Livelihood Improvements - Wildlife Costs

= Positive Attitudes?

Assessing the effects of protected area management on the livelihoods and attitudes of local communities in the Shimba Hills, Kenya

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A thesis submitted in partial fulfilment of the requirements for the degree of Master of Science and the Diploma of Imperial College London
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## Acronyms

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<thead>
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<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AL</td>
<td>Alternative Livelihood</td>
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<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<tr>
<td>EACFE</td>
<td>Eastern African Coastal Forest Ecoregion</td>
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<tr>
<td>FLR</td>
<td>Forest Landscape Restoration</td>
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<tr>
<td>ICDP</td>
<td>Integrated Conservation and Development Project</td>
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<tr>
<td>KFS</td>
<td>Kenya Forest Service</td>
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<td>KWS</td>
<td>Kenya Wildlife Service</td>
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<td>MDG</td>
<td>Millennium Development Goals</td>
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<td>NTFP</td>
<td>Non-Timber Forest Products</td>
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<td>PA</td>
<td>Protected area</td>
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<td>PFM</td>
<td>Participatory Forest Management</td>
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<td>SLF</td>
<td>Sustainable Livelihoods Framework</td>
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<td>WWF</td>
<td>World Wide Fund for Nature</td>
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Abstract

Integrated conservation and development projects (ICDPs) aim to reduce unsustainable dependence on forest resources by helping local communities to gain more sustainable livelihoods through activities that are either unrelated to the forest or dependent on the sustainable use of the resource. This helps to compensate for the wildlife costs of living near a protected forest and helps to create more support for conservation.

This study assessed the effectiveness of an ICDP that has been focusing on the Shimba Hills Forest/National Reserve in coastal Kenya in improving livelihoods, reducing dependence on forest resources, reducing costs of wildlife and improving attitudes towards the conservation of the forest. An initial assessment was carried out in 2006 in 14 villages surrounding the reserve at the start of the ICDP implementation and this survey was repeated in the same villages the first had assessed.

It was found that livelihoods had not improved, however the area sampled may have been misrepresentative of the total area subjected to the ICDP. However, forest product use had decreased, indicating increased law enforcement within the reserve. Perceived costs of wildlife had increased and the majority of households had negative attitudes towards the reserve, which were associated with wildlife costs; however, there was a significant increase in the number of households with positive attitudes, which were associated with household use of forest products, indicating that products held greater value to households than in 2006, in turn suggesting that WWF’s work on forest-dependent livelihood income-generating activities had been successful, in the specific areas they were implemented.

It is recommended that future work strives to increase the effectiveness and distribution of sustainable livelihood activities so that benefits can be felt more widely. The issue of human/wildlife conflict needs to be dealt with by further research into prevention measures, mitigation of impacts and compensation for costs incurred.

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Introduction

Problem statement

Across the developing world, forest cover and poverty tend to coincide (Sunderlin, Dewi et al. 2008). Poverty-stricken rural populations rely on the forest for free resources such as fuelwood, timber, medicinal plants and food such as fruit and bushmeat (Byron and Arnold 1997), as well as for cultural and spiritual heritage (MacKinnon, Megateli et al. 2002), and an estimated 90% of poor people across the world depend on forest resources for at least part of their income (USAID 2006). Within poor communities, dependence on forest resources increases with increased poverty (Byron and Arnold 1997; Babulo, Muys et al. 2008).

There is growing recognition of the importance of protecting forests for their biodiversity, ecosystem services and mitigation against climate change, as well as an ever-increasing rate of global deforestation (UNEP 2009) and the protection of forests has been the focus of global conservation targets since the 1992 Earth Summit in Rio de Janeiro. Since the first established national park in 1864, the Yellowstone National Park in the USA, the protection of land has often involved the displacement of rural people (McShane 2003) – sometimes many thousands (Brockington 2002) – and the banning of access to resources (Colchester 2004) MORE. This has had severe consequences for the impacted populations because they lose access to benefits but still have to bear the costs (Hamilton, Baranga et al. 1990).

The main costs of living near a forest are the conflicts between humans and wildlife, which may involve injury or death of livestock and people and loss of food supply or income from crop damage (Gillingham and Lee 2003; Roe and Elliott 2006). Wildlife conflict costs are highest for those living nearest the forest (Sekhar 1998), and these are often people living most remotely from markets and who may be most affected by loss of resource access (Howell, Schwabe et al. 2010).
Despite causing so much disruption to local people, the expected wildlife benefits of this sort of conservation has been found in many cases not to be achieved (Olupot, Barigyira et al. 2009; Craigie, Baillie et al. 2010). This is often because such management methods do not account for the needs of the rural poor: with such strict laws and no alternative livelihoods provided, these communities have no choice but to continue utilising the forest illegally (Bruner, Gullison et al. 2001). Law enforcement is well known as the main cause of reduction in illegal activity (Blomley, Namara et al. 2010); yet many protected areas (PAs) do not have sufficient law enforcement, which is why ‘more than 70% of 201 parks across 16 tropical countries are affected by poaching, encroachment, logging and a host of lesser threats’ (van Shaik, Terborgh et al. 1997).

Apart from a few remaining advocates (Terborgh 1999), approaches to conservation have gradually moved away from the ‘fines and fences’ attitude towards methods that account for rural populations and the need for their sustainable economic development (Kremen, Merenlender et al. 1994). This is mainly due to the growing appreciation of indigenous and local community rights (Colchester 2004) as well as the reasoning that the long term conservation of habitats depends on the implementation of sustainable use strategies locally (McNeely 1988).

In the mid 1980s, the World Wide Fund for Nature (WWF) introduced Integrated Conservation and Development Projects (ICDPs) (Hughes and Flintan 2001), which operate on the theory that alleviating local poverty will reduce dependence on forest resources, in turn reducing forest degradation and deforestation (Hughes and Flintan 2001).

ICDPs often involve setting up alternative livelihood (AL) projects for forest-dependent communities. Activities may include bee-keeping, which does not use forest resources consumptively, or the sustainable harvesting and sale of non-timber forest products (NTFPs) (Singh, Bhattacharya et al. 2010).

Other conservation interventions include facilitating the involvement of communities in forest management decisions (for example, Participatory Forest Management (PFM) (Raina, Kioko et al. 2009)) which gives communities varying degrees of power to then manage the forest sustainably.
Policy and research

Successful integrated community and development projects aim to contribute to the achievement of several global goals. For example, the entire concept of community involvement in conservation ‘mirrors’ the main three aims of the Convention on Biological Diversity (CBD), which came into force in 1993 (CBD 2004): Conservation of biodiversity; sustainable use of its components; and fair and equitable sharing of benefits from resources. ICDPs also contribute to achieving the United Nation’s Millennium Development Goals (MDGs) such as End Poverty and Hunger by providing communities with sustainable incomes and employment (including women and young people) through alternative livelihood programmes; and Ensure Environmental Sustainability by promoting sustainable development as a policy and reversing the loss of environmental resources and reducing biodiversity loss, as well as improving access to sustainable and safe drinking water sources and basic sanitation (MDG 2000).

ICDPs have great potential to help both the environment and human populations, therefore contributing to the goals of the CBD and the MDGs, and there have been some successful projects (Olupot, Barigyira et al. 2009; Raina, Kioko et al. 2009). However, their success in conservation of forests depends on the development aspects working sufficiently to outweigh the costs of living near a forest and alleviating local poverty (Hughes and Flintan 2001). It is clear, therefore, that in order to see that resources are being spent efficiently and effectively, monitoring and evaluating the impacts of ICDPs on local communities is essential, not just in terms of whether the livelihood project is running smoothly but in terms of overall improvements of livelihoods, taking into account the wildlife-associated costs that may counteract any improvement (Bajracharya, Furley et al. 2006). Being negatively affected by wildlife can also reduce support for the conservation of their habitat, jeopardising its sustainability (Gillingham and Lee 2003). Therefore, research into wildlife costs and the exact factors that affect attitudes is vital for sustainable conservation.
Aims and objectives

This project aims to evaluate the success of the management of a protected area in coastal Kenya involving AL activities, PFM and wildlife management, in terms of whether the benefits to local communities have outweighed the wildlife costs of living near a protected forest and if this has improved attitudes towards the reserve. WWF initiated the two projects between 2005 and 2006 in the Shimba Hills Forest/National Reserve, which forms a fragment of the remaining East African coastal forest ecoregion and biodiversity hotspot (Myers, Mittermeier et al. 2000). This reserve is densely populated by elephants and is surrounded by poverty-stricken rural farmers, so the potential for wildlife costs to communities is high, as is the potential for benefits from an ICDP. In 2006 a household survey was carried out to assess the welfare of local communities and their relationship with the forest (Andel 2007) and a repeat survey is needed to assess any changes that may have occurred.

The objectives of this study are contained in two sections, as follows:

Livelihood assets

- To determine how the livelihoods of households living near the reserve have changed since 2006, linking changes with WWF activities

Household relationships with the forest

- To determine how household reliance on forest resources has changed since 2006
- To determine how wildlife costs to households have changed since 2006
- To determine how attitudes towards the forest have changed since 2006

Hypotheses
1. With AL activities and JFM in place it is expected that the livelihoods of the affected communities will have improved, mostly through evidence of increased membership of alternative livelihood or conservation groups or employment in PFM

2. With AL activities and the expected improvement in livelihoods it is expected that dependence on forest resources will have decreased

3. Due to improved management of the forest involving better wildlife security it is expected that costs to households from wildlife will have decreased

4. Due to the expected improvement in livelihoods with expected reduced wildlife costs, it is expected that attitudes to the reserve will have improved

**Overview of thesis structure**

**Chapter 1** has given an introduction to the subject area surrounding this research project

**Chapter 2** will give a detailed review of the literature related to ICDPs, wildlife costs to households, forest-related benefits and attitudes towards conservation, followed by the background to the WWF projects that this study is monitoring

**Chapter 3** will describe and explain the methods used for research and data analysis

**Chapter 4** will describe the results found, according to each hypothesis

**Chapter 5** will first discuss the possible reasons for the results found. It will then assess the strengths and limitations of the methods used, followed by a discussion of the implications for PA policy, future research and PA management. It will end in a brief conclusion.
**Background**

**Forest-related benefits to local communities**

Among forest communities, dependence on the forest and its resources ranges from partial to full, according to wealth (Babulo, Muys et al. 2008). Wealthier households may use the forest to provide a smaller portion of their income, to supplement the main source of income. It is beneficial to diversify income sources in this way in order to be able to cope with shocks or sudden shortages in individual sources of income (Shackleton and Shackleton 2004), despite forest incomes being generally not as profitable as other sources (Ellis 1998). With increasing poverty people depend more on the forest resources to provide incomes since they do not have the means or skills to find more profitable sources of income (Babulo, Muys et al. 2008). Dependence on forest resources and poverty also correlate with remoteness of households from markets, and can form a substantially greater proportion of income than in households less remote (Howell, Schwabe et al. 2010).

Many agricultural communities use forest resources to supplement their diet, particularly in low-production seasons. With lack of modern agricultural aids such as fertiliser or irrigation equipment, crops can fail which reduces food supply (Byron and Arnold 1997), thereby increasing dependence on forest food products. For example, most households in Sundarban, Bay of Bengal, rely on the collection of NTFPs for up to 79% of their total annual household income, due to the low yields in crops as a result of high soil salinity levels (Singh, Bhattacharya et al. 2010).

**Loss of forest-related benefits to Protected Areas**

The impacts of PA establishment on communities in terms of exclusion and resource use restriction have been very little studied (Ferraro 2002) and very little of this research actually quantifies the economic and social impacts; most information included in reports is anecdotal (Brockington 2002; Ferraro 2002; West, Igoe et al. 2006). This is thought to be for several reasons: Impacts of resource-use restriction are hard to assess
since household dependence on resources varies greatly and despite this knowledge, no PA-related study has followed the same households’ welfare over time. Also, proper comparisons are very seldom possible since socio-economic baseline data for ‘before and after’ comparisons, as well as for non-forest-dependent households which can act as controls, are often lacking (Wilkie, Morelli et al. 2006).

The anecdotal evidence has shown that the displacement (physical and resource) caused by PAs has led to various types of impoverishment through landlessness, joblessness, homelessness, marginalization, food insecurity, increased morbidity and mortality, loss of access to common property resources, and social disarticulation (Cernea 2006; Mombeshora and Le Bel 2009). In the case of the Indians who fought against their exclusion from Yellowstone National Park, it led to hundreds of deaths (Colchester 2004).

The few existing quantitative studies support the anecdotal evidence that costs of PAs to local people can be very detrimental: For example, Ferraro (2002) calculated the opportunity costs of living near the Ranomafana National Park, Madagascar, to be between $353 and $1316 per household, equating to annual costs of $19 to $70. Elsewhere in Madagascar, Brand et al (2002) (cited in Balmford and Whitten (2003)) estimated costs to rural communities of not doing slash and burn agriculture would be between $93- 191$ per household per year.

**Livelihood costs of wildlife**

The establishment of PAs leaves local communities with not only disrupted livelihoods and loss of forest benefits but with the costs of living near a forest. Living in close proximity to wild animals that inhabit the forest holds significant risks to livelihoods: Livestock are preyed upon by predators such as lions since they are easier prey than wild ungulates (Treves and Karanth 2003); crops are raided by animals such as elephants, baboons and bush pigs (Naughton-Treves 1998). There is also the risk of general damage to household structures, for example, fences or water tanks, and in some cases, human injury or death (Hoare 1999; Naughton, Rose et al. 1999).
Risk of wildlife conflict is exacerbated by the fact that the home-ranges of large mammals often extend beyond protected areas (Hoare 1999; Treves and Karanth 2003). The problem is intensified further by fragmentation and encroachment by agriculture and grazing, leaving animals with both little choice but to approach farms and little obstruction in the way of buffer habitat (Michalski et al 2006).

Wildlife costs are often measured in either economic terms, for example percentage damage of crops or livestock (Naughton-Treves 1998), or percentage of crop- or livestock-related income lost (Michalski, Boulhosa et al. 2006); or in the frequency of events, for example the number of households affected by crop loss per year (Weladji and Tchamba 2003).

The evidence suggests that wildlife damage can cause a loss of up to approximately 60% of total crop yield or income. For example, during a 30 day study in Ghana an average of 48% of crops were lost to elephants (Barnes, Azika et al. 1995). Weladji and Tchamba (2003) found that crop damage affected 86% of households in six months in the Bénoué Wildlife Conservation Area of North Cameroon, resulting in annual percentage loss of crop income from wildlife damage range between 25 and 62%. Annual costs of elephant raids on crops can reach $510 per affected household in Cameroon (Naughton, Rose et al. 1999). Considering 50% of people in sub-Saharan Africa live on approximately $1 per day (Boh 2010) such losses can have profound effects on their livelihoods and economic welfare.

Although data of actual economic losses are helpful in giving concrete evidence for changes in poverty, as far as conservation is concerned, the costs as perceived by the affected households themselves are perhaps a more useful way of monitoring. The reason for this is that perceptions of costs can expose the different levels of importance households place on different sources of cost, which outsiders may not fully appreciate.

For example, over 95% of people living next to the Selous Game Reserve in Tanzania perceived crop damage from wildlife to be a limiting factor of crop yields and it was thought to be overall more detrimental than bad seasonal weather conditions, lack of agricultural improvements such as fertiliser, or disease and pests (Gillingham and Lee
This would indicate to conservation or development organisations that wildlife management is a bigger priority for action than improving farming methods.

Also, it can be simpler to monitor impacts by surveying people’s opinions rather than monitoring actual wildlife activity, which could take more than a year to measure accurately given potentially high levels of temporal variation in activity (Hoare 1999).

Perceptions of forest costs and benefits are important to research also because it is these that determine whether attitudes towards the forest are positive or negative. If people perceive the costs to be higher than benefits, they will view conservation of the forest as a hindrance on their own development. This may result in conservation initiatives not being sustainable, as is the case with strict protected areas (Gillingham and Lee 2003). Contrarily, if local communities are not negatively affected by forest costs, and they appreciate the benefits of conserving it, they are more likely to support its conservation (Roe and Elliott 2006). Accordingly, many studies have used attitudinal surveys to see if communities view conservation positively or negatively (Bandara and Tisdell 2003; Gillingham and Lee 2003; Gadd 2005).

**Attitudes towards protected areas**

The denial of rights to local people regarding land and resource use has caused much resentment towards conservation, which has in turn reduced the likelihood of success of some conservation initiatives. For example, Bwindi Impenetrable Forest in Uganda was gazetted as a forest reserve in 1932, with little consultation with the local people. This incited the people to set fires in the forest, burning 5% of the total area and endangering mountain gorillas and other species (Hamilton, Baranga et al. 1990) and expressed the view that all gorillas should be put in zoos. Also, a primate conservation project in the Tana Gallery forests in Kenya in 1995 which demanded the relocation of local communities had to be abandoned due to their resistance to being moved (Githitho 2004).

The additional cost of human-wildlife conflict means the already negative attitudes of people towards PA management and loss of benefits are made worse since people resent the fact that these damaging animals are being protected. For example, attitudes
towards the management of the Nanda Devi Biosphere Reserve in India were found to be predominantly negative (75%) (Maikhuri, Nautiyal et al. 2001). Reasons for this are likely to be that past management regimes had excluded people from the core area, which prevented income from medicinal plants and tourism, and damage to crops and livestock from wildlife also reduced annual income. Compensation was given but this was barely 5% of the income lost from selling the produce.

**Aims of integrated conservation and development projects:**

Integrated Conservation and Development Projects aim to provide benefits to the communities affected by the establishment of a PA, as a way of compensation and also so that their dependence on forest resources is reduced and their attitudes towards conservation are improved (Roe and Elliott 2006). Alternative livelihood activities help to diversify livelihoods away from farming and unsustainable harvesting of forest products, thus increasing livelihood stability; and community participation in forest management provides employment to locals as well as improving attitudes to the conservation of the forest by increased understanding of its importance.

Many reviews of ICDPs have found a lack of evidence of impacts (Hughes and Flintan 2001; Roe and Elliott 2006; Schreckenberg, Camargo et al. 2010), for much the same reasons as for other protected areas. However, there are a few good examples of successful ICDPs in terms of providing benefits to people, and evidence that this can then reduce dependence on resources and improve attitudes towards conservation, in the knowledge that sustainable use of resources benefits livelihoods.

For example, an ICDP initiated across three Kenyan forests in 2004 combined PFM with AL activities such as honey and silk production (Raina, Kioko et al. 2009). Communities gained valuable income from these activities, and the increased number of bees improved crop yields. Consequently, attitudes towards conservation improved and illegal cutting and harvesting of timber in the buffer zones had reduced by 50% by the final year of the project.

Another example concerns an ICDP that was set up in the Shinyanga region of Tanzania, where traditional woodland had been reduced to 1000ha by land conversion and
overgrazing. The ICDP reintroduced a traditional livestock management method whereby areas of land are closed off from grazing and allowed to regenerate. After just 15 years the woodland area had increased to 250,000ha, dramatically improving the landscape and the lives of the inhabitants through increased grazing land, thus increasing support for its conservation (Barrow, Timmer et al. 2002). In this case, the communities had the desire to protect the land but did not have the resources to facilitate it. The ICDP, therefore, facilitated the protection of the land and improvements of livelihoods, whereas a PA would have had the same effect on the land but would have caused resentment among the people.

The existing ICDP success stories have meant that such projects have become very popular, perhaps too popular, given that valid evidence of their success is scarce. On a national level, since they involve economic development aspects they have been given a huge amount of funding (Hughes and Flintan 2001) and the number of ICDPs have greatly increased in recent years, more than doubling the area of forest owned by communities in developing countries between 1985 and 2000, and accounting for approximately 22% of the total forest of those countries (White and Martin 2002). For example, indigenous populations have established rights to 20% of the Brazilian Amazon approximately 1mn km² (Schwartzman, Moreira et al. 2000). Jau Park in central Amazonia is the world’s largest nature reserve, of 20,000 km², and its management plan is supported and implemented by the caboclo population, who were involved in the decision-making process (Fundação Vitória Amazônica 1998, cited in Schwartzmann 2000).

**Negative impacts/risks of ICDPs**

When ICDPs are not planned or implemented appropriately, local populations may feel no benefits. The following example is not conservation based, but illustrates the point. In Ghana it is recognised that illegal mining is poverty driven and so many AL projects have been set up in an attempt to improve livelihoods and reduce dependence on mining. However, these attempts have been largely ineffective, for several reasons. The livelihood strategies focus on agriculture, whereas most people in Ghana are literate and so farming would not be a desirable livelihood. Secondly, mining can be a profitable
occupation and so for an AL activity to work, income prospects must be higher than the current occupation, and farming is not necessarily so. Thirdly, the AL activities had been set up without research into existing markets and opportunities to gain an income from these livelihoods, leaving many farmers unable to sell their produce (Hilson and Banchirigah 2009).

In some situations neither party may benefit, for example if the costs have not been properly weighed up against the benefits, for both the PA authorities and the local communities. Emerton (1999) found that the costs of running Lake Mburo National Park, Uganda, with integrated conservation and development aspects significantly outweighed the benefits to both park authorities and local communities, and that the park was making a substantial loss each year.

Another concern for the sustainability of ICDPs arises from the fact that they have mostly been developed in buffer zones – outside the bounds of the main protected area – to ensure sustainable use of resources outside the PA as well as benefiting human development (Kremen, Merenlender et al. 1994). In many areas, however, rather than aiming to be participatory and empowering local people, buffer zones have been created as a way of inhibiting free use of the land, despite it not being in the PA. For example the authorities of Korup National Park, Cameroon, have increased law enforcement within the buffer zone more than in any other area, and if laws are broken, locals may be evicted from the zone (Lance 1995, cited in Neumann (1997)). Therefore, depending on how the ICDP is implemented, buffer zone regulation can be perceived in two ways: either helpful and beneficial to the people living there, or just an extension of government control over land use and further denial of rights of the people, in order to better protect the integrity of the habitat inside the PA. (Neumann 1997). Conservationists have a tough challenge to ensure greater benefits to the local communities than if they had more control over the buffer zone land themselves.

Monitoring socio-economic impacts of ICDPs

Since there is a risk that ICDPs may not be implemented properly and therefore not help human development, and considering the effect that this might have on attitudes, it is
important to monitor effects on livelihoods. A livelihood is defined as ‘the capabilities, assets (including both material and social resources) and activities required for a means of living’, and measuring these assets is thought to be a more comprehensive way of studying poverty levels than using, for example, gross domestic product per capita income. This is particularly important for research on the impacts of PAs, which can impact on a variety of aspects of household livelihoods, other than income (Schreckenberg, Camargo et al. 2010).

The Sustainable Livelihoods Framework (SLF) (Carney 1998; Scoones 1998) uses five asset types and a range of corresponding indicators (examples shown in brackets) to define livelihoods: Human (health or education), Social (membership of social groups or household size), Financial (employment or livestock owned), Physical (roof or floor materials) and Natural (area of land owned or access to water) assets. A livelihood is said to be sustainable when ‘it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resources base’ (Chambers and Conway 1992). The qualities of each asset help to determine the sustainability of the livelihood.

The SLF can help to recognise the complexity of livelihood components and allows poverty levels to be attributed to the right causes, for example, low crop production (Natural assets). This can assist conservation organisations to understand where to focus the development side of ICDPs. It exposes the linkages between assets, revealing possible ways of improving assets (Adato and Meinzen-Dick 2002). Conservation interventions may not, for example, be able to directly increase people’s income (Financial asset) but, by setting up agriculturally-focused social groups, could increase people’s involvement in such groups (Social asset) and increase circulation of knowledge of farming techniques, improving crop production (Natural asset). This means that conservation organisations can also then evaluate the impact of their interventions by measuring the livelihood assets before and after.

Knowledge of local household livelihood assets can indicate which assets conservation organisations should aim to improve in order to achieve the conservation objectives of the ICDP. For example, Babulo et al (2008) found that households most dependent on
forest resources (for whom forest resources contributed >60% of household income) had the least educated household heads, the lowest area of agricultural land and agricultural aids and the least access to credit. These indicate that the Human, Natural and Financial assets should be the focus of interventions in order to reduce dependence on forest resources.

Conservation of the Eastern African Coastal Forests Ecoregion
The Eastern Africa Coastal Forests Ecoregion (EACFE) spans across six countries from southern Somalia to Southern Mozambique. Its limits are from the coastline (including some islands), to less than 200km inland (Salehe 2005). The extremely high biodiversity value means that the ecoregion is included in many conservation organisations’ priority areas for conservation, for example, Conservation International’s Global Biodiversity Hotspots (Myers, Mittermeier et al. 2000), WWF’s Global 200 Ecoregions (Olson and Dinerstein 2002); Birdlife International’s endemic bird areas (Stattersfield, Crosby et al. 1998); more locally, it is part of the Swahili Centre of Endemism (Burgess 1998). However, extensive deforestation has left only 400 (Salehe 2005) fragments amongst coastal woodland, savannah, wetlands and farmland, totalling only 6,259km² of forest (WWF 2009) which is 2% of the original ecoregion area (WWF 2006).

Agricultural expansion, charcoal burning, fuelwood collection, uncontrolled logging and unplanned settlement have been ranked as the highest direct threats to the coastal forests (Salehe 2005). Coastal East Africa is one of the poorest regions in the world and these threats are thought to be driven by lack of alternative livelihood options, HIV/AIDS, loss of cultural/spiritual value of sacred forests, limited institutional capacity and support, legal and land ownership issues, and international market demands (WWF 2006).

Kwale district on the southeastern coast of Kenya holds most of Kenya’s forest area of between 660km² and 1,390km² depending on the definition of forest (Githitho 2004). Forty two out of the 47 forest patches are gazetted as protected areas (WWF 2006). The Kwale forests contain 64 of Kenya’s 105 known globally threatened species, including six mammals, three birds, two amphibians and 53 plants (CEPF 2003). Kwale also has huge importance culturally, since the majority of all sacred forests (known as kayas) along the Kenyan coast are found within Kwale (WWF 2006).
Kwale is one of the poorest districts in Kenya, with 45% of its population living in absolute poverty (GOK 2002). With 81% of people unemployed, agriculture is the main source of income (80.6%) and over 97% of fuel is sourced from charcoal and firewood from forests, which puts a huge pressure on both non-gazetted and gazetted forest habitat for land conversion and resource extraction (WWF 2006). Figure 1, below, demonstrates the effect that legal protection status has had on reducing deforestation of the Shimba Hills ecosystem in Kwale.

Figure 1. the fenced boundary of the Shimba Hills Reserve, with protected forest on the left and unprotected land on the right (taken by the author)

Kenya Wildlife Service (KWS) administers the Wildlife (Conservation and Management) Act, the latest revision of which was in 1985. The corresponding policy supports community initiatives in conservation but does not allow consumptive use of wildlife resources in parks (KWS and KFS 2009), hence there is a recognised need for the act to be more based on modern approaches to conservation. The latest Forest Act in 2005, administered by Kenya Forest Service (KFS), has more modern policies: local communities living adjacent to the forest reserves have controlled access (through licences) to forest resources including dead/fallen wood for domestic purposes,
thatching grass for roofing, berries or fruit for consumption, creepers and lianas for building materials, water points for livestock and honey from honey barrels placed in the forest (GOK 2005). However, law enforcement has been weak, with a significant degree of illegal harvesting activity occurring (Githitho 2004).

**KWALE PROJECTS**

As part of a large scale conservation programme for the EACFE, in 2005 WWF initiated a forest landscape restoration (FLR) programme in Kwale district. FLR is based on the management of the whole landscape, and aims to return the forest’s functionality, insofar as the ecological services, processes and goods that are provided (Maginnis and Jackson 2003). This therefore demands the acknowledgement of interests of local communities in deciding objectives. The project includes all forests within the district and aims to restore degraded forest areas, sustain participatory forest management between communities and KFS, and support community livelihood initiatives (Salehe 2005).

A second project, initiated by WWF in 2006, focuses on improved management and conservation of Kwale district forests. A significant part of the project involves the setting up of sustainable livelihoods, including forest-dependent income-generating activities such as bee-keeping; forest-product substitution activities such as the cultivation of medicinal plants; and the supporting of, and further training in, existent livelihood projects; as well as supporting the marketing process (GOK 2006).

The Shimba Hills ecosystem contains the largest remaining forest fragment, of 63km², in Kwale and comprises the Shimba Hills Forest/National Reserve, Mkongani West and North Forest Reserves, and the Mwaluganje Elephant Sanctuary and Forest Reserve. It is the most important area of forest in Kwale since it contains 56 of the district’s 64 threatened species (CEPF 2003). Therefore, much of these two projects have been focused around the Shimba Hills and it is the management around this reserve which will be the focus for this study.
Description of study site

The SH ecosystems is 259km$^2$ of mosaic of coastal forest, woodland and grassland. It lies between 39°17’ and 39°30’ East, 4°09’ and 4°21’ South and has an altitudinal range of 100 to 448 metres above sea level.

The climate is hot and humid, with long rains in April and July and short rains in October to November. Average rainfall on the eastern, windward side of the hills is 1150mm and less than 500mm in the west. The temperature ranges between 19 and 36°C, coolest in July and August, hottest in February. Soil fertility is poor due to a weathered sandy topsoil and low organic matter content.

The vast majority of people living around the Shimba Hills reserve are small-scale farmers. Crops grown are mainly cassava, maize, sweet potato and pigeon peas and tree crops such as cashew nut and coconut. With the western side of the reserve being drier,
farmers here are more vulnerable to crop failure. There is also a higher population density in the west, which altogether results in higher levels of poverty. Various aid and development organisations have worked around the Shimba Hills, including the Danish International Development Agency, DANIDA, which help farmers with agroforestry, livestock and agricultural projects as well as wildlife control and mitigation. Plan International has also been working in the area since 1997, supporting schools and education, as well as improving health facilities and building water tanks to provide safe rainwater sources (Liagamula Kayegeri, Plan International, pers.comm). The Red Cross has also helped with the distribution of food and mosquito nets.

**WWF Project Activities**

**Livelihoods**

As part of both the improved management project and the FLR initiative, livelihood projects have been set up in different administrative locations around the reserve by the formation of community groups: bee keeping and tree planting in Majimboni, bee-keeping, tree planting and aloe farming (for herbal products) in Lukore, aloe farming and other herbal products and tree planting in Mwaluphamba, and tree planting and herbal products in Mkongani (see map below). As well as this, a small-loans facility has been organised through the Kwale Conservation Trust Fund.

As part of their PFM strategy, WWF supported the establishment of the Shimba Hills Community Forest Association (SHICOFA) which brings together several conservation groups around the Shimba Hills, including the Shimba Hills Forest Tour Guide Association (SHIFOGA), Lima Group, which carries out agro-forestry activities, and a medicinal garden group, among others.

Annual technical reports of the groups are incomplete, but have given some (mixed) results: for example, bee-keeping projects experience problems concerning many hives not ever being colonised; groups not being provided with protective clothing leave honey to go to waste; complaints of insufficient capacity and training to properly manage the enterprise; lack of marketing options. However, bee-keeping in Lukore has experienced a high local demand for honey, bringing more success to the project. Agro-
forestry initiatives have proved more successful, with 50-80% of targeted households having commercially grown trees on their farms as opposed to 30% of non-targeted households; also, some non-targeted households have been reported to start off their own tree nurseries, having heard about neighbours’ successes.

**Reduction of HW conflict**

In 2005 the Shimba Hills Reserve held a population of approximately 700 elephants, far greater than its carrying capacity of 300. This had the effect of severely degrading the habitat, as well as heightening the frequency of human/wildlife conflict in adjacent communities. It was the aim of the FLR initiative, with KWS, to translocate roughly 400 elephants to Tsavo East National Park (GOK 2006). Annual technical reports show that by 2006 there were roughly 640 elephants and by 2007, there were roughly 350 elephants left in the reserve. The reserve had been marked by 86km of solar-powered electric fencing since the late 1980s, and the FLR initiative worked to repair and maintain this since the elephants have frequently broken through. Various wildlife deterrents such as the use of chili, bee hives and Kei apple have also been implemented. Initial reports, in 2006, suggested a reduction of human/wildlife conflict events; however, more recent reports have not given any details on this.
Methods

Livelihood assets

The SL Framework was used in this study to assess the livelihoods of households living by the Shimba Hills reserve and, consequently, to establish whether there had been any changes over the period that WWF has been supporting AL activities, PFM and FLR. The first livelihoods survey was carried out in 2006, so in order to make valid comparisons, the 2006 questionnaire was used again for this study. However, it contained several questions which were not used for indicators and so many of these were omitted from my survey as they were considered to be either unnecessary or too sensitive to ask. The questionnaire was semi-structured but included some open-ended questions (all indicator questions were closed-questions). The questions were primarily aimed at assessing livelihoods; however there were several perceived costs/benefits and attitudes orientated questions, all of which were retained in the questionnaire.

A short pilot test was carried out on five employees of WWF to check that all questions were appropriately chosen and set out. The pilot test was also used as a practice session for the two Kenyan assistants, who would be interpreting the English questionnaire into Swahili and then recording the answers in English. It was essential to practice so that both assistants knew exactly how to ask the questions, and both would be consistent in the ways that they asked questions. Having carried out the pilot test no further revisions of the questionnaire were made.

Questionnaires were carried out on a sample of 10% of each village; 14 villages within the four locations (see Table 1), with half the number of villages being at least 3km away from the forest (far), and the other half adjacent to the forest. For villages in the smaller location of Lukore, however, more than 10% was sampled in order to get a big enough sample size for Lukore as a whole. The sampling method could not be random as this was not feasible in the time available, since the villages were widely sprawled across the landscape. Each questionnaire took about 30 minutes to carry out. For time efficiency, the questionnaire team were split into two groups, whereby each assistant would be
accompanied by a village elder and carry out the questionnaires in different parts of the village. I would accompany each assistant alternately each day, to check for consistency between assistants as much as possible (bearing in mind the questions were asked in Swahili).

Table 1. Details of the survey sample, including the geographical position of the 14 villages surveyed and the 10% sample size

<table>
<thead>
<tr>
<th>Side</th>
<th>Location</th>
<th>Village</th>
<th>Near/Far</th>
<th>Population size</th>
<th>Sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>East</td>
<td>Majimboni</td>
<td>Msulwa</td>
<td>Near</td>
<td>102</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kidongo</td>
<td>Near</td>
<td>59</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mwalumba</td>
<td>Far</td>
<td>62</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mwapala</td>
<td>Far</td>
<td>184</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Lukore</td>
<td>Mkanda 3</td>
<td>Near</td>
<td>100</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mkanda 2</td>
<td>Far</td>
<td>80</td>
<td>15</td>
</tr>
<tr>
<td>West</td>
<td>Mwaluphamba</td>
<td>Terezani</td>
<td>Near</td>
<td>214</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bahakanda</td>
<td>Near</td>
<td>186</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mlafyeni</td>
<td>Far</td>
<td>262</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mirihini</td>
<td>Far</td>
<td>178</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Mkongani</td>
<td>Mkomba</td>
<td>Near</td>
<td>284</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tirie</td>
<td>Near</td>
<td>352</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mtsamvian</td>
<td>Far</td>
<td>236</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mzinji</td>
<td>Far</td>
<td>248</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>2547</td>
<td>273</td>
</tr>
</tbody>
</table>

Links between livelihoods and WWF activities

Data was not available for the type of occupation of permanently employed/part-time/self employed household members or for the type of community group from 2006; however, the 2010 survey did obtain this type of information through the questionnaire, by asking open-ended questions as to their occupation and the name of any group households took part in.

Household relationships with the forest

Dependence on forest resources

Information on this aspect was obtained only through one question in the questionnaire, which asked if households benefited from any products from the forest and gave options such as firewood, income from timber, grass and medicine.
Wildlife Costs

Data for this objective was obtained partly through the questionnaire, using the following question: ‘Has your household experienced any problems from the forest in the last 12 months?’, as well as finding out what proportion of reasons for reduced crop production was due to wildlife damage. Human/wildlife conflict data was also obtained from the Kenya wildlife Service offices in Kwale town. This process involved searching through the Occurrence Books from the year 2002 to 2010 for any records of reports from villagers of the four study locations, concerning presence of wild animals on farms, crop raids, or injuries or deaths caused by animals. This data was collected in order to compare reported HW conflict events with perceptions of wildlife problems and establish any discrepancies between each type of data (as can occur between perception and actuality (Gillingham and Lee 2003)).

Attitudes

Attitudes towards the forest and forest management were ascertained by asking households whom they thought benefited most from the forest, and whether they thought they benefited more or less from the forest than 5 years ago.

ANALYSIS

Livelihood Indicators

Having carried out the questionnaires and heard many responses, it was felt that some of the indicators used in 2006 would not be appropriate for analysis, so out of all the original indicators, a final shortlist was produced. The reviewing process is summarised in table 2 below.

Statistical Analysis

All statistical tests were carried out using the statistical programme R.

First, respondent characteristics were analysed using Chi² tests in order to test for differences between years. These were: sex of the respondent; whether the respondent
was the head of the household; and the sex of the household head. This test was in order to rule out the possibility that any changes found were due to household demographics.

Table 2. The reviewing process of the livelihood indicators used in 2006 and the final short list to be included in the 2010 survey

<table>
<thead>
<tr>
<th>Original list of Indicators</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human</strong></td>
<td></td>
</tr>
<tr>
<td>Education level of the household head; Households with members in secondary education; Walking time to school; Walking time to health facility</td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>Whether or not the household head was born locally; Household size; Household membership of a community group</td>
<td></td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td></td>
</tr>
<tr>
<td>Employment within household; Self employment within household; Hiring of labour; Number of cows owned; Number of goats owned; Number of chickens owned</td>
<td></td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
</tr>
<tr>
<td>Quality of roofing material; Quality of floor material; Quality of lighting type; Number of possessions; Household ownership of a mosquito net</td>
<td></td>
</tr>
<tr>
<td><strong>Natural</strong></td>
<td></td>
</tr>
<tr>
<td>Number of acres owned; Number of acres fallow; Number of tree and crop species on farm; Walk time to water source; Walk time to forest; Time taken to collect firewood; Quality of water source; Number of animal species seen on farm; Problems experienced from forest; Perceived benefit from forest</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Omissions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Not a valid indicator of wealth</strong></td>
<td></td>
</tr>
<tr>
<td>Self employment: rather than indicating wealth, members may be self employed because they are not educated enough for employment.</td>
<td></td>
</tr>
<tr>
<td>Number of possessions: this is not measured in terms of value, so 5 cheap possessions would not be differentiated from 5 expensive possessions.</td>
<td></td>
</tr>
<tr>
<td>Number of acres fallow: this could represent either extra land not needed or lack of man power to farm.</td>
<td></td>
</tr>
<tr>
<td>Household head born locally: no evidence was found to indicate that households in which the head was born locally would be wealthier</td>
<td></td>
</tr>
<tr>
<td><strong>Unreliable</strong></td>
<td></td>
</tr>
<tr>
<td>Walking time to school, health facility, water source, forest, collection of firewood: with no watch or clock, households may not perceive time accurately.</td>
<td></td>
</tr>
<tr>
<td>Number of crops, trees and animals seen on farm: households may not want to spend effort listing all crops/trees/animals, or may not know different tree/animal species names, or only list those animals which are pests.</td>
<td></td>
</tr>
<tr>
<td>Quality of water source: wells and springs can be protected or unprotected which greatly affects the quality of water, and responses did not differentiate between the two (REF).</td>
<td></td>
</tr>
<tr>
<td><strong>Unnecessary</strong></td>
<td></td>
</tr>
<tr>
<td>Household Head education level: this was thought unlikely to have changed since 2006 since adults are unlikely to attend further education once too old for school.</td>
<td></td>
</tr>
<tr>
<td>Quality of floor material: roof material gives similar indication.</td>
<td></td>
</tr>
<tr>
<td>Perceived problems/benefits from forest: more opinion-based.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final list of indicators</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human</strong></td>
<td></td>
</tr>
<tr>
<td>Secondary education within the household; Whether or not households seek professional medical aid when ill rather than do nothing or buy traditional medicine</td>
<td></td>
</tr>
<tr>
<td><strong>Social</strong></td>
<td></td>
</tr>
<tr>
<td>Household size; Household membership of a community group</td>
<td></td>
</tr>
<tr>
<td><strong>Financial</strong></td>
<td></td>
</tr>
<tr>
<td>Employment within the household; Labour hiring; Number of cows; Number of chickens; Number of goats owned</td>
<td></td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
</tr>
<tr>
<td>Quality of roofing type; Quality of lighting type; Ownership of a mosquito net within the household; Number of agricultural aids used</td>
<td></td>
</tr>
<tr>
<td><strong>Natural</strong></td>
<td></td>
</tr>
<tr>
<td>Number of acres owned; Crop production levels</td>
<td></td>
</tr>
</tbody>
</table>
Testing for effects on response variables

The data for all objectives were tested for the effect of Year individually and its interactions with the other explanatory variables (see below) to assess changes since 2006.

Livelihood data was also analysed with Side, to account for the difference in poverty levels between the east and west sides of the Shimba Hills, and Distance from the forest (Near and Far), since wealth is negatively affected by both remoteness from markets (which are further from the forest) and Wildlife Costs, which are inversely correlated with distance from the forest. Forest Product Use was also analysed with Side and Distance, since forest resource dependence increases with decreasing wealth and increasing proximity to the forest.

Wildlife costs were analysed with Distance, for reasons explained above. Attitudes were expected to be affected by many of these factors but in order to keep the model more robust, Elephant Problems were used to represent all animal problems; and also to be used as a proxy for Distance from the forest. The explanatory variables used were, therefore, Side, to explore the effects of wealth; Forest Product Use, since reduced dependence on resources is likely to lead to fewer objections to the imposed restrictions of use by PA authorities; and finally Elephant Problems, since costs incurred from wildlife incite negative attitudes to conservation.

It was recognised that Village could affect the results, since there were different sample sizes between 2006 and 2010; however, it was beyond the scope of this project to analyse the effects Village may have had since the sample size was too small.

All response variables were input into a generalised linear model in order to separate out effects between their corresponding explanatory variables by looking at effects of interactions and each explanatory variable individually. Each interaction or individual factor was removed and the model updated, using a likelihood ratio test to justify each removal, until a minimal model was left.

Number of acres was the only continuous data and was analysed using a normal distribution with the data logged. Count data was tested using a poisson distribution, or
a quasi-poison if the variance was greater than the mean (count data included household size, number of cows, chickens and goats, and number of agricultural aids). All other data was either binomial or multinomial, the latter of which were then categorised more broadly into two categories to be tested with a binomial distribution as well.

The total sample size was 510 but some responses were deemed invalid due to, for example, the respondent not knowing the answer (although this was a valid option in some questions), or unable to assign their response to any of the given categories (across both years). As a result, most variables had a valid sample size of between 500 and 510; however, the sample size for Medical help was 408; Acres 474; Government benefits 464. The sample size for Benefit Levels was just 263 since this data was collected only in 2010, in which the sample size was 273.

Analysis of the KWS human/wildlife conflict data was carried out using a linear model to test for any significant changes over time in the number of conflict incidences around the reserve per year.

Sustainable Livelihoods analysis tends to culminate in the formation of a radar diagram where the five assets can be viewed together for a community or population according to their different strengths (Freeman, Ellis et al. 2004). For each indicator a score is given between 1 and 5 and an overall score is given to the asset by averaging scores for each indicator of that asset.

For binomial data, a score between 0 and 5 was given for each indicator according to the percentage of households in that portion (Year, Side or Distance) who answered positively for that response variable, indicating the wealth of that asset. For count and continuous data, a range between 0 and the maximum value given (across both years; values are averages of each portion) was divided into scores between 0 and 5. For most data, a greater number equalled more wealth; but for data in which a greater number indicated less wealth the score was put in decreasing order.
Radar diagrams were made for 1) overall comparisons of year, 2) comparisons between the east and west sides of the forest in 2010, and 3) comparisons between households close to and far from the forest in 2010.

Data on occupation and membership of community group were analysed descriptively since the sample sizes were too small to warrant any statistical tests.
Results

Respondent Characteristics

No significant difference between years was found with any of the respondent characteristics, as shown in the table below.

Table 3. Pairwise comparisons of respondent characteristics between 2006 and 2010

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$</th>
<th>Degrees of freedom</th>
<th>P-value</th>
<th>Male (%) 2006 -&gt; 2010</th>
<th>Yes (%) 2006 -&gt; 2010</th>
<th>Male (%) 2006 -&gt; 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex of respondent</td>
<td>7e-04</td>
<td>1</td>
<td>0.9786</td>
<td>53.4 -&gt; 53.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respondent is household head</td>
<td>2.0446</td>
<td>1</td>
<td>0.1527</td>
<td></td>
<td>73.7 -&gt; 79.5</td>
<td></td>
</tr>
<tr>
<td>Sex of household head</td>
<td>0.6643</td>
<td>1</td>
<td>0.415</td>
<td></td>
<td></td>
<td>66.9 -&gt; 70.7</td>
</tr>
</tbody>
</table>

Livelihood Assets

Objective 1: To use the Sustainable Livelihoods Framework to determine how livelihood assets of communities have changed since 2006

Table 4 indicates the individual and combined effects of the explanatory variables Year, Distance and Side on each response variable of livelihood asset indicator, in terms of the direction of change and significance. It is clear that there have been many significant changes since 2006, the majority of them being a reduction in quality. Side and distance, too, affect quality of indicators. The results found are described in more detail below, according to the five livelihood assets.

Human Assets

Secondary education within households has not changed significantly since 2006 and is currently at 37%. However, households are less likely to have any members with secondary education on the west side of the forest ($t=-1.18$, d.f. 506, $p<0.001$) and far from the forest ($t=-0.52$, d.f. 506, $p<0.01$).
**Table 4. The significant effects of year, side and distance on sustainable livelihood asset indicators.** Each P value is taken from the minimal adequate glm, which started with all three explanatory variables and the two interactions. n/s indicates that the p-value of the variable was not significant at the 5% level so the variable was removed from the model. The parameter estimates (P.E.) show the degree and direction of change. Dark blue indicates a positive effect, light blue indicates a negative effect. There were no significant effects of the interactions of Year:Side or Year:Distance on any of the response variables.

<table>
<thead>
<tr>
<th></th>
<th>Year $\beta_{2010}$</th>
<th>Side $\beta_{\text{west}}$</th>
<th>Distance $\beta_{\text{near}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>P.E.</td>
<td>P-value</td>
</tr>
<tr>
<td>Secondary education</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Quality of medical aid</td>
<td>&lt; 0.001</td>
<td>1.24</td>
<td>n/s</td>
</tr>
<tr>
<td>Household size</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Membership of community group</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Employment</td>
<td>&lt; 0.05</td>
<td>-0.61</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Labour hired</td>
<td>&lt; 0.01</td>
<td>-0.69</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of cows</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Number of chickens</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of goats</td>
<td>&lt; 0.001</td>
<td>-0.53</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Quality of roof material</td>
<td>&lt; 0.05</td>
<td>-0.46</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Quality of lighting</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Ownership of mosquito net</td>
<td>&lt; 0.001</td>
<td>2.19</td>
<td>n/s</td>
</tr>
<tr>
<td>Number of agricultural aids</td>
<td>&lt; 0.001</td>
<td>-0.77</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Number of acres</td>
<td>&lt; 0.001</td>
<td>-0.39</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Crop production levels</td>
<td>n/s</td>
<td>-</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Approximately 50% of households in 2006 said they would visit a pharmacy, doctor or hospital when seriously ill rather than go to a traditional doctor, buy local medicine or do nothing. This number has increased significantly, to 88% ($t=1.24$, d.f. 399, $p=0.001$). Neither side of the forest, nor distance from the forest, have any effect on this result.

**Social Assets**

Average household size has not changed significantly since 2006 and is currently 8.3 members. However, households in the west side of the forest have significantly more members than in the east, with an average of 9.2 members as opposed to 6.6 ($t=0.27$, d.f. 507, $p=<0.001$).

The percentage of households with any members being part of a social group in 2010 is 45.8%, which has not changed significantly since 2006; however, membership is significantly less common in the west than in the east ($t=-1.29$, d.f. 505, $p=<0.001$), with 37% of households connected with a social group in the west and 77% in the east.
**Financial Assets**

In 2006 the percentage of households with any members employed was 19.5%, with 63% of households being farmers with no extra source of income. Since then, it has significantly decreased, to 10.6% (t=-0.61, d.f. 505, p=<0.05) (see Figure 3). The number of households hiring labour in the last year has also decreased (see figure x), from 31.8% to 17.9% (t=-0.69, d.f. 505, p=<0.01). Both employment and labour hiring were significantly less common in the west (employment: t=-0.78, d.f. 505, p=<0.01; labour hiring: t=-1.37, d.f. 505, p=<0.001). Distance from the forest had contrasting effects on employment and labour hiring, however, with significantly more employment near to the forest than far (t=0.62, d.f. 505, p=<0.05), but significantly less labour hired (t = -0.54, d.f. 505, p=<0.05).

There has been no significant change in the number of cows or chickens owned since 2006. Ownership of goats has significantly decreased since 2006, with 5.9 cows owned on average in 2006 and 3.6 owned in 2010 (t=-0.53, d.f. 499, p=<0.001). Side affects the number of chickens and cows owned, with fewer of both being owned in the west.
(chickens: t=-0.62, d.f. 501, p=<0.001; cows: t=-0.57, d.f. 501, p=<0.05). Ownership of cows also decreases with decreasing distance from the forest (t=-1.25, d.f. 501, p=<0.001).

Physical Assets

The number of households with better quality roofing has declined by 13% since 2006, with only 27.5% currently using iron sheets or tiles rather than coconut fronds or grass (t=-0.46, d.f. 504, p=<0.05). Significantly more households in the west have lower quality roofing than those in the east (t=-1.50, d.f. 504, p=<0.001). Households in the west also have lower quality lighting sources than those in the east (t=-0.84, d.f. 502, p=<0.01) but unlike roof quality there has been no significant change in quality of lighting since 2006. Lighting quality is greater near the forest than far from it (t=0.68, d.f. 502, p=<0.01).

Household ownership of a mosquito net has increased hugely since 2006 (t=2.19, d.f. 497, p=<0.001), with just 23.3% of households owning a net in 2006 to over 70% in 2010. There is no significant difference between sides of, or distance from, the forest.

The average number of agricultural aids such as fertiliser, improved seed storage or ploughing, used by households has decreased significantly from an average of 1.8 per household in 2006 to 0.8 in 2010 (t=-0.77, d.f. 504, p=<0.001), and there are generally fewer agricultural aids used in the west than in the east (t=-0.38, d.f. 504, p=<0.001).

Natural Assets

Farm plots have significantly decreased in size from an average of 10.5 acres being owned in 2006 (s.e. 0.58) and only 7.8 acres owned in 2010 (s.e. 0.69) (t=-0.39, d.g. 468, p=<0.001) (see figure 4). Plot size is smaller in the west (average size 6 acres, s.e. 0.46) than in the east (average size 15.3 acres, s.e. 0.8) (t=-0.97, d.g. 468, p=<0.001), and smaller near the forest (average size 8.1 acres, s.e. 0.53) than far away (average size 10.4 acres, s.e. 0.76) (t=-0.23, d.f. 469, p=<0.01).
Crop production responses included ‘increased’, ‘stable’, ‘unstable’ and ‘decreased’. For analysis, the former two were grouped into ‘increased’ and the latter two into ‘decreased’. Opinions on whether crop production levels have increased or decreased over the last five years have not significantly changed since 2006, but those living in the west more commonly think production has decreased than households in the east (t=-0.79, d.f. 501, p=<0.001). Those living nearer the forest are more likely to think that crop production has increased (t=0.59, d.f.501, p=<0.05). Reasons for crop production increasing and decreasing are shown in the figure below.

It is evident that the use of agricultural aids is the main reason for increases in crop production, with a slightly higher percentage of households benefiting from agricultural aids in the east and near the forest. Reasons for decreases in crop production are predominantly lack of agricultural aids and bad conditions (mostly drought), which are most common in the west and far from the forest. Wildlife problems are much greater near the forest than far from it and affect both sides of the forest roughly equally.

![Figure 4](image-url)

**Figure 4.** The average number of acres owned by households within each geographical area surrounding the reserve, in 2006 and 2010.
Standard error: 2006 = 0.58; 2010 = 0.69; East = 0.80; West = 0.46; Near = 0.53;
Livelihood assets summary

Below are the Sustainable Livelihoods radar diagrams, portraying the quality of each asset according to year, side of the forest, and distance from the forest. The diagrams show that Human and Social assets have increased in quality over time. Indeed, access to medical care has significantly improved; however, the apparent increase in social assets is misleading, since it has been found that changes were not significant in either of the social indicators.

Figure 5. The reasons given in 2010 for crop production change over the last five years, within all geographical areas. A. Reasons for decrease in production. B. Reasons for increase in production. Percentages are of the total number of people who either responded with ‘increase’ (n=46) or ‘decrease’ (n=225).
Physical assets have not changed at all and financial and natural assets have decreased quite substantially. The change in financial assets is driven by reduced employment and labour hiring and the change in natural assets is driven by smaller land plot sizes. Side remains an important factor in the quality of all five types of livelihood asset: overall, those living in the West have lower quality livelihoods in all aspects except Social. Distance from the forest does not currently appear to affect livelihood assets, except that financial assets are slightly lower nearer to the forest (indicated by fewer cows owned – although not significant – and fewer households hiring labour), and physical assets very slightly higher (indicated by better quality lighting sources).

Figure 6. Livelihood assets of households surrounding the Shimba Hills Reserve. A. Comparison of assets between 2006 and 2010. B. Comparison of assets between the east and the west sides of the reserve in 2010. C. Comparison of assets between households near to and far from the reserve in 2010.
Livelihood indicators related to WWF activity

Permanent and temporary or self employment predominantly included occupations in the public service/professional field, and skilled and unskilled manual labour. Of the 99 household members employed, only eight (8.1%) had jobs that could possibly be related to WWF’s activities with alternative livelihoods and PFM (Figure 7). These included agro-forestry, electric fence maintenance work, the sale of firewood and carpentry. However, the latter two may not be related to forest management or WWF livelihood activities and may instead be unsustainable activities.

Figure 7. The occupation types of permanently employed and temporary or self employed members of households. Possible WWF-related occupations include agroforestry, fence technician work, selling of firewood and carpentry

Of all the community groups named by interviewees, none were the groups which are known to be undertaking alternative livelihood activities supported by WWF.

The relationship between households and the forest

The table below shows the effects of Year, Side and Distance on how households are affected by the forest, both positively from the use of forest products, and negatively from wildlife problems.
Table 5. The significant effects of Year, Side and Distance on household relationships with the forest Each P value is taken from the minimal adequate glm, which started with all three explanatory variables and the two interactions. n/s indicates that the p-value of the variable was not significant at the 5% level so the variable was removed from the model. The parameter estimates (P.E.) show the degree and direction of change. Dark blue indicates a positive effect, light blue indicates a negative effect.

<table>
<thead>
<tr>
<th></th>
<th>Year:Side</th>
<th>Year:Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta_{2010}$</td>
<td>$\beta_{\text{West}}$</td>
</tr>
<tr>
<td>Forest products</td>
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</tr>
<tr>
<td>Elephant problems</td>
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<tr>
<td>Other animals</td>
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<td>$1.00$</td>
</tr>
<tr>
<td>Wildlife crop damage</td>
<td>n/s</td>
<td>-</td>
</tr>
</tbody>
</table>

Objective 2: To assess how forest resource use has changed since 2006

It is evident from Figure 8 below that substantially fewer households use forest resources in 2010 than they did in 2006 ($t=-2.37$, d.f. 502, $p=<0.001$). Fewer people in the west benefit from forest products than the east overall ($t=-1.33$, d.f. 502, $p=<0.001$), although slightly more households benefit in the west now than in the east ($t=1.82$, d.f. 502, $p=<0.001$); however compared to 2006 this difference is very small. More people living near the forest use its resources than those further away ($t=2.46$, d.f. 502, $p=<0.001$); however, there is less difference now than there was in 2006 ($t=-2.15$, d.f. 502, $p=<0.001$).

Figure 8. Forest product use by households, with differences shown between all geographical areas in 2006 and 2010
Figure 9 below shows the amount of use of different types of forest resource has remained roughly the same, except firewood is proportionately a more commonly used product now than it was in 2006.

![Figure 9](image_url)

**Figure 9. The different forest products used by households in 2006 and 2010. Percentage is of the number of households who use each forest product out of the total number of households using forest products (households may use more than one product). 2006 n = 172, 2010 n = 72.**

**Objective 3: To assess how the perceived costs of the forest for the local communities have changed since 2006**

Data on reported human/wildlife conflict events showed there was no significant rise in human wildlife conflict reporting over this period ($t=1.4$, d.f. 7, $p=0.2$). However, there was considerable fluctuation between years, as shown in Figure 10, below.

![Figure 10](image_url)

**Figure 10. The number of human/wildlife conflict incidences per year reported to KWS by households of the four study locations between 2002 and 2010. The number for the full year of 2010 has been extrapolated from the rate between January and June.**
According to questionnaire data, significantly more households say they experience wildlife problems now than in 2006 overall: for example, in 2006 the percentage of people who had experienced elephant problems was under 50%, whereas in 2010 it was over 82% (elephants: $t=2.21$, d.f. 505, $p<0.001$; other wild animals: $t=1.00$, d.f. 506, $p<0.001$). Problems with wildlife are experienced significantly more frequently near the forest than further away, overall (elephants: $t=2.48$, d.f. 503, $p<0.001$; other animals: $t=2.04$, d.f. 506, $p<0.001$).

Although crop production levels have not changed since 2006, a significant increase in crop damage from wildlife has occurred near the forest ($t=1.99$, d.f. 399, $p<0.01$), with 6.6% of households who experienced crop reductions giving wildlife as the main reason in 2006 and 18.2% blaming wildlife in 2010. Wildlife problems are now causing a loss in production to 14.8% of households in total.

**Objective 4: To determine whether or not attitudes to the forest have improved since 2006**

Table 6 shows that household perceptions that villagers benefit from the forest most have increased significantly ($t=1.08$, d.f. 500, $p<0.05$), particularly among households who collect forest products ($t=1.73$, d.f. 499, $p<0.01$) (Figure 11). In line with this, perceptions that the government benefits most have decreased significantly among households who collect forest products ($t=-1.46$, d.f. 454, $p<0.01$), whereas they have not significantly decreased overall ($t=-0.77$, d.f. 454, $p=0.06$). Perceptions that the government benefits most are less common in the west side of the forest than in the east ($t=-0.6$, d.f. 454, $p<0.05$) and perceptions that villagers benefit most are more common ($t=0.93$, d.f. 500, $p<0.01$).

If a household has experienced problems from elephants, the perceived beneficiary will more likely be the government ($t=0.64$, d.f. 454, $p<0.05$) and less likely to be the villagers ($t=-0.80$, d.f. 500, $p<0.01$).
Table 6. The significant effects of year, side, forest product use and elephant problems on household attitudes towards the forest. Each P value is taken from the minimal adequate glm, which started with all three explanatory variables and the two interactions. n/s indicates that the p-value of the variable was not significant at the 5% level so the variable was removed from the model. The parameter estimates (P.E.) show the degree and direction of change. Dark blue indicates a positive effect, light blue indicates a negative effect. There were no significant effects of Year:Side or Year:Elephant Problems interactions on any response variable.

<table>
<thead>
<tr>
<th></th>
<th>Year $\beta_{2010}$</th>
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<th>Elephant Problems $\beta_{\text{Yes}}$</th>
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</table>

Figure 11. The percentage of households who perceive that villagers benefit most from the forest, in 2006 and 2010, showing differences between side of the forest and whether or not households use forest products.

Fifty eight percent of households believed they benefited less from the forest now than five years ago whereas only 19% believed they benefited more now than five years ago. There was no significant effect of side of the forest or elephant problems on whether households believed they benefited more or less than five years previously. However, households were more likely to believe they benefited more than five years ago if they collected forest products ($t=3.00$, d.f. 204, $p<0.001$).
Discussion

Have livelihoods improved in forest-adjacent communities, and how does this link with WWF's activities?

Hypothesis: Livelihood assets of households surrounding the reserve will have improved since 2006

WWF’s two projects, Forest Landscape Restoration and Improved Conservation and Governance for Kenya Coastal Forest Protected Area System, contained development objectives including the development of PFM and agroforestry and alternative livelihood activities that reduce pressure on the forest. This project sought to ascertain the impacts of these activities on rural livelihoods.

The first limitation of this monitoring project is that it cannot attribute any changes in livelihoods to the work of WWF. This is because no location outside the range of WWF’s work was selected at the start of the project to act as a control with which to separate out baseline changes in livelihoods over time from changes due to the reserve management. Finding another location that is similar to the study locations in every way except having WWF management would be almost impossible and this is the reason why many studies do not have such controls (Schreckenberg, Camargo et al. 2010). Nevertheless, with no control it cannot confidently be said, moreover it would be wrong to say, that any changes in livelihoods are due to WWF’s work; one can only search for correlations and suggest causes.

It is evident that, overall, livelihoods have not improved. The benefit of using the SLF, however, is that livelihoods can be dissected and changes each asset and their indicators individually assessed.

The western side of the Shimba Hills is known to be poorer than the eastern side, due to a higher population and less favourable climatic conditions for farming. The quality of livelihood assets found in this study conformed to this view, since households on the
West side ranked lower in most assets (except household size) than the east, both in 2006 and in 2010.

The effects of distance from the forest on livelihood assets was studied because human wildlife conflict is more likely to occur in households living close to the forest than in those living further away. This can affect crop production (natural assets), thus income generation and in turn financial, physical, human, and social assets. Also, households can be more remote from transport links and markets, and therefore poorer, nearer the forest (Howell, Schwabe et al. 2010). However, there seemed to be very few livelihood assets affected by distance. Moreover, production levels were found to be higher near the forest than far away. There was also a higher quality of lighting, and both higher employment and higher secondary education nearer the forest, suggesting more sustainable livelihoods; however, on livelihoods overall there is little effect.

Only two sustainable livelihood indicators have improved since 2006; these are access to professional medical care and household ownership of a mosquito net. These wealth indicators are not directly related to WWF’s activities and their improvement is highly likely to be due to the work of development and aid organisations, Plan International and the Red Cross. Medical care is vitally important in improving human assets, since, for example, in asking the question concerning medical aid, this study found that the vast majority of households had had a serious disease or illness, such as malaria, flu and cholera, in the last year. Mosquito nets, although an indicator of physical assets, can help to improve human assets through improved health if used appropriately.

As well as building and supporting health facilities, Plan International also support schools and education; however their work focuses more on improving school facilities and not so much the enrolment of pupils (Kayegeri, Plant International, 2010, pers. comm.). Education has been shown to be a great influence on a household’s ability to diversify livelihoods by improving knowledge and skills (Ellis 1998) and therefore making them more sustainable, and so the lack of improvement of livelihoods overall may be in part due to the lack of increase in secondary school attendance.

The establishment that 63% of households rely on farming as a livelihood with no other source of income and almost no participation in WWF activities necessitates the
investigation into the sustainability of their other livelihood indicators that influence farming success, in order to be able to improve the sustainability of farming. Many farming-related indicators have not improved. For example, hiring of labour has decreased. This does not necessarily represent lower wealth, since with increasing population density labour intensity increases due to the higher ratio of potential farm labourers to area of farmland (Pender 2004). Therefore, hiring of labour may be reduced if there are enough members of the family already available to farm. However, in this sample, household size has remained the same as in 2006 which means that man power for farming is likely to have decreased with less hiring of labour. Supporting this, labour hiring is less common in the west, where the population density is higher and household size is larger than in the east. Indeed, several households complained that large areas of their land remained fallow since they did not have the labour power to cultivate it.

Membership in community groups helps to enhance farming productivity, by improving the level of contact and relations between households, thus enabling the circulation of knowledge and tips regarding farming techniques. The lack of increase in group membership does not necessarily mean a lack of increase in agricultural group membership; however, it could be preventing the further dissemination of farming knowledge and skills through communities. Many groups demand a payment for membership and since household access to necessities such as food or healthcare is often insufficient, there may be a lag for membership in groups to increase, until other assets improve. This supports the evidence found that fewer households were members of a group in the poorer, west side of the forest. In this study, many of the households with no membership in a group commented on the high registering fee.

There are many external factors which affect the production of crops around the Shimba Hills reserve, for example, drought, floods, infertile soils, wildlife damage, crop pests and diseases. Therefore it is essential that for farming livelihoods to be sustainable, these limitations are reduced by agricultural aids such as fertiliser or pesticide, improved storage of crops, or improved ploughing. The decrease in the use of agricultural aids, therefore, implies that the sustainability of farming as a livelihood is reduced. Ownership of cows, which aid ploughing, has not changed but is lower in the west. The decrease in plot size is most likely to be due to the increase in population and therefore increased
density of households. This heightens the importance of agricultural aids in order to make small plots as productive as possible, particularly in the west, and emphasizes the linkage between livelihood assets (in this case, physical and natural). Production levels have shown no improvement, which means that for any increase in income to occur from crops (once household food supplies are sufficient), improving the sustainability of livelihoods, is unlikely at present.

The indicators most directly related to WWF’s activities are household membership of a community group and employment, since WWF’s work is carried out and institutional capacity built through the creation of groups for both alternative livelihood activities and participatory forest management, and both AL and PFM provide employment for households. There has been no change in membership in a group since 2006, although this measure is on a household level, and does not identify whether there has been any change in the number of household members in a group, or the number of groups a household is part of. It could be, for instance, membership of groups within those households that already have access to groups has increased (i.e. more than one group per household) whereas access to groups by households living more remotely has not changed. Employment has decreased since 2006 which reduces a household’s financial assets, thus potentially impacting on all other assets through lack of funds to buy possessions or to pay for medical care and education, for example.

It was expected that employment and group membership would have improved due to WWF’s facilitation of groups and employment opportunities. However, it was found that not one job was related to the forest. Self employment was not considered a valid indicator of wealth so was not used to measure livelihood assets, however, it was studied to find any part time jobs that may indicate involvement with conservation. In total, only 8% of people employed in some way had jobs that may be related to WWF’s work. Similarly, none of the community groups named by respondents during the questionnaire was one of those which are known to have been supported by WWF’s work (and which are included in their group reviews). More accurate and reliable data on these aspects could have been obtained had there been questions asking directly whether or not they were a member of one of WWF’s groups, or employed by the forest management. However, the existing data on membership of social groups and
employment has given a fairly good (albeit indirect) indication that household involvement within the survey area in AL and PFM is very low.

The lack of representation of involvement in WWF’s work within the study sample could be on account of the non-random sampling of households. It was not feasible to carry out a randomly sampled survey due to lack of time and funding available, either to pay the assistants and village elders for more labour time in order to reach wherever the random sampling method determined, or to pay for transport to access them by: Villages were sprawled across the landscape and access routes were poor.

Because of this, in terms of livelihood assets, it is not possible to assess impacts of WWF’s work or any correlations between AL activities or being part of PFM and livelihood changes. It does serve to show, however, that AL and PFM activities are not fully distributed across communities and any positive effect they are having may be restricted to that area.

**Household relationships with the forest**

**How has forest resource dependence changed since 2006?**

*Hypothesis 2: Forest product use will have decreased since 2006*

The number of households saying they benefit from forest-related products has decreased since 2006, thus the hypothesis can be accepted. On the surface, this suggests that forest resource dependence has been reduced; however, it was expected that an improvement in livelihoods would have been the causal factor in reduced forest-dependence, and livelihood assets have shown a decrease since 2006, overall. Moreover, the livelihood improvements were expected to be due to WWF’s activities, which, it seems, have not involved any of the households surveyed. Instead, therefore, the reason for reduced forest product use may be increased law enforcement around the protected area, reducing illegal collection of forest products, or the increase in prices of resource use permits, rather than successful alternative livelihood activities.

Indeed, previously to 2006, law enforcement was weak (Mukalla, KFS 2010, pers. comm.) and 73% of households were found to use forest resources. The new Forest Act
as of 2005 allows communities controlled access to certain resources but much of these require permits, which many households may not be able to afford. Firewood is the biggest resource collected, for example, and in 2007 KFS increased the cost of monthly fuel-wood permits from 45 KSh to 100KSh (Mukalla 2010, pers.comm). KFS and KWS have increased their capacity for patrolling since 2006 and illegal logging can incur fines of between 20 000 and 50 000 KSh (= $US294 - $US735) and one to two years imprisonment. When law enforcement was weaker and the risk of arrest was lower, the prospect of free resources is more likely to have outweighed the possible punishments; now, however, with increased patrolling households may be more risk averse and not collect resources from the forest.

The increase in law enforcement helps to explain why the differences in product use with distance from the forest were pronounced in 2006 but are much less so now – in 2006 those near the forest had better access to resources; now, however, access is restricted by costs of permits, which applies to all, since livelihood wealth seems to show little difference overall between those near the forest and those far away. Again, in 2006 resource differed between east and west but now there is very little difference. This indicates that despite greater wealth in the east than in the west, permit costs are still too high for households to afford, leaving effectively no difference in wealth between sides in this respect.

Whereas the livelihood assets social group and employment did not strongly indicate any involvement in WWF’s activities, of the proportion of households who still use forest products 35% said they receive an income from timber. This suggests that either these households are part of a sustainable use group or PFM, which is surprising since this information wasn’t revealed in employment or community group questions; or, it indicates that some households are still benefiting from forest-related incomes illegally. However, many of these households were from one particular village (Mirhini) which makes the former suggestion more probable.

How have perceived costs from wildlife changed since 2006?

_Hypothesis 3: Perceived problems from wildlife will have decreased since 2006_
Despite the halving of the reserve’s elephant population between 2005 and 2007, there has been an increase since 2006 both in reported cases of HW conflict and in perceived elephant and other animal problems (which means that the hypothesis cannot be accepted). This suggests that there may be other factors influencing the movement of elephants towards farms other than overpopulation, as has been found elsewhere (Hoare 1999). However, the number of households affected (according to questionnaire data) is roughly the same as the number reported to KWS, which, considering the survey size was only a fraction of the true population of the four locations, indicates a huge discrepancy between the number of reported incidents and the perceived costs to households.

One reason for such a discrepancy could be that not all HW conflict cases may be considered serious enough to be reported to KWS and, even if the case is serious, reporting cases can be costly if a household has no phone or lives remote from a road and has to travel to the KWS offices to report the incident in person. Also, the evident decrease in plot size since 2006, particularly near the forest, linked with increased population, implies that households are more densely distributed near the forest. This means that whereas only one report need be made for each time an elephant or other wild animal approaches, several households are affected as the animals move from one farm to the next.

Despite these possibilities, it is more than likely that the discrepancy is due to households perceiving wildlife costs to be greater than the actual costs, as has been found in several other studies (Gillingham and Lee 2003), causing households to over-report the problem. Extreme HW conflict events may increase the perceived costs disproportionately (Naughton-Treves 1996, in Naughton-Treves 1998) and whilst smaller animals such as baboons and bushpigs can damage a significant area of crops (Naughton-Treves 1998), elephants can occasionally destroy entire farm-plots in a single event (Gillingham and Lee 2003). Over-reporting of HW conflict events can also occur when communities do not have ownership rights over the protected area and so are resisting to the loss of access to resources but maintained wildlife costs (Gillingham and Lee 2003); this could certainly be the case households in the Shimba Hills, given their loss of access to resources.
The reduction in problems with elephants and other animals with distance from the forest is most likely due to the fact that wild animals are averse to conflict with humans (Hoare 1999) so would be less likely to venture far away from the forest as doing so increases their vulnerability to conflict with humans. Additionally, although the most common reasons for reduced crop production in 2010 overall were lack of agricultural aids and poor conditions (see fig. X), near the forest wildlife damage was roughly as common as the first two reasons. Despite more wildlife damage, however, production near the forest has increased more than it has further away. The main reason given for this is agricultural aids.

Although the vast majority of households said they experienced problems from wildlife, particularly near the forest, wildlife problems as a reason for crop reduction were only given for 18% of households, which is quite low compared to what has been found elsewhere (Gillingham and Lee 2003). What can be gathered from this is that perhaps many households view wildlife as a problem whether or not they damage their crops. Alternatively, they may experience crop damage but consider agricultural improvements or climatic conditions to be more influential on production. Those near the forest, however, perhaps have a much higher degree or incidence of crop damage from wildlife, which is why wildlife problems as a main influence in crop production is more common near the forest.

How have attitudes changed towards the forest and forest authorities since 2006 and how does this link to forest resource benefits and wildlife costs?

**Hypothesis 4: Attitudes towards the forest will have improved since 2006**

If the deductions are correct that resource use has decreased due to better law enforcement and not due to improved livelihoods and less dependence, it would be expected that attitudes to the forest and authorities would have become more negative. This study found mixed results: the majority of households still believe that the government benefits most from the reserve and that they themselves benefit less than five years ago; however an increasing number of households believe that villagers benefit the most. The evidence that households are more likely to hold a positive
attitude when they use forest products now than in 2006 suggests that the products hold greater value for households than before, which could be due to WWF’s work in facilitating incomes from sustainable resource extraction; indeed, several households said they were able to get income from timber. However, this was found to be specific to only certain areas and overall it seems that positive attitudes are dependent on the benefits households gain from all types of forest products, everywhere. This implies that they are not benefiting from alternative livelihood activities since this should have reduced dependence on resources.

As expected, negative attitudes are significantly more likely to form if the household has been affected by wildlife problems. Currently, compensation is only given to households when there is injury or death (Mwamburi, KWS 2010, pers. comm.), whereas the most common impact is destruction of crops, which can potentially cause a loss of much of the season’s production (Nchanji and Lawson 1998 in Naughton, Rose et al. 1998). This can then have a significant and long-lasting impact on households if, for example, they then cannot afford food, education or healthcare. Therefore, since the majority of households have experienced wildlife problems, this could be the reason for the majority view that the government benefits most.

**Strengths and weaknesses of research methods**

Apart from the limitations already described, there are other issues that should be considered if carrying out a similar study in the future.

**Survey technique**

This sustainable livelihoods study used household level data which reveals the heterogeneity of wealth between households. District-level livelihood studies involve collecting government data on, for example, secondary school attendance, and are quicker to carry out. However, district level data homogenises all variance within a district and gives an unrealistic picture of the poverty level, and gives no indication of priority areas (Erenstein, Hellin et al. 2010). Indeed, it is evident from this study that within Kwale district poverty levels are much higher in the west and therefore these communities need more development attention than those in the east.
A limitation of using household surveys is that the impression that it is revealing the true situation can be misleading, since, for example, the data is more subjective and households may exaggerate or withhold information depending on their expectations of the survey outcome. Also, it is often the household head, usually male, who answers the questionnaire, which may give a different impression of the various aspects of household wealth from a woman’s perspective (Schreckenberg, Camargo et al. 2010). Fortunately, in this study the questions were mostly fact-based and there was a roughly equal number of male and female responses, so the scope for and degree of misleading results should be minimal.

In light of all these strengths and limitations, it may have been beneficial to combine household surveys with community-based surveys in the form of focus groups, where all different aspects of the community are represented (for example different wealth categories, religions, occupations, ages, and both male and female) (Schreckenberg, Camargo et al. 2010), and back this up with government data. The findings from one method used can help to interpret other findings and can increase confidence in results (Adato and Meinzen-Dick 2002).

In order to compare data between 2010 and 2006, questions had to remain the same as in 2006 and any other aspects that may have been helpful in assessing changes in livelihoods, perceived costs and benefits and attitudes were not able to be investigated. A beneficial question to have contained in both surveys could have been, for example, the degree of dependence on the forest in terms of proportion of income or diet.

**Limitations of the SL framework as a measure of livelihoods**

The SL Framework used here was based on the five original assets as defined by Carney (1998) and Scoones (1998). However, it has been criticised for not being comprehensive enough since it does not include aspects of livelihoods such as cultural or political well-being (Adato and Meinzen-Dick 2002; Schreckenberg, Camargo et al. 2010). Depending on the political and cultural background to the area studied, these assets may be worth considering.

A strength of the livelihood assets framework is that the consequent mapping of asset scores or viewing as a radar diagram has been found to be easy to interpret (Kristjanson,
Radeny et al. 2005) and so gives local decision makers or district officials a better idea of where and how to prioritise development efforts. However, it must be remembered that scores are based on comparisons between, for example, year of study, and therefore show relative differences, not absolute levels of wealth. This is particularly risky for continuous or count data, when the top score is given to the top value recorded, whether or not this is high in absolute terms. Therefore, any investigation into livelihood assets, or decision-making based on assets should consider the values of the indicators individually and the raw data rather in addition to the overall scores. Also, the scoring system can augment insignificant changes and hide significant changes, as was found in this study; therefore a more accurate scoring system, perhaps based on the direction and degree of significant changes, may be worth attempting.

**Policy implications and future research**

ICDPs are potentially the best way of achieving global conservation and development goals, since they are directed large amounts of funding and can tackle both aspects at once (Hughes and Flintan 2001). However, if not supported by strong national and local conservation and development-based policies, the scope for a successful ICDP is reduced.

For example, judging by household use of resources in this study, WWF’s work is helping to contribute to the conservation goals by reducing forest product use. However, the development aspect of their work has not appeared to so successful. This is partly due to Kenya’s Forest Policy which allows for the controlled consumptive use of resources; however, this survey has found that the costs of resource use permits are perhaps too high and thus local communities are effectively being excluded from access to resources. The permit system may not necessarily be sustainable in the long term, should, for example, funds for law enforcement be reduced. Therefore, conservation and development policy should aim to focus more strongly on the sustainable local use of resources and PFM rather than depending on permits. In addition, there should be a more effective and human-friendly policy on compensation for human/wildlife conflict.
WWF’s efforts have not been entirely successful in terms of capacity building and training for alternative livelihood schemes and the marketing process, which is a problem found in other projects, for example, Hilson and Banchirigah (2009), and is possibly why the beneficial effects of the groups had not spread deeper into the communities. Therefore, work needs to be done to ensure livelihood improvement attempts are more effective. The following recommendations are made:

Livelihoods

The findings of this study suggest that no alternative livelihood activities were being undertaken in the sections of the villages surveyed. Being part of a group helps to circulate information and spread it through communities, possibly even to non-group member households via social interactions. It would therefore be good to try to integrate AL groups further into communities so that affected households are spread over a wider area.

Human/wildlife Conflict

Human/wildlife conflict needs to be addressed if rural development aspects of ICDPs are to successfully improve livelihoods overall thus alleviating local poverty. Several areas for future research are recommended.

The prevention of wildlife approaching farms

Research is needed to find out the most effective ways of preventing animals entering farms. Possible options include employing forest guards to scare the animals away from the farms, which can be very effective (Weladji and Tchamba 2003); or strategies such as positioning unpalatable tea or cocoa plantations on farm boundaries adjacent to parks, which deter the animals away from crops (Naughton-Treves 1998; Naughton, Rose et al. 1999); however, small farms may not have any choice but to plant food crops such as maize.

Mitigation of impacts
Providing alternative livelihoods is a good way of mitigating the effects of wildlife, since it reduces the dependence on crops for livelihoods (Ellis 1998). It is therefore important to focus these projects near the forest in particular.

**Compensation for losses**

It is advisable to carry out a survey to determine how communities want the human/wildlife conflict situation to be dealt with: (Weladji and Tchamba 2003). It is important to involve communities in decisions in order for these strategies to be successful (Gillingham and Lee 2003). Monetary compensation for crop damage can be quite effective in low-income areas since the amount demanded will be lower (Bulte and Rondeau 2007); as long as the compensation is distributed with no corruption along the way (Weladji and Tchamba 2003). It is a good idea to make compensation conditional on such bases as not culling any animals; or using environmentally-friendly farming practices such as including planting native trees.

Alternative methods of compensation could include free permits to collect forest resources such as grass – this approach has been successful in Nepal (Sharma 1991 in Weladji and Tchamba 2003).

**Conclusion**

Despite some faults in this project’s survey methods, some valid conclusions have been made: very few of the households studied benefited from alternative livelihood activities or employment in forest management, and livelihoods have not been improved overall. Forest product use has decreased, but this is more likely to be due to improved law enforcement rather than reduced dependence. Perceived wildlife costs have become more widespread and although attitudes have become more positive, households are still overall objectionable to the forest and its authorities. These findings indicate that livelihood groups need to be further integrated into communities for all to feel the benefits. Research into more successful wildlife management techniques is essential so that crop damage is reduced, and for this to be successful there needs to be a joint planning team of authorities and local communities. This should then help to improve attitudes towards the forest and government, making forest conservation more sustainable.


KFS and KWS (2009). Draft Shimba Hills integrated ecosystem management plan


