perception among the Soligas that the forest had been in a better condition before the Wildlife Protection Act 1972, when there were no Lantana covering the forest floor. Because seasonal fires were banned after the establishing of the Sanctuary, weeds now grew uncontrolled. The fires also used to control the population of parasitic plants and ticks. Many felt that there were nothing they could do to save the forest any more, and that due to the extensive undergrowth, mainly consisting of Lantana, which has sprung up in the absence of regular, controlled fires, a forest fire could now burn down the entire forest.

Older people would talk about how they used to dwell in the interior of the forest, collect NTFPs, cultivate the land and manage pests and weeds by seasonal fires. “Back then the forest was in a good condition, the forest was healthy, now the forest is sick” (personal communication, interviewee, 2007). These older people would be resentful to the way the Forest Department has protected the forest, and would say that the only way to protect their forest is to give them the responsibility and to allow seasonal, controlled forest fires.

Many of the younger respondents did not know about the ways of living before the Wildlife Protection Act 1972. Now they have electricity, televisions, their children go to school and they have non-forest based employment opportunities, and they express more positive attitudes, also towards the Forest Departments’ way of conserving the forest.

Thus, the notion that there are positive attitudes towards conservation when there are benefits for local people (Bawa et al. 2007; Hegde et al. 1996; Sekhar 2003) coincide with findings in this study among the Soligas in BR Hills.

NTFP collection for forest dwellers in India is important, not only as an income source but also to preserve their social and cultural heritage (Das 2005). The Soligas’ dependence on the forest and its resources should not be considered only from an economic viewpoint, because the forest, to the Soligas, is so much more. It is their history and culture, and some expressed that the forest is their mother. The forest is the basis for their livelihoods, it is an essential part of their identity and their religion, and their dependence on NTFPs is only a part of what the

forest means to them. The Soligas can name all of the plant species in the area, they know the habitats, can identify animals through smells, sound and trails, and recognise alarm signals from birds. They pray to animal gods and they have conserved the forest for centuries (Madegowda 2009).

Conservation can improve development by sustainable resource use to support livelihoods (Campese et al. 2009) and conservation can be improved where people's rights and access to resources are secured (Borrini-Feyerabend et al. 2004). Denying the Soligas access to NTFPs can lead to loss of or reduced knowledge about its use. Children are now encouraged to attend school, and less time spent on learning about ancient usage of forest products can lead to a loss of valuable traditional knowledge.

*Summing up: The Soligas have inherent knowledge of the forest and its resources. Most of the Soligas (56 %) thinks that by giving them the responsibility of protecting the forest it will be best protected. The Soligas care for the forest and their entire history of culture and social life revolves around the forest.*

#### **5.3.4 The Soligas' Attitudes Towards the Forest Department**

The Soligas have not been part of the policymaking in conserving the BR Hills, but they have been given information and been educated on sustainable harvesting of NTFPs by ATREE staff (ATREE 2005). There has also been initiated capacity building, such as participatory resource monitoring where LAMPS, VGKK and ATREE have collaborated to educate the Soligas on how to sustainably harvest NTFPs for commercial use (Bawa et al. 2007).

Before the ban the relationship between the Soligas and the Forest Department was said to be relatively good. The Soligas were allowed to continue the collection of NTFPs for commercial use (even after the official memorandum banned all collection in 2004) and in return the Soligas helped the FD with forest works, fire fighting, and reporting illegal activities.

After the implementation of the ban in BR Hills, eighty-three per cent said they still reported illegal activity in the forest to the Forest Department, and would help them fight forest fires, 11 % would not report illegal activity in the forest or help fight fires, and 6 % would only help

fight fires. When asked why they would help the forest officials, 47 % said they helped forest officials out of fear of punishment, 19 % said they helped because they had responsibility to the forest, and 31 % helped because of payment or they would want to please the forest officials so they could enter the forest. The respondents that did not help the forest officials said it was because they had taken the forest from the Soligas and that they would not be harassed to do the forest officials' work. Some were antagonistic towards the Forest Department and would use this opportunity to retaliate by not helping fight fires.

Right after the ban on NTFPs in 2006, there were several incidents of forest fires around the BR Hills, and the state's forest officials arrested a number of Soligas on the assumption that they had started the fires because of the implementation of the ban (Kothari et al. 2007). This led to further alienation between the forest officials and the Soligas. There have been several cases in India where local people have set fire to the forest to demonstrate their hostile attitudes toward the authorities (Badola 1998; Kothari et al. 2007).

The most important reason for supporting the Forest Department was fear of the FD employees (56 %). Some would say that if they did not help fight fires the FD officers would accuse them of starting the fires. The second most important reason for helping the FD was benefits like job opportunities or that they would be allowed to enter the forest to collect NTFPs without being harassed (38 %). The third reason for helping the FD protect the forest was that it was their (the Soligas) forest and they felt it was their responsibility (24 %) <sup>18</sup>.

Even though local people are positive towards conservation, they will engage in illegal activities and exploitation as long as their livelihood needs are not covered (Kühl et al. 2009). So while positive attitudes are beneficial for conservation, the urgent need for food and income take precedence (Kühl et al. 2009).

Attitude changes require information in order to change the beliefs (Sekhar 2003), mainly through participation and persuasive communication. Letting the Soligas participate in conservation may change their attitude towards the Forest Department officials.

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<sup>18</sup> The percentages do not sum up to be 100 % because several of the respondents gave more than one reason for helping the FD.

The Soligas have become more and more indifferent to the forest condition due to the behaviour of the Forest Departments officials, this is confirmed in other studies (Badola 1998; Kiss 1990). When the Soligas are placed in a situation where they suddenly lose the major part of their cash income, this might lead to a feeling of loss of control over their own life. This again may lead to resentment towards conservation and authority (Kleiven et al. 2004).

*Summing up: The relationship between the Forest Department and the Soligas was said to be good before the ban on NTFP collection for commercial use. However, after the ban this relationship has soured. The Soligas tell stories of harassment and they hardly dare to enter the forest to collect NTFPs for domestic use.*

## 6 CONCLUSIONS AND RECOMMENDATIONS

### 6.1 Conclusions

The aim of this study was to assess livelihood adaptations after the ban on NTFP collection for commercial use. In order to understand present constraints and adaptations, it was necessary to find the distribution of cash income-generating activities and dependence on cash income from NTFP collections before the ban. Households' opportunities and access to assets were made visible through the help of the Sustainable Livelihood Approach (Ellis 2000; Scoones 1998) and the five capitals that describes the households assets and hence access to income.

The Soligas are to a great degree dependent on cash income from NTFP collection, the average dependence being 85.2 %. Ninety-seven per cent of the respondents were engaged in both NTFP collection for domestic and commercial use before the ban. Off-farm activity was the second most important cash income for the Soligas before the ban and fixed employment and casual labour were the two most important cash income-generating activities in this category. Eighty-one per cent of the Soligas owned land, the average size of land being 0.62 ha. Even before the ban 15.3 % of the households were engaged in cash crop cultivation.

After the ban the Soligas turned to off-farm activities, and casual labour (45 %) now constitute the biggest share of the total cash income to the household. However, their cash income is almost halved and most of the respondents suffer from lack of basic needs like food and clothes. A growing number of farmers now rely on cash crops like coffee, and a large share of households have to migrate seasonally to find labour. In addition to this, they are in conflict with the Forest Department and are being harassed if they enter the forest. This has prevented many of the Soligas from collecting NTFPs for domestic use, which means that products they used to collect in the forest, now have to be purchased.

Landless households are, on average, better off than landowners after the ban. This could indicate that households with land struggle to engage in off-farm activity and to migrate seasonally due to coffee and food cultivation.

The diversification after the ban is much the same as before, only without NTFP collection, and the distribution of cash income has shifted from heavily relying on environmental resources to relying on on-farm and off-farm activities.

The Soligas' dependence on NTFP collection for commercial use is relatively equal among the households. Other studies have shown that the poorest households are more dependent on NTFP collection than the wealthier (Byron and Arnold 1999; Mahapatra et al. 2005). This, however, does not seem to be the case in BR Hills. Households in this study were relatively equally dependent on NTFP collection, and this is probably because this study is done among a rather homogenous group of people, who all face the same problems, and who are all thought to be very poor. Further research should be done to compare households both inside and outside the sanctuary.

The oldest respondents were talking about how they used to have all they needed when they were forest dwellers and engaged in shifting cultivation, and lived in their traditional manner. However, almost all the Soligas (74 %) said that they did not fulfil their basic needs after the ban. Before the ban they had enough food and were able to celebrate all the festivals. This is interesting because before the ban they were described as a people "already on the margins of existence" (Kothari et al. 2007), but according to themselves they were happy and fulfilled all their needs. Before being introduced to a more modern cash-based economy and realising that other, non-tribal people have more than themselves, the Soligas had no reason to feel poor, as long as their needs were fulfilled. Also, restricted use of the forest has undermined them as a tribe, not only economically, but socially and culturally.

The Gini coefficient indicates a greater inequality after the ban. This illustrates that NTFP collection used to have an equalising effect on the Soliga households. The growing inequality could be due to the fact that the Soligas, increasingly, are moving towards a modern, cash-based market economy, where inequality is a major driver for economic growth. Growth is the main objective in modern economy and this is bound to leave some worse off than others.

Most of the respondents did not think that NTFP collection degraded the forest. On the contrary, they thought that the best way to protect the forest was if they were given the responsibility to protect the forest. While collecting NTFPs they would cut down branches infected with pest, remove Lantana, and be able to report illegal activity in the forest. Almost

everyone agreed that the Forest Departments' way of protecting the forest had in fact destroyed the forest. Banning seasonal fires had allowed Lantana to cover the forest floor, which has thus led to numerous other problems.

The Soligas' relationship with the Forest Department has become rather unpleasant after the ban. FD officials would harass people entering the forest believing they would collect NTFP for commercial use, or start fires. This has led to many of the Soligas being afraid to collect NTFPs even for domestic use, which is still legal. Also, only 21 % of the respondents knew why the ban had been introduced in the first place.

Lack of information, the feeling of being left out of the process, lack of control over one's own life, uncertainty regarding the future, and harassment by officials; all these factors have left the Soligas antagonistic towards the Forest Department and alienated to the forest that for centuries has been the basis of their livelihood, and has left them to a small degree indifferent to conservation. Conflicts between local people and conservation are according to the Food and Agriculture Organization (FAO) (2008) among the main threats to conservation of different species.

Suffering among local people leads to conflicts, which leads to lack of support for conservation, which leads to lack of respect towards the Forest Department and the forest resources and this again leads to illegal activity (Apte and Kothari 2000).

It is important to remember that this study was done only a year and a half after the ban was implemented, so the Soligas are expected to be in a transitional stage of their adaptations after the ban. Further studies are needed to look at how they will adapt to this shock, and what the final outcome will be.

Tribes in India are today, to a varying degree, developing a modern way of living and moving towards a modern, cash-based economy (Ninan 2006). This is probably the biggest threat to conservation. The tribal economy was based on and closely connected to the forest (Ninan 2006), and hardly had any negative impact on the forest. Today, however, with the growing populations of forest dwelling people and with their growing development toward a modern way of living, they are posing a bigger threat to the conservation of the forest. Improved infrastructure, growing markets, education, health facilities, electricity and the increasing

need for cash income is hard to combine with a protected area. The biggest argument for allowing local people to dwell and use the forest has been that they are extracting resources in a sustainable manner. When this no longer is the case, arguing against restrictions of the forest will be difficult.

The development towards a cash-based economy creates new challenges for the Soligas, the Forest Department, and the conservation of the forest. First the Soligas were forced to resettle permanently to protect the forest, when they were still practising subsistence economy and by all records not degrading the forest. Then the Soligas, when they finally manage to create a stable cash income based mainly on commercialisation of NTFPs, are once again left deprived when the FD bans NTFP collection. The Forest Department has to put into practice restrictions implemented by the State to people who are becoming increasingly antagonistic towards them.

A big loser in this battle is the forest and its wildlife. The Soligas are trying to maintain their strong bond to the forest, claiming that they are the only ones who know how to protect the forest, and at the same time develop livelihood strategies in order to reduce their vulnerability. The Forest Department on the other side, is claiming that the Soligas' presence is degrading the forest, and that they have the proper means to conserve nature by restricting all use and activity in the forest. The lesson learned from other cases around the world is that with the aim of best conserving a populated forest, one needs to include all stakeholders, especially local people whose livelihoods depend the most on forest resources. So far, however, both the forest and the Soligas are suffering.

The deforestation rates in the World and India are critical, and the growing number of people, both inside and outside the forests, create a major impact on the forest and its' resources. Loss of species and habitats is increasing at an alarming rate all over the World. In order to save e.g. the tiger, some areas need protection. Even though tribes and forest dwellers have lived in harmony with large animals and nature for millennia, there is no guarantee that this will be the case in the future. Development takes place, schemes and projects are implemented to see that the poorest peoples' livelihoods are improved. However, in many areas this is done at the expense of nature.

There are around 60 million forest dwellers around the world today who are almost entirely dependent on forest resources to sustain their livelihoods. At the same time the annual loss of forests is around 13 million ha. We need to secure forest dwellers' livelihoods and we need to stop forest degradation.

## 6.2 Recommendations

- The Soligas have extensive knowledge about the forest and all its components, and this is valuable knowledge which has been overlooked for many years. Wildlife policies should take local people into consideration when planning conservation, to ensure people's livelihoods, to avoid future conflicts and to achieve the best way of protecting nature. Traditional practises should be respected and encouraged, since these have the least negative impact on the forest.
- For people and wildlife to coexist, there are several prerequisites that need to be met. Traditional activities usually have very low impact on natural resources, but commercialisation on NTFPs are more extensive than collection for domestic use, hence there ought to be monitoring and further research on NTFP extraction and how it affects the forest. The Soligas should be given responsibilities, and could, in addition to collecting NTFPs look out for poachers and other illegal activity in the forest. Prevention of fire, weeding and in case of fire help fight it are activities the Soligas are happy to perform when their needs are fulfilled. The Soligas should be part of the planning, implementation and monitoring of the different conservation activities.
- The Soligas should be compensated for resources "lost" to conservation.
- The Soligas need alternative sources of cash income-generating activities. If the Forest Department can offer the Soligas casual labour or fixed employment working for conservation of the forest, it would be favourable to all parties.
- Increasing human populations are related to increased pressure on nature, but people living in a traditional manner do not have as great an impact on their forest as do

plantations, quarries and mining activities. Low consumer patterns and sustainable land-use patterns are important when combining local people and protected areas.

- In order to achieve the desired attitude and behaviour on community levels, analyses on how economic policies and restrictions are affecting local peoples' behaviour toward natural resources are needed, and from this it is necessary to establish the incentives needed for change (McNeely and Ness 1996).
- Rather than using general management approaches, one could be site specific and use the best solution available for each area. The management of protected areas should not be viewed exclusively as natural science, but as a process involving natural, political, and other social sciences (Vedeld et al. 2001).

Before the ban on NTFP collection for commercial use, the relationship between the Forest Department and the Soligas was relatively good. The aim should be to create communication and cooperation between all the stakeholders in the conservation of BR Hills. The work done by the two NGOs in the Sanctuary, ATREE and VGKK, along with LAMPS all present an opportunity for better cooperation in further conservation of the forest.

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## **Appendix I – Household questionnaire**

Date of interview:

Podu:

Questionnaire number:

Name of interviewee:

Household number and number of workers:

### **Before the Wildlife Protection Act of 1972:**

1. What were your sources of income prior to the Wildlife Protection Act of 1972?

### **Before the ban of NTFP:**

2. What were your sources of income prior to the ban of NTFPs?
3. What was the annual cash income from the different sources?
4. Did you collect NTFPs for domestic use?

### **After the ban:**

1. What are your sources of income now?
2. What is your annual cash income now?
3. Do you own any land? How much land do you own?
4. Are you able to fulfil your family's basic needs?
5. Have you found other sources of income?
6. Are there products you used to collect for domestic use that you can't collect anymore?
7. Has anybody in this settlement migrated permanently after the ban of NTFP?
8. Has anybody in this settlement migrated seasonally after the ban of NTFP?
9. What do you need to improve your livelihood?

### **About the forest:**

10. Why do you think the government banned the collection of NTFP for commercial use?
11. Do you report to the government when you see illegal activity by people from outside?
12. Do you help prevent and fight forest fires?
13. Why do/don't you help the FD?
14. Do you extract NTFPs from the forest illegally?
15. Do you think that the collection of NTFP for commercial use is degrading the forest?
16. What do you think is the best way of protecting the forest?

## Appendix II – Total cash income

### Bivariate Fit of Total cash income, BB By Cash income from NTFP BB

#### Linear Fit

Total cash income, BB = 10642.227 + 0.8614441\*Cash income from NTFP BB

#### Summary of Fit

RSquare	0.732858
RSquare Adj	0.730668
Root Mean Square Error	12764.82
Mean of Response	39968.15
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	5.4534e+10	5.453e+10	334.6853
Error	122	1.9879e+10	162940532	<b>Prob &gt; F</b>
C. Total	123	7.4413e+10		<.0001

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	10642.227	1970.696	5.40	<.0001
Cash income from NTFP BB	0.8614441	0.047088	18.29	<.0001

### Bivariate Fit of Total cash income, BB By Off-farm bb

#### Linear Fit

Total cash income, BB = 37522.285 + 0.4772786\*Off-farm bb

#### Summary of Fit

RSquare	0.063961
RSquare Adj	0.056289
Root Mean Square Error	23894.06
Mean of Response	39968.15
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4759534945	4.7595e+9	8.3365
Error	122	6.9653e+10	570926331	<b>Prob &gt; F</b>
C. Total	123	7.4413e+10		0.0046

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	37522.285	2306.911	16.27	<.0001
Off-farm bb	0.4772786	0.165303	2.89	0.0046

### Bivariate Fit of Income from agriculture AB By Income after the ban (AB)

#### Linear Fit

Income from agriculture AB = 3175.684 + 0.083024\*Income after the ban (AB)

#### Summary of Fit

RSquare	0.0405
RSquare Adj	0.032635
Root Mean Square Error	8685.023
Mean of Response	4988.71
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	388429599	388429599	5.1496
Error	122	9202414594	75429628	<b>Prob &gt; F</b>
C. Total	123	9590844194		0.0250

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	3175.684	1116.522	2.84	0.0052
Income after the ban (AB)	0.083024	0.036586	2.27	0.0250

### Bivariate Fit of Off-farm ab By Income after the ban (AB)

#### Linear Fit

Off-farm ab = -3952.766 + 0.9037397\*Income after the ban (AB)

#### Summary of Fit

RSquare	0.821446
RSquare Adj	0.819982
Root Mean Square Error	9055.49
Mean of Response	15782.53
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4.6025e+10	4.602e+10	561.2649
Error	122	1.0004e+10	82001898	<b>Prob &gt; F</b>
C. Total	123	5.6029e+10		<.0001

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-3952.766	1164.149	-3.40	0.0009
Income after the ban (AB)	0.9037397	0.038147	23.69	<.0001

## Appendix III – Total cash income, NTFP cash income excluded

### Bivariate Fit of TI-e bb By Off-farm bb

#### Linear Fit

TI-e bb = 873.61948 + 0.9857915\*Off-farm bb

#### Summary of Fit

RSquare	0.953728
RSquare Adj	0.953349
Root Mean Square Error	2841.599
Mean of Response	5925.403
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2.0304e+10	2.03e+10	2514.577
Error	122	985111796	8074686.8	<b>Prob &gt; F</b>
C. Total	123	2.129e+10		<.0001

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	873.61948	274.3492	3.18	0.0018
Off-farm bb	0.9857915	0.019659	50.15	<.0001

### Bivariate Fit of TI-e bb By Cash income from Farming BB

#### Linear Fit

TI-e bb = 5367.853 + 0.7239396\*Cash income from Farming BB

#### Summary of Fit

RSquare	0.022964
RSquare Adj	0.014956
Root Mean Square Error	13057.45
Mean of Response	5925.403
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	488901012	488901012	2.8675
Error	122	2.0801e+10	170496984	<b>Prob &gt; F</b>
C. Total	123	2.129e+10		0.0929

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	5367.853	1217.943	4.41	<.0001
Cash income from Farming BB	0.7239396	0.427514	1.69	0.0929

# Appendix IV – Household number and number of workers (BB)

## Bivariate Fit of HH number By Total cash income, BB

Linear Fit					
HH number = 3.8514833 + 2.2279e-5*Total cash income, BB					
Summary of Fit					
RSquare		0.09625			
RSquare Adj		0.088842			
Root Mean Square Error		1.686025			
Mean of Response		4.741935			
Observations (or Sum Wgts)		124			
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	36.93511	36.9351	12.9931	
Error	122	346.80683	2.8427	<b>Prob &gt; F</b>	
C. Total	123	383.74194		0.0005	
Parameter Estimates					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		3.8514833	0.289741	13.29	<.0001
Total cash income, BB		2.2279e-5	6.181e-6	3.60	0.0005

## Bivariate Fit of Number of workers in hh By Total cash income, BB

Linear Fit					
Number of workers in hh = 1.2617879 + 0.0000215*Total cash income, BB					
Summary of Fit					
RSquare		0.250656			
RSquare Adj		0.244514			
Root Mean Square Error		0.917941			
Mean of Response		2.120968			
Observations (or Sum Wgts)		124			
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	34.38637	34.3864	40.8091	
Error	122	102.79912	0.8426	<b>Prob &gt; F</b>	
C. Total	123	137.18548		<.0001	
Parameter Estimates					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		1.2617879	0.157747	8.00	<.0001
Total cash income, BB		0.0000215	3.365e-6	6.39	<.0001

## Bivariate Fit of HH number By Cash income from NTFP BB

Linear Fit					
HH number = 3.8610856 + 2.5875e-5*Cash income from NTFP BB					
Summary of Fit					
RSquare		0.128212			
RSquare Adj		0.121066			
Root Mean Square Error		1.655943			
Mean of Response		4.741935			
Observations (or Sum Wgts)		124			
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	49.20014	49.2001	17.9422	
Error	122	334.54180	2.7421	<b>Prob &gt; F</b>	
C. Total	123	383.74194		<.0001	
Parameter Estimates					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		3.8610856	0.255653	15.10	<.0001
Cash income from NTFP BB		2.5875e-5	6.109e-6	4.24	<.0001

### Bivariate Fit of Number of workers in hh By Cash income from NTFP BB

#### Linear Fit

Number of workers in hh = 1.3290655 + 2.3262e-5\*Cash income from NTFP BB

#### Summary of Fit

RSquare	0.289866
RSquare Adj	0.284045
Root Mean Square Error	0.893602
Mean of Response	2.120968
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	39.76543	39.7654	49.7986
Error	122	97.42005	0.7985	<b>Prob &gt; F</b>
C. Total	123	137.18548		<.0001

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	1.3290655	0.137959	9.63	<.0001
Cash income from NTFP BB	2.3262e-5	3.296e-6	7.06	<.0001

### Bivariate Fit of HH number By Cash income from Farming BB

#### Linear Fit

HH number = 4.7350458 + 8.9458e-6\*Cash income from Farming BB

#### Summary of Fit

RSquare	0.000195
RSquare Adj	-0.008
Root Mean Square Error	1.773362
Mean of Response	4.741935
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.07465	0.07465	0.0237
Error	122	383.66728	3.14481	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.8778

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.7350458	0.165412	28.63	<.0001
Cash income from Farming BB	8.9458e-6	0.000058	0.15	0.8778

### Bivariate Fit of Number of workers in hh By Cash income from Farming BB

#### Linear Fit

Number of workers in hh = 2.1040038 + 2.2026e-5\*Cash income from Farming BB

#### Summary of Fit

RSquare	0.003299
RSquare Adj	-0.00487
Root Mean Square Error	1.05866
Mean of Response	2.120968
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.45259	0.45259	0.4038
Error	122	136.73289	1.12076	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.5263

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2.1040038	0.098747	21.31	<.0001
Cash income from Farming BB	2.2026e-5	3.466e-5	0.64	0.5263

### Bivariate Fit of HH number By Off-farm bb

#### Linear Fit

HH number = 4.7996598 - 1.1264e-5\*Off-farm bb

#### Summary of Fit

RSquare	0.006908
RSquare Adj	-0.00123
Root Mean Square Error	1.767398
Mean of Response	4.741935
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2.65105	2.65105	0.8487
Error	122	381.09088	3.12370	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.3587

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.7996598	0.170638	28.13	<.0001
Off-farm bb	-1.126e-5	1.223e-5	-0.92	0.3587

### Bivariate Fit of Number of workers in hh By Off-farm bb

#### Linear Fit

Number of workers in hh = 2.1535218 - 6.3525e-6\*Off-farm bb

#### Summary of Fit

RSquare	0.006146
RSquare Adj	-0.002
Root Mean Square Error	1.057147
Mean of Response	2.120968
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.84316	0.84316	0.7545
Error	122	136.34232	1.11756	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.3868

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2.1535218	0.102065	21.10	<.0001
Off-farm bb	-6.353e-6	7.313e-6	-0.87	0.3868

### Bivariate Fit of REI bb By HH number

#### Linear Fit

REI bb = 0.7399902 + 0.0211024\*HH number

#### Summary of Fit

RSquare	0.020519
RSquare Adj	0.012491
Root Mean Square Error	0.258576
Mean of Response	0.840056
Observations (or Sum Wgts)	124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.1708840	0.170884	2.5558
Error	122	8.1571064	0.066862	<b>Prob &gt; F</b>
C. Total	123	8.3279904		0.1125

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.7399902	0.066761	11.08	<.0001
HH number	0.0211024	0.0132	1.60	0.1125

### Bivariate Fit of REI bb By Number of workers in hh

#### Linear Fit

REI bb = 0.771739 + 0.0322104\*Number of workers in hh

#### Summary of Fit

RSquare	0.017091
RSquare Adj	0.009034
Root Mean Square Error	0.259028
Mean of Response	0.840056
Observations (or Sum Wgts)	124

<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.1423317	0.142332	2.1213
Error	122	8.1856587	0.067096	<b>Prob &gt; F</b>
C. Total	123	8.3279904		0.1478

<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.771739	0.052357	14.74	<.0001
Number of workers in hh	0.0322104	0.022115	1.46	0.1478

## Appendix V – Land size

### Bivariate Fit of Total cash income, BB By Hectares of land

<b>Linear Fit</b>				
Total cash income, BB = 36482.77 + 5634.0303*Hectares of land				
<b>Summary of Fit</b>				
RSquare		0.01436		
RSquare Adj		0.006281		
Root Mean Square Error		24518.98		
Mean of Response		39968.15		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1068530377	1.0685e+9	1.7774
Error	122	7.3344e+10	601180466	<b>Prob &gt; F</b>
C. Total	123	7.4413e+10		0.1850
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	36482.77	3418.024	10.67	<.0001
Hectares of land	5634.0303	4225.987	1.33	0.1850

### Relative environmental cash income to hectare (range):

<b>Summary of Fit</b>					
RSquare		0.105449			
RSquare Adj		0.083085			
Root Mean Square Error		0.249162			
Mean of Response		0.840056			
Observations (or Sum Wgts)		124			
<b>Analysis of Variance</b>					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	3	0.8781751	0.292725	4.7152	
Error	120	7.4498153	0.062082	<b>Prob &gt; F</b>	
C. Total	123	8.3279904		0.0038	
<b>Effect Tests</b>					
Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Ha (range)	3	3	0.87817511	4.7152	0.0038
<b>Least Squares Means Table</b>					
Level	Least Sq Mean	Std Error	Mean		
1	0.67901527	0.05195391	0.679015		
2	0.91390198	0.03844656	0.913902		
3	0.87694863	0.04475085	0.876949		
4	0.82072634	0.04708723	0.820726		

### Bivariate Fit of HH number By Hectares of land

<b>Linear Fit</b>				
HH number = 4.4402513 + 0.4876657*Hectares of land				
<b>Summary of Fit</b>				
RSquare		0.020862		
RSquare Adj		0.012836		
Root Mean Square Error		1.754938		
Mean of Response		4.741935		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	8.00558	8.00558	2.5994
Error	122	375.73635	3.07981	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.1095

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.4402513	0.244644	18.15	<.0001
Hectares of land	0.4876657	0.302474	1.61	0.1095

### Bivariate Fit of Number of workers in hh By Hectares of land

**Linear Fit**  
Number of workers in hh = 1.7637026 + 0.5775111\*Hectares of land

**Summary of Fit**

RSquare	0.081839
RSquare Adj	0.074313
Root Mean Square Error	1.016093
Mean of Response	2.120968
Observations (or Sum Wgts)	124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.22714	11.2271	10.8743
Error	122	125.95834	1.0324	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.0013

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	1.7637026	0.141647	12.45	<.0001
Hectares of land	0.5775111	0.175129	3.30	0.0013

### Bivariate Fit of Cash income from Farming BB By Hectares of land

**Linear Fit**  
Cash income from Farming BB = 227.46249 + 877.26048\*Hectares of land

**Summary of Fit**

RSquare	0.027771
RSquare Adj	0.019802
Root Mean Square Error	2726.544
Mean of Response	770.1613
Observations (or Sum Wgts)	124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	25906316	25906316	3.4848
Error	122	906953281	7434043.3	<b>Prob &gt; F</b>
C. Total	123	932859597		0.0643

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	227.46249	380.089	0.60	0.5507
Hectares of land	877.26048	469.9355	1.87	0.0643

### Bivariate Fit of Coffee AB By Hectares of land

**Linear Fit**  
Coffee = 134.82582 + 169.22954\*Hectares of land

**Summary of Fit**

RSquare	0.008062
RSquare Adj	-6.84e-5
Root Mean Square Error	986.0183
Mean of Response	239.5161
Observations (or Sum Wgts)	124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	964053	964053	0.9916
Error	122	118612318	972232	<b>Prob &gt; F</b>
C. Total	123	119576371		0.3213

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	134.82582	137.4541	0.98	0.3286
Hectares of land	169.22954	169.9459	1.00	0.3213

### Bivariate Fit of Income from agriculture AB By Hectares of land

<b>Linear Fit</b>					
Income from agriculture AB = 2027.1139 + 4787.3533*Hectares of land					
<b>Summary of Fit</b>					
RSquare		0.080442			
RSquare Adj		0.072905			
Root Mean Square Error		8502.332			
Mean of Response		4988.71			
Observations (or Sum Wgts)		124			
<b>Analysis of Variance</b>					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	771506312	771506312	10.6724	
Error	122	8819337882	72289655	<b>Prob &gt; F</b>	
C. Total	123	9590844194		0.0014	
<b>Parameter Estimates</b>					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		2027.1139	1185.252	1.71	0.0898
Hectares of land		4787.3533	1465.426	3.27	0.0014

### Bivariate Fit of Coffee (included in farm) 2 By Hectares of land

<b>Linear Fit</b>					
Coffee (included in farm) 2 = 1140.6957 + 4108.3787*Hectares of land					
<b>Summary of Fit</b>					
RSquare		0.074296			
RSquare Adj		0.066709			
Root Mean Square Error		7617.579			
Mean of Response		3682.258			
Observations (or Sum Wgts)		124			
<b>Analysis of Variance</b>					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	568184600	568184600	9.7916	
Error	122	7079356368	58027511	<b>Prob &gt; F</b>	
C. Total	123	7647540968		0.0022	
<b>Parameter Estimates</b>					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		1140.6957	1061.915	1.07	0.2849
Hectares of land		4108.3787	1312.933	3.13	0.0022

### Bivariate Fit of NTFP AB By Hectares of land

<b>Linear Fit</b>					
NTFP AB = 1514.3878 - 874.51551*Hectares of land					
<b>Summary of Fit</b>					
RSquare		0.013146			
RSquare Adj		0.005057			
Root Mean Square Error		3980.009			
Mean of Response		973.3871			
Observations (or Sum Wgts)		124			
<b>Analysis of Variance</b>					
Source	DF	Sum of Squares	Mean Square	F Ratio	
Model	1	25744445.9	25744446	1.6252	
Error	122	1932537732	15840473	<b>Prob &gt; F</b>	
C. Total	123	1958282177		0.2048	
<b>Parameter Estimates</b>					
Term		Estimate	Std Error	t Ratio	Prob> t
Intercept		1514.3878	554.826	2.73	0.0073
Hectares of land		-874.5155	685.9774	-1.27	0.2048

# Appendix VI – Distance to the main road and the Temple

## Bivariate Fit of Distance to Main road By Total cash income, BB

### Linear Fit

Distance to Main road = 0.6008481 - 7.0725e-7\*Total cash income, BB

### Summary of Fit

RSquare	0.000258
RSquare Adj	-0.00794
Root Mean Square Error	1.087596
Mean of Response	0.572581
Observations (or Sum Wgts)	124

### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.03722	0.03722	0.0315
Error	122	144.30955	1.18287	<b>Prob &gt; F</b>
C. Total	123	144.34677		0.8595

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.6008481	0.186902	3.21	0.0017
Total cash income, BB	-7.073e-7	3.987e-6	-0.18	0.8595

## Bivariate Fit of Distance to Main road By Cash income from NTFP BB

### Linear Fit

Distance to Main road = 0.4838385 + 2.6068e-6\*Cash income from NTFP BB

### Summary of Fit

RSquare	0.00346
RSquare Adj	-0.00471
Root Mean Square Error	1.085853
Mean of Response	0.572581
Observations (or Sum Wgts)	124

### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.49937	0.49937	0.4235
Error	122	143.84740	1.17908	<b>Prob &gt; F</b>
C. Total	123	144.34677		0.5164

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.4838385	0.167639	2.89	0.0046
Cash income from NTFP BB	2.6068e-6	0.000004	0.65	0.5164

## Bivariate Fit of Distance to Main road By Cash income from Farming BB

### Linear Fit

Distance to Main road = 0.5558884 + 2.1674e-5\*Cash income from Farming BB

### Summary of Fit

RSquare	0.003036
RSquare Adj	-0.00514
Root Mean Square Error	1.086084
Mean of Response	0.572581
Observations (or Sum Wgts)	124

### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.43821	0.43821	0.3715
Error	122	143.90856	1.17958	<b>Prob &gt; F</b>
C. Total	123	144.34677		0.5433

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.5558884	0.101305	5.49	<.0001
Cash income from Farming BB	2.1674e-5	3.556e-5	0.61	0.5433

## Bivariate Fit of Distance to Main road By Off-farm bb

### Linear Fit

Distance to Main road = 0.6404304 - 1.324e-5\*Off-farm bb

### Summary of Fit

RSquare	0.025374
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RSquare Adj		0.017385		
Root Mean Square Error		1.073847		
Mean of Response		0.572581		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	3.66267	3.66267	3.1762
Error	122	140.68410	1.15315	<b>Prob &gt; F</b>
C. Total	123	144.34677		0.0772
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		0.6404304	0.103677	6.18
Off-farm bb		-1.324e-5	7.429e-6	-1.78
				<b>Prob&gt; t </b>
				<.0001
				0.0772

### Bivariate Fit of Distance to Main road By non-farm pension only

<b>Linear Fit</b>				
Distance to Main road = 0.5508475 + 1.024e-5*non-farm pension only				
<b>Summary of Fit</b>				
RSquare		8.373e-5		
RSquare Adj		-0.00818		
Root Mean Square Error		1.069467		
Mean of Response		0.552846		
Observations (or Sum Wgts)		123		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	0.01159	0.01159	0.0101
Error	121	138.39492	1.14376	<b>Prob &gt; F</b>
C. Total	122	138.40650		0.9200
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		0.5508475	0.098452	5.60
non-farm pension only		1.024e-5	0.000102	0.10
				<b>Prob&gt; t </b>
				<.0001
				0.9200

### Bivariate Fit of REI bb By Distance to Main road

<b>Linear Fit</b>				
REI bb = 0.8190215 + 0.0367369*Distance to Main road				
<b>Summary of Fit</b>				
RSquare		0.023392		
RSquare Adj		0.015387		
Root Mean Square Error		0.258196		
Mean of Response		0.840056		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	0.1948103	0.194810	2.9222
Error	122	8.1331801	0.066665	<b>Prob &gt; F</b>
C. Total	123	8.3279904		0.0899
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		0.8190215	0.02625	31.20
Distance to Main road		0.0367369	0.021491	1.71
				<b>Prob&gt; t </b>
				<.0001
				0.0899

### Distance to Temple before the ban

### Bivariate Fit of Distance to Temple By Total cash income, BB

<b>Linear Fit</b>				
Distance to Temple = 5.2432368 + 2.0548e-5*Total cash income, BB				
<b>Summary of Fit</b>				
RSquare		0.002628		
RSquare Adj		-0.00555		
Root Mean Square Error		9.886265		
Mean of Response		6.064516		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	31.420	31.4195	0.3215
Error	122	11924.064	97.7382	<b>Prob &gt; F</b>

C. Total	123	11955.484		0.5718
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		5.2432368	1.698943	3.09
Total cash income, BB		2.0548e-5	3.624e-5	0.57
				0.5718

### Bivariate Fit of Distance to Temple By Cash income from NTFP BB

<b>Linear Fit</b>				
Distance to Temple = 4.277281 + 0.0000525*Cash income from NTFP BB				
<b>Summary of Fit</b>				
RSquare		0.016942		
RSquare Adj		0.008884		
Root Mean Square Error		9.815067		
Mean of Response		6.064516		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	202.547	202.547	2.1025
Error	122	11752.937	96.336	<b>Prob &gt; F</b>
C. Total	123	11955.484		0.1496
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		4.277281	1.515299	2.82
Cash income from NTFP BB		0.0000525	3.621e-5	1.45
				0.1496

### Bivariate Fit of Distance to Temple By Cash income from Farming BB

<b>Linear Fit</b>				
Distance to Temple = 6.4039675 - 0.0004408*Cash income from Farming BB				
<b>Summary of Fit</b>				
RSquare		0.015158		
RSquare Adj		0.007085		
Root Mean Square Error		9.823968		
Mean of Response		6.064516		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	181.221	181.221	1.8777
Error	122	11774.263	96.510	<b>Prob &gt; F</b>
C. Total	123	11955.484		0.1731
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		6.4039675	0.916337	6.99
Cash income from Farming BB		-0.000441	0.000322	-1.37
				0.1731

### Bivariate Fit of Distance to Temple By Off-farm bb

<b>Linear Fit</b>				
Distance to Temple = 6.5386656 - 9.2524e-5*Off-farm bb				
<b>Summary of Fit</b>				
RSquare		0.014961		
RSquare Adj		0.006887		
Root Mean Square Error		9.82495		
Mean of Response		6.064516		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
<b>Source</b>	<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Model	1	178.868	178.868	1.8530
Error	122	11776.616	96.530	<b>Prob &gt; F</b>
C. Total	123	11955.484		0.1759
<b>Parameter Estimates</b>				
<b>Term</b>		<b>Estimate</b>	<b>Std Error</b>	<b>t Ratio</b>
Intercept		6.5386656	0.948574	6.89
Off-farm bb		-9.252e-5	0.000068	-1.36
				0.1759

### Bivariate Fit of Distance to Temple By Non-farm BB

<b>Linear Fit</b>				
Distance to Temple = 6.0487805 + 0.0004065*Non-farm BB				

<b>Summary of Fit</b>				
RSquare			0.000316	
RSquare Adj			-0.00788	
Root Mean Square Error			9.897718	
Mean of Response			6.064516	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3.777	3.7766	0.0386
Error	122	11951.707	97.9648	<b>Prob &gt; F</b>
C. Total	123	11955.484		0.8447
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	6.0487805	0.892447	6.78	<.0001
Non-farm BB	0.0004065	0.00207	0.20	0.8447

## Appendix VII – Effect variable

### Response Effect variable

<b>Actual by Predicted Plot</b>				
<b>Summary of Fit</b>				
RSquare			0,092026	
RSquare Adj			0,069327	
Root Mean Square Error			26005,05	
Mean of Response			18130,77	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	3	8224963317	2,7417e+9	4,0541
Error	120	8,1152e+10	676262604	<b>Prob &gt; F</b>
C. Total	123	8,9376e+10		0,0088
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4150,8468	7037,545	0,59	0,5564
HH number	-977,3652	1610,698	-0,61	0,5451
Number of workers in hh	8227,2559	2781,905	2,96	0,0037
Hectares of land	1882,8504	4678,757	0,40	0,6881

### Bivariate Fit of Total cash income, BB By Effect variable

<b>Linear Fit</b>				
Total cash income, BB = 29070.835 + 0.6010394*Effect variable				
<b>Summary of Fit</b>				
RSquare			0.433893	
RSquare Adj			0.429253	
Root Mean Square Error			18581.99	
Mean of Response			39968.15	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	3.2287e+10	3.229e+10	93.5071
Error	122	4.2125e+10	345290476	<b>Prob &gt; F</b>
C. Total	123	7.4413e+10		<.0001
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	29070.835	2013.597	14.44	<.0001
Effect variable	0.6010394	0.062156	9.67	<.0001

## Appendix VIII - Household number and number of workers (AB)

### Bivariate Fit of HH number By Income after the ban (AB)

#### Linear Fit

HH number = 4.3801823 + 1.6566e-5\*Income after the ban (AB)

#### Summary of Fit

RSquare 0.040299  
 RSquare Adj 0.032432  
 Root Mean Square Error 1.737432  
 Mean of Response 4.741935  
 Observations (or Sum Wgts) 124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	15.46426	15.4643	5.1229
Error	122	368.27768	3.0187	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.0254

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.3801823	0.223359	19.61	<.0001
Income after the ban (AB)	1.6566e-5	7.319e-6	2.26	0.0254

### Bivariate Fit of Number of workers in hh By Income after the ban (AB)

#### Linear Fit

Number of workers in hh = 1.9034578 + 9.9604e-6\*Income after the ban (AB)

#### Summary of Fit

RSquare 0.040753  
 RSquare Adj 0.03289  
 Root Mean Square Error 1.038579  
 Mean of Response 2.120968  
 Observations (or Sum Wgts) 124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	5.59065	5.59065	5.1830
Error	122	131.59483	1.07865	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.0246

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	1.9034578	0.133517	14.26	<.0001
Income after the ban (AB)	9.9604e-6	4.375e-6	2.28	0.0246

### Bivariate Fit of HH number By NTFP AB

#### Linear Fit

HH number = 4.7216313 + 2.0859e-5\*NTFP AB

#### Summary of Fit

RSquare 0.00222  
 RSquare Adj -0.00596  
 Root Mean Square Error 1.771565  
 Mean of Response 4.741935  
 Observations (or Sum Wgts) 124

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.85207	0.85207	0.2715
Error	122	382.88987	3.13844	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.6033

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.7216313	0.163794	28.83	<.0001
NTFP AB	2.0859e-5	0.00004	0.52	0.6033

### Bivariate Fit of Number of workers in hh By NTFP AB

#### Linear Fit

Number of workers in hh = 2.1572039 - 3.7227e-5\*NTFP AB

**Summary of Fit**

RSquare 0.019783  
 RSquare Adj 0.011748  
 Root Mean Square Error 1.04987  
 Mean of Response 2.120968  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2.71387	2.71387	2.4622
Error	122	134.47161	1.10223	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.1192

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2.1572039	0.097068	22.22	<.0001
NTFP AB	-3.723e-5	2.372e-5	-1.57	0.1192

**Bivariate Fit of HH number By Income from agriculture AB****Linear Fit**

HH number = 4.9112773 - 3.3945e-5\*Income from agriculture AB

**Summary of Fit**

RSquare 0.028798  
 RSquare Adj 0.020838  
 Root Mean Square Error 1.747811  
 Mean of Response 4.741935  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	11.05118	11.0512	3.6176
Error	122	372.69075	3.0548	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.0595

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.9112773	0.180452	27.22	<.0001
Income from agriculture AB	-0.000034	1.785e-5	-1.90	0.0595

**Bivariate Fit of Number of workers in hh By Income from agriculture AB****Linear Fit**

Number of workers in hh = 2.064443 + 1.1331e-5\*Income from agriculture AB

**Summary of Fit**

RSquare 0.008975  
 RSquare Adj 0.000852  
 Root Mean Square Error 1.055641  
 Mean of Response 2.120968  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.23128	1.23128	1.1049
Error	122	135.95420	1.11438	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.2953

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2.064443	0.108989	18.94	<.0001
Income from agriculture AB	1.1331e-5	1.078e-5	1.05	0.2953

**Bivariate Fit of HH number By Off-farm ab****Linear Fit**

HH number = 4.4066878 + 2.1242e-5\*Off-farm ab

**Summary of Fit**

RSquare 0.06588  
 RSquare Adj 0.058223  
 Root Mean Square Error 1.71412  
 Mean of Response 4.741935  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	25.28082	25.2808	8.6042
Error	122	358.46112	2.9382	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.0040

<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	4.4066878	0.191723	22.98	<.0001
Off-farm ab	2.1242e-5	7.242e-6	2.93	0.0040

### Bivariate Fit of Number of workers in hh By Off-farm ab

<b>Linear Fit</b>				
Number of workers in hh = 1.9774188 + 9.0954e-6*Off-farm ab				
<b>Summary of Fit</b>				
RSquare		0.033787		
RSquare Adj		0.025867		
Root Mean Square Error		1.042343		
Mean of Response		2.120968		
Observations (or Sum Wgts)		124		
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	4.63510	4.63510	4.2662
Error	122	132.55038	1.08648	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.0410
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	1.9774188	0.116585	16.96	<.0001
Off-farm ab	9.0954e-6	4.404e-6	2.07	0.0410

## Appendix IX – Lack of basic needs

### Oneway Analysis of Income after the ban (AB) By Lack of cover of basic needs

<b>Oneway Anova</b>					
<b>Summary of Fit</b>					
Rsquare		0.07542			
Adj Rsquare		0.067842			
Root Mean Square Error		20665.45			
Mean of Response		21837.37			
Observations (or Sum Wgts)		124			
<b>t Test</b>					
2-1					
Assuming equal variances					
Difference	13379.5	t Ratio	3.154653		
Std Err Dif	4241.2	DF	122		
Upper CL Dif	21775.3	Prob >  t	0.0020		
Lower CL Dif	4983.6	Prob > t	0.0010		
Confidence	0.95	Prob < t	0.9990		
<b>Analysis of Variance</b>					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Lack of cover of basic needs	1	4250038745	4.25e+9	9.9518	0.0020
Error	122	5.2101e+10	427060747		
C. Total	123	5.6351e+10			
<b>Means for Oneway Anova</b>					
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	92	18384.6	2154.5	14120	22650
2	32	31764.1	3653.2	24532	38996
Std Error uses a pooled estimate of error variance					

# Appendix X – NTFP dependence (Relative Environmental (NTFP) cash income

## Bivariate Fit of Total cash income, BB By REI bb

<b>Linear Fit</b>				
Total cash income, BB = 34123.75 + 6957.1465*REI bb				
<b>Summary of Fit</b>				
RSquare			0.005417	
RSquare Adj			-0.00274	
Root Mean Square Error			24629.96	
Mean of Response			39968.15	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	403090460	403090460	0.6645
Error	122	7.4009e+10	606634892	<b>Prob &gt; F</b>
C. Total	123	7.4413e+10		0.4166
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	34123.75	7503.136	4.55	<.0001
REI bb	6957.1465	8534.805	0.82	0.4166

## Bivariate Fit of Cash income from NTFP BB By REI bb

<b>Linear Fit</b>				
Cash income from NTFP BB = -3220.821 + 44358.412*REI bb				
<b>Summary of Fit</b>				
RSquare			0.222988	
RSquare Adj			0.216619	
Root Mean Square Error			21634.15	
Mean of Response			34042.74	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.6387e+10	1.639e+10	35.0116
Error	122	5.71e+10	468036537	<b>Prob &gt; F</b>
C. Total	123	7.3487e+10		<.0001
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	-3220.821	6590.51	-0.49	0.6259
REI bb	44358.412	7496.694	5.92	<.0001

## Bivariate Fit of Cash income from Farming BB By REI bb

<b>Linear Fit</b>				
Cash income from Farming BB = 2355.533 - 1887.2208*REI bb				
<b>Summary of Fit</b>				
RSquare			0.031796	
RSquare Adj			0.02386	
Root Mean Square Error			2720.895	
Mean of Response			770.1613	
Observations (or Sum Wgts)			124	
<b>Analysis of Variance</b>				
Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	29660989	29660989	4.0065
Error	122	903198608	7403267.3	<b>Prob &gt; F</b>
C. Total	123	932859597		0.0475
<b>Parameter Estimates</b>				
Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	2355.533	828.8784	2.84	0.0053
REI bb	-1887.221	942.8478	-2.00	0.0475

## Bivariate Fit of Off-farm bb By REI bb

<b>Linear Fit</b>				
Off-farm bb = 34973.125 - 35531.581*REI bb				

**Summary of Fit**

RSquare 0.503209  
 RSquare Adj 0.499137  
 Root Mean Square Error 9223.951  
 Mean of Response 5124.597  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	1.0514e+10	1.051e+10	123.5763
Error	122	1.038e+10	85081281	<b>Prob &gt; F</b>
C. Total	123	2.0894e+10		<.0001

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	34973.125	2809.934	12.45	<.0001
REI bb	-35531.58	3196.295	-11.12	<.0001

**Bivariate Fit of HH number By REI bb****Linear Fit**

HH number = 3.9250926 + 0.9723669\*REI bb

**Summary of Fit**

RSquare 0.020519  
 RSquare Adj 0.012491  
 Root Mean Square Error 1.755245  
 Mean of Response 4.741935  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	7.87409	7.87409	2.5558
Error	122	375.86784	3.08088	<b>Prob &gt; F</b>
C. Total	123	383.74194		0.1125

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	3.9250926	0.534708	7.34	<.0001
REI bb	0.9723669	0.60823	1.60	0.1125

**Bivariate Fit of Number of workers in hh By REI bb****Linear Fit**

Number of workers in hh = 1.6752365 + 0.5305968\*REI bb

**Summary of Fit**

RSquare 0.017091  
 RSquare Adj 0.009034  
 Root Mean Square Error 1.05131  
 Mean of Response 2.120968  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	2.34460	2.34460	2.1213
Error	122	134.84088	1.10525	<b>Prob &gt; F</b>
C. Total	123	137.18548		0.1478

**Parameter Estimates**

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	1.6752365	0.320265	5.23	<.0001
REI bb	0.5305968	0.364301	1.46	0.1478

**Bivariate Fit of Hectares of land By REI bb****Linear Fit**

Hectares of land = 0.4351174 + 0.2184515\*REI bb

**Summary of Fit**

RSquare 0.011806  
 RSquare Adj 0.003706  
 Root Mean Square Error 0.522174  
 Mean of Response 0.618629  
 Observations (or Sum Wgts) 124

**Analysis of Variance**

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	1	0.397421	0.397421	1.4575
Error	122	33.265246	0.272666	<b>Prob &gt; F</b>
C. Total	123	33.662667		0.2297

### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	0.4351174	0.159072	2.74	0.0072
REI bb	0.2184515	0.180944	1.21	0.2297

## Appendix XI – Gini coefficient

Percentile ratios for distribution of income\_per\_person\_bb: all valid obs.

p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
5.430	2.147	0.395	2.227	1.441	0.647

Generalized Entropy indices GE(a), where a = income difference sensitivity parameter, and Gini coefficient

All obs	GE(-1)	GE(0)	GE(1)	GE(2)	Gini
	0.24037	0.18396	0.17159	0.18933	0.32574

Atkinson indices, A(e), where e > 0 is the inequality aversion parameter

All obs	A(0.5)	A(1)	A(2)
	0.08503	0.16803	0.32467

```
. sort income_per_person_ab
. ineqdeco income_per_person_ab
```

Percentile ratios for distribution of income\_per\_person\_ab: all valid obs.

p90/p10	p90/p50	p10/p50	p75/p25	p75/p50	p25/p50
9.111	3.722	0.408	2.650	1.828	0.690

Generalized Entropy indices GE(a), where a = income difference sensitivity parameter, and Gini coefficient

All obs	GE(-1)	GE(0)	GE(1)	GE(2)	Gini
	0.59449	0.35902	0.34471	0.44565	0.44757

Atkinson indices, A(e), where e > 0 is the inequality aversion parameter

All obs	A(0.5)	A(1)	A(2)
	0.16151	0.30164	0.54316

## Appendix XII – Perceptions on NTFP collection

### Oneway Analysis of Hectares of land By Is NTFP degrading the forest?

Oneway Anova						
Summary of Fit						
Rsquare			0,029751			
Adj Rsquare			0,021799			
Root Mean Square Error			0,517411			
Mean of Response			0,618629			
Observations (or Sum Wgts)			124			
t Test						
2-1						
Assuming equal variances						
Difference	-0,23121	t Ratio		-1,93416		
Std Err Dif	0,11954	DF		122		
Upper CL Dif	0,00543	Prob >  t		0,0554		
Lower CL Dif	-0,46786	Prob > t		0,9723		
Confidence	0,95	Prob < t		0,0277		
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F	
Is NTFP degrading the forest?	1	1,001511	1,00151	3,7410	0,0554	
Error	122	32,661156	0,26771			
C. Total	123	33,662667				
Means for Oneway Anova						
Level	Number	Mean	Std Error	Lower 95%	Upper 95%	
1	23	0,806957	0,10789	0,59338	1,0205	
2	101	0,575743	0,05148	0,47382	0,6777	
Std Error uses a pooled estimate of error variance						

### Oneway Analysis of Distance to Main road By Is NTFP degrading the forest?

Oneway Anova						
Summary of Fit						
Rsquare			0,031092			
Adj Rsquare			0,02315			
Root Mean Square Error			1,070693			
Mean of Response			0,572581			
Observations (or Sum Wgts)			124			
t Test						
2-1						
Assuming equal variances						
Difference	0,48945	t Ratio		1,978609		
Std Err Dif	0,24737	DF		122		
Upper CL Dif	0,97915	Prob >  t		0,0501		
Lower CL Dif	-0,00025	Prob > t		0,0251		
Confidence	0,95	Prob < t		0,9749		
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F	
Is NTFP degrading the forest?	1	4,48797	4,48797	3,9149	0,0501	
Error	122	139,85880	1,14638			
C. Total	123	144,34677				
Means for Oneway Anova						
Level	Number	Mean	Std Error	Lower 95%	Upper 95%	
1	23	0,173913	0,22325	-0,2680	0,61587	
2	101	0,663366	0,10654	0,4525	0,87427	
Std Error uses a pooled estimate of error variance						

### Oneway Analysis of Distance to Temple By Is NTFP degrading the forest?

Oneway Anova	
Summary of Fit	
Rsquare	0,077188

Adj Rsquare		0,069624			
Root Mean Square Error		9,509556			
Mean of Response		6,064516			
Observations (or Sum Wgts)		124			
<b>t Test</b>					
2-1					
Assuming equal variances					
Difference	7,0185	t Ratio	3,194467		
Std Err Dif	2,1971	DF	122		
Upper CL Dif	11,3679	Prob >  t	0,0018		
Lower CL Dif	2,6692	Prob > t	0,0009		
Confidence	0,95	Prob < t	0,9991		
<b>Analysis of Variance</b>					
<b>Source</b>		<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Is NTFP degrading the forest?		1	922,821	922,821	10,2046
Error		122	11032,663	90,432	
C. Total		123	11955,484		
<b>Means for Oneway Anova</b>					
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Error</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
1	23	0,34783	1,9829	-3,577	4,2731
2	101	7,36634	0,9462	5,493	9,2395
Std Error uses a pooled estimate of error variance					

### Oneway Analysis of REI bb By Is NTFP degrading the forest?

<b>Oneway Anova</b>					
<b>Summary of Fit</b>					
Rsquare		0,019893			
Adj Rsquare		0,011859			
Root Mean Square Error		0,258659			
Mean of Response		0,840056			
Observations (or Sum Wgts)		124			
<b>t Test</b>					
2-1					
Assuming equal variances					
Difference	-0,09404	t Ratio	-1,57358		
Std Err Dif	0,05976	DF	122		
Upper CL Dif	0,02426	Prob >  t	0,1182		
Lower CL Dif	-0,21234	Prob > t	0,9409		
Confidence	0,95	Prob < t	0,0591		
<b>Analysis of Variance</b>					
<b>Source</b>		<b>DF</b>	<b>Sum of Squares</b>	<b>Mean Square</b>	<b>F Ratio</b>
Is NTFP degrading the forest?		1	0,1656651	0,165665	2,4762
Error		122	8,1623253	0,066904	
C. Total		123	8,3279904		
<b>Means for Oneway Anova</b>					
<b>Level</b>	<b>Number</b>	<b>Mean</b>	<b>Std Error</b>	<b>Lower 95%</b>	<b>Upper 95%</b>
1	23	0,916651	0,05393	0,80988	1,0234
2	101	0,822614	0,02574	0,77166	0,8736
Std Error uses a pooled estimate of error variance					

## Appendix XIII – Attitudes on forest protection

### Oneway Analysis of Total cash income, BB By How to protect the forest?

Oneway Anova					
Summary of Fit					
Rsquare			0,04763		
Adj Rsquare			0,031757		
Root Mean Square Error			24074,81		
Mean of Response			39667,07		
Observations (or Sum Wgts)			123		
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
How to protect the forest?	2	3478439064	1,7392e+9	3,0007	0,0535
Error	120	6,9552e+10	579596672		
C. Total	122	7,303e+10			
Means for Oneway Anova					
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	9	27122,2	8024,9	11233	43011
2	45	35535,8	3588,9	28430	42641
3	69	43997,7	2898,3	38259	49736
Std Error uses a pooled estimate of error variance					

### Oneway Analysis of Income from agriculture AB By How to protect the forest?

Oneway Anova					
Summary of Fit					
Rsquare			0,046263		
Adj Rsquare			0,030367		
Root Mean Square Error			8708,176		
Mean of Response			4931,707		
Observations (or Sum Wgts)			123		
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
How to protect the forest?	2	441405878	220702939	2,9104	0,0583
Error	120	9099880464	75832337		
C. Total	122	9541286341			
Means for Oneway Anova					
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	9	8711,11	2902,7	2963,9	14458
2	45	6651,11	1298,1	4080,9	9221
3	69	3317,39	1048,3	1241,7	5393
Std Error uses a pooled estimate of error variance					

### Oneway Analysis of Effect variable By How to protect the forest?

Oneway Anova					
Summary of Fit					
Rsquare			0,051484		
Adj Rsquare			0,035676		
Root Mean Square Error			26247,92		
Mean of Response			17749,72		
Observations (or Sum Wgts)			123		
Analysis of Variance					
Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
How to protect the forest?	2	4487485675	2,2437e+9	3,2567	0,0419
Error	120	8,2674e+10	688953386		
C. Total	122	8,7162e+10			
Means for Oneway Anova					
Level	Number	Mean	Std Error	Lower 95%	Upper 95%
1	9	6062,2	8749,3	-11261	23385
2	45	12151,9	3912,8	4405	19899
3	69	22924,9	3159,9	16669	29181
Std Error uses a pooled estimate of error variance					

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## ABBREVIATIONS

BR Hills	Biligiri Rangaswamy Temple Wildlife Sanctuary
NTFP	Non-timber forest products
LAMPS	Large-scale Adivasi Multipurpose Societies
FD	Forest Department
ATREE	Ashoka Trust for Research in Ecology and the Environment
VGKK	Vivekananda Girijana Kalyana Kendra
WCED	World Commission on Environment and Development
FAO	Food and Agriculture Organization
GoI	Government of India
GoK	Government of Karnataka
UNDP	United Nations Development Programme
WCMC	World Conservation Monitoring Centre
NGO	Non-Governmental Organisation
DFID	UK Department for International Development
PA	Protected Areas
JFPM	Joint Forest Planning and Management
JMF	Joint Forest Management
MAR	Minorities at Risk
RCDC	Regional Centre for Development Cooperation
INR	Indian Rupee