Nature Conservation in a Tropical Rainforest: Economics, Local Participation and Sustainability

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Abstract

The loss of tropical forests has led to establishment of protected areas such as national parks to conserve environment. National parks often affect the livelihoods of local people, especially when they are strongly linked to natural resources. For conservation efforts in a national park to be efficient, cooperation of local people is required. This thesis focuses on valuations of conservation regimes, ecotourism and conservation held by local people, and on the contribution of national park and non-timber forest products to their livelihoods. The data originated from personal interviews in local communities around the Okwangwo Division of the Cross River National Park in Nigeria. In Paper I, the contribution of the Okwangwo Division to development of local communities was examined. The results showed that local people who reside around the park benefit from different types of infrastructure, employment and income from tourism. Some of the development projects undertaken by the park authorities appear to be capital intensive both in the short and long term, and risk becoming unsustainable. A choice experiment approach was applied in Paper II to elicit the preferences held by local people for different nature conservation regimes. The results showed that most of the respondents preferred the nature conservation regime that would give them more access to infrastructure. Paper III reports a study regarding willingness to conserve a leafy vegetable (afang) important for communities in the vicinity of the Okwangwo Division, using data from a contingent valuation approach. The findings showed that local people have a willingness to conserve the afang. However, since conservation of afang would entail costs to landholders, there is a need for incentives to encourage them. Data from the contingent valuation approach was also used in Paper IV to examine the willingness of local communities to contribute to ecotourism. The results revealed that most of the respondents were willing to contribute money for an ecotourism project associated with the Okwangwo Division. The findings also suggest that impacts of ecotourism on the traditions of local people should be considered when designing an ecotourism project. The income that local people around the Okwangwo Division derive from sale of non-timber forest products (NTFP) was assessed in Paper V. The results showed that NTFP play an important role in livelihoods of the local people. The results suggested that a shift from primarily subsistence to more of a cash economy may lead to an unsustainable exploitation of the products.

Keywords: Nature conservation, local people, preferences, ecotourism, land use,

contingent valuation, choice experiment, sustainability, Nigeria, tropical rainforest

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Dedication

To my lovely family and late father, Jonathan B. Ezebilo

Contents

List of Appended Papers

This thesis is based on the work contained in the following papers, referred to by Roman numerals in the text:

I. Ezebilo, E.E. and Mattsson, L. (2010) Socio-economic benefits of protected areas as perceived by local people around Cross River National Park, Nigeria. *Forest Policy and Economics* 12, 189-193.

II. Ezebilo, E.E. Local residents' preferences for nature conservation regimes in south-eastern Nigeria. *Ecological Economics* (under review).

III. Ezebilo, E.E. (2010) Conservation of a leafy vegetable important for communities in the Nigerian rainforest. *Forest Ecology and Management* 259, 1660-1665.

IV. Ezebilo, E.E., Mattsson, L. and Afolami, C.A. (2010) Economic value of ecotourism to local communities in the Nigerian rainforest zone. *Journal of Sustainable Development* 3(1), 51-60.

V. Ezebilo, E.E. and Mattsson, L. (2010) Contribution of non-timber forest products to livelihoods of communities in southeast Nigeria. *International Journal of Sustainable Development and World Ecology* 17(3), 231-235.

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Abbreviations

OD   Okwangwo Division
CVM   Contingent valuation method
CE   Choice experiment
CV   Compensating variation
EV   Equivalent variation
CS   Consumer surplus
WTP   Willingness to pay
NGN   Nigerian currency, Nigerian Naira
USD   US currency, United States Dollars
NTFP   Non-timber forest product

Introduction

The tropical forests are of great importance to global biodiversity. For example, about 90% of the world's species are found in tropical forests (UNEP, 2001). Tropical forests provide environmental services such as clean air and water, prevention of soil erosion, nutrient and carbon cycling, biodiversity and regulation of global and regional climate-systems. They also provide cultural, spiritual and recreational benefits (Perrings, 2000). Tropical forests provide goods that are important for agriculture and medicines. For example, cocoa, banana, rice, coffee, citrus fruits, pineapples, quinine, and peanuts originate from tropical forests. Conservation of wild relatives of these plant species is required to maintain productivity (Pearce, 1991). Genes from wild plants can be used to fortify domesticated varieties against their vulnerability to diseases, pests and changes in climate. Without tropical forests, this opportunity is lost, as is the chance to develop new food plants. One-quarter of modern medicines originate from plants in tropical forest. Examples include, quinine used for treatment of malaria, vinblastine for control of tumour, and andrographolide used as an antibiotic (Bierer et al., 2010).

About 50 million indigenous people who live in tropical region depend on forests for their livelihoods. Tropical forests offer various benefits – e.g. food, shelter, medicine, and employment – to these people. Forest products contribute to the well-being of people especially for low-income earners who live in rural areas and may help to reduce the incidence of poverty (Sunderlin et al., 2005; World Bank, 2002). The rate of tropical forest loss in the world has increased. For example, the annual deforestation was about 0.6% in the 1970s but as much as 1.8 − 2.1% in the 1980s (Pearce, 1991). Between 1995 and 2000 about 9,400,000 hectares (ha) of forests were deforested annually across the world (FAO, 2005). The annual rate of forest loss in Africa is about four million hectares (FAO, 2005). Deforestation and

forest degradation are more severe in the tropics than in other regions of the world (WRI, 2005). Tropical deforestation accounts for about 20% of anthropogenic carbon (IPCC, 2007a). This has serious consequences for species, tropical forest ecosystem services and people who depend on forests for their livelihoods (Chapin et al., 2000). For example, 12% of the bird species, 25% of the mammals and 32% of the amphibians living in tropical forests are threatened with extinction over the next century (WRI, 2005).

Central Africa is home to one of the world's largest tropical rainforests, second only to the rainforest of the Amazon Basin in South America (FAO, 2005). This forest stretches from the Democratic Republic of Congo to the Republic of Cameroon. The rainforests of Central Africa sequester two-thirds of the carbon stored in the vegetation in tropical Africa. Forest loss and degradation in Central Africa account for about 73% of the total carbon released from land use changes in Africa (Gaston et al., 1998). West Africa is another tropical forest region in Africa. This region stretches from southern Nigeria to Guinea Bissau where logging, land fragmentation, and clearing for agriculture often degrade the forest. The West African forest is the most fragmented tropical forest in the world (Sayer et al., 1992; Myers et al., 2000; Rudel and Roper, 1997). Nigeria has lost about 90% of its natural tropical rainforests (Caldecott et al., 1989; Ebin, 1991). The annual rate of forest loss in Nigeria is 410,000 ha (3.3%). Between 2000 and 2005 the country lost 55.7% of her primary forests (FAO, 2005). These old-growth forests are the most biologically diverse ecosystems. The impact of human activities on forest conservation and climate has increased (Searchinger et al., 2008; Malhi et al., 2008; IPCC, 2007b). Human activities that threaten the Nigerian tropical rainforest include agriculture and fuel-wood (Adejuwon, 1971; Berry, 1974); spread of rural settlements (Osunade, 1991); oil and gas exploration (Akparobi et al., 2000; Abare, 2003; Ubong, 2003); and introduction of exotic species (Aloba, 1983; Ekanade et al., 1996). These have impacts on ecosystem services and livelihoods of people in Nigeria (Zhao et al., 2006; Lewis, 2006). Forest and biodiversity conservation policies have seen a huge evolution in Nigeria in the last decades. They have traditionally been based on the creation of protected areas in which most human activities are prohibited. The Nigerian government has shown increasing concern for the preservation of indigenous species. This has led to the establishment of game reserves and national parks and also being signatory to international cooperation agreement for protection of wildlife. A decree to regulate traffic in endangered species was promulgated in 1985. The Nigerian Conservation Foundation (NCF) was established in 1982 to involve private participation in the promotion of forest and biodiversity

conservation ethics in Nigeria. But the nation's goals of managing wildlife for tourism, preservation of a national heritage and biodiversity conservation remain hard-pressed in the face of mounting economic problems, an expanding population, and the continuing destruction of natural habitats.

The efficiency of protected areas, especially in the long-term, heavily depends on the way that the buffer zone – the area surrounding the central protected areas – is managed. The development of agriculture in the buffer zone can lead to wide destruction of natural ecosystems and biological diversity and, thus diminish the efficiency of conservation measures in the central areas. The general function of the buffer zone is to protect some ecological characteristics of the artificial ecosystems so that the ecological stability of the central protected area will improve. To achieve their conservation goals, authorities of protected areas require cooperation of local communities who reside in the proximity of the protected areas because the livelihood activities of local people have impacts on the areas. The establishment of protected areas such as national parks for biodiversity conservation has in most developing countries not been very successful (Dixon and Sherman, 1990). This has been attributed to inadequate linkages between conservation efforts and the local conditions (Emerton, 2001; Shyamsunder and Kramer, 1996). For example, local people are seldom involved in planning regimes for forest and biodiversity conservation in national parks. Most local people depend on natural resources for their livelihoods and land is their major asset (Platteau, 2006).

The establishment of national parks leads to reduction in land area available to local people and consequently their livelihoods. The local people are seldom compensated for a reduction in access to land because the land resource in Nigeria is mostly the state property (Famoriyo, 1982). This generates a conflict situation between national park managers and local people. To minimize conflicts, many national park authorities in Africa have combined biodiversity conservation with development (Barrow and Murphree, 2001), i.e. provision of infrastructure such as rural feeder roads, primary health care, water and vocational training centres. The infrastructure is expected to provide local people with access to more livelihood opportunities that have less negative impacts on biodiversity conservation. For example, vocational training centre would provide local people access to new technologies in food processing, preservation and sustainable harvesting techniques. National park authorities in Africa promote ecotourism to generate income and provide local people more access to livelihood opportunities (Abbot et al., 2001; Marsh, 2000). To improve the efficiency of biodiversity conservation, national park authorities have proposed

community-based conservation, i.e. involvement of local communities in conservation of species that contributes to their livelihoods. This may help to reduce the pressure exerted on wild population thus reducing the risk of extinction of species. National park authorities have also proposed to involve local people in planning natural resource management regimes because if they are involved in choice of conservation regimes, more of the people would support conservation efforts.

Objectives of the thesis

Using the Okwangwo Division of the Cross River National Park in Nigeria as a case, the general objective of this thesis is to examine valuations of conservation regimes, ecotourism and conservation held by local people, as well as the contribution of national park and non-timber forest products to their livelihoods. The specific objectives are to:

1) Assess contribution of the Okwangwo Division to development of local communities in the vicinity of the park, i.e. provision of infrastructure, income from ecotourism and employment (Paper I).
2) Examine the preferences held by local people for nature conservation regimes (Paper II).
3) Estimate economic values of conservation of an indigenous plant species and ecotourism, respectively to local communities (Papers III and IV).
4) Estimate income from non-timber forest products traded in markets and how these values are influenced by socio-economic factors (Paper V).

Forest and biodiversity conservation in Nigeria

Characteristics of the Nigerian forests

Nigeria's vegetation can be classified as in Figure 1. These diverse habitats and the tropical climate lead to a large amount of biodiversity in terms of terrestrial and aquatic species. Nigeria has 274 mammal species and 906 bird species (Ezealor, 2002; Federal Environmental Protection Agency, 2003). The endemic species include three monkey species, i.e. the white-throated monkey (Cercopithecus erythrogaster), sclater's guenon (Cercopithecus sclateri) and the Niger Delta red colobus (Procolobus pennantii epieni);

three bird species, i.e. the Anambra waxbill (Estrilda poplipaia), the Ibadan malimbe (Malimbus ibadanensis) and the Jos indigo-bird (Vidua maryae), see Aminu-Kano (2001). Many of the birds and mammals of Nigeria are at low population levels and mostly found in protected areas, where they are still threatened due to inadequate protection. Some larger species such as giraffes, antelopes and ostriches are threatened due to habitat degradation and hunting pressures (Federal Ministry of Environment, 2001). Nigerian forests habour 135 reptile species, 109 amphibian species, and 648 fish species (Federal Environmental Protection Agency, 1992). One of the snake species (Nahelya egbensis) and five of the amphibians are endemic to Nigeria (Aminu-Kano, 2001). Nigeria has 20,000 insect species, 77 mollusk species, 5 echinoderm species, 848 algae species, 5,013 higher plant species and 200 lower plant species (Federal Environmental Protection Agency, 1992; Federal Environmental Protection Agency, 2003). According to the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (Hilton-Taylor, 2000) 148 animal and 146 plant species of those being globally threatened are found in Nigeria. Of these, 26 animal and 18 plant species are classified as endangered, while 3 animal and 15 plant species are critically endangered worldwide. Nigerian forests are known as a global hotspot for primate species such as the Cross River gorilla, chimpanzee and drill (Bassey and Oates, 2001).

Agencies responsible for forest and biodiversity conservation in Nigeria

Biodiversity and forest conservation activities in Nigeria are the responsibility of various governmental agencies, non-governmental organizations (NGOs), and universities. The government agencies are the Federal Ministry of Environment, Ministry of Agriculture, and Ministry of Water Resources. Government agencies at the state level, local government level and community level are also charged with aspects of biodiversity conservation. The administration of game and forest reserves is managed at the state level. Many NGOs participate in various aspects of biodiversity and tropical forest conservation initiatives (Nigeria Conservation Foundation, 2000). The NGOs include the Nigeria Conservation Foundation (NCF), Nigerian Field Society, Center for Environmental Resources and Sustainable Ecosystem, and the Nigerian Environmental Action/Study Team. International NGOs such as Wetlands International and the Wildlife Conservation Society have ongoing programmes in Nigeria. Universities

also have roles to play in Nigeria's conservation efforts, by being involved in research activities regarding biodiversity conservation. The Government of the Federal Republic of Nigeria is a signatory to many natural resources conventions and treaties. These include Convention on the Protection of the World Cultural and Natural Heritage, Convention on International Trade in Endangered Species (CITES), Convention on the Conservation of Migratory Species of Wild Animals, Convention on Biological Diversity (CBD), and Ramsar Convention on Wetlands of International Importance.
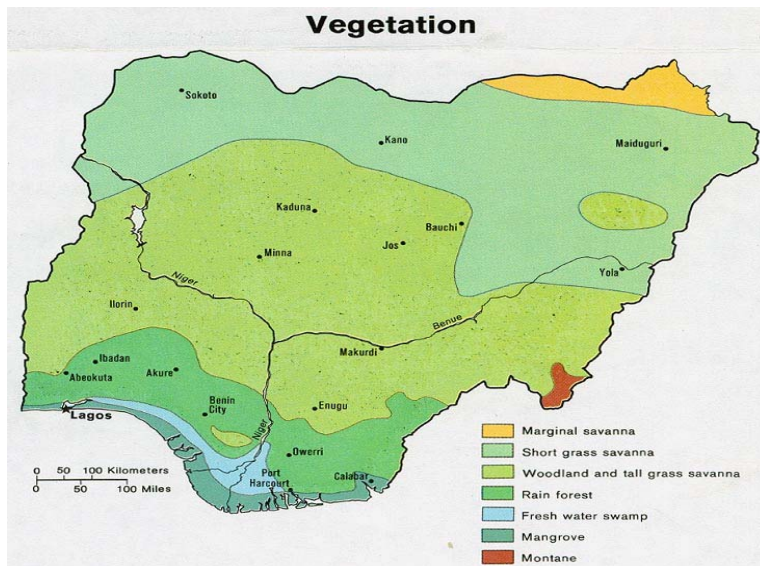
Figure 1. Vegetation types in Nigeria

http://www.mapcruzin.com/free-maps-thematic/nigeria_veg_1979.jpg

Causes of inefficient land use in Nigeria

Conversion of forestland to other land uses such as agriculture is one of the primary factors that contribute to loss of forests and consequently biodiversity loss. The value of land is much affected by location and land uses (Dolan and Lindsey, 1988). Uses of land may be compatible or incompatible with each other. Incompatible land uses is likely to generate a conflict. For example, agriculture and biodiversity conservation are typically

conflicting in Nigeria (Osemeoba, 1988). In cases where land is treated as private property, the market can be used to resolve land use conflicts (Gravelle and Rees, 2004). Given no market failures (inability of prices to reflect the true value of resource use), markets tend to allocate land to its highest valued use. A rational economic agent who is faced with the decision of whether to conserve an area of tropical forest or to use the area for agriculture will base his decision on the rate of return (profitability) of the two options. The economic agent will choose conservation if the rate of return from this alternative is greater than that from agriculture (Tietenberg and Lewis, 2010), i.e. net benefits from conservation exceed those from agriculture. Benefits from biodiversity conservation accrue in a longer time perspective. A typically landowner will prefer benefits now rather than later, and costs later than now. Assume that the landowner is to choose between $100 today and $100 ten years ahead. From the individual's perspective the $100 today will be preferred because the money can be invested in a bank or land to become $100 plus accrued interest during the ten years ahead, i.e. from the individual's perspective, it is more profitable to 'develop' than to conserve. Furthermore, the economic values of conservation are not revealed in market prices (non-market priced) and the individual landowner has no economic incentive to take account of them. The benefits may also accrue to other people more than to the landowner himself. The benefits from 'development' of the land by agriculture are tangible, while the benefits from conservation are more intangible. The rate of return from conservation appears to be low to the individual landowner which may not give him enough economic incentive to conserve.

In some developing countries property rights to land is informal or nonexistent. Land use may be determined on a "first-come, first-served" basis. In this case land is acquired for free, and occupiers do seldom consider the cost of other alternative land uses that must be forgone (opportunity cost). This results in inefficiency as low-valued uses may dominate over high-valued uses. For example, forestland with high biodiversity value may be converted to farmland. The property rights on land influences the forms, intensity and efficiency of land use (Osemeobo, 1991). Although the Nigerian Land Use Act (in force since 1978) stipulates that all lands are owned by the government, but traditional land users perceive government ownership of land as an alien concept. Hence, land ownership in Nigeria has been an unresolved issue. The Land Use Act is dormant and exists just as a mask on the customary land tenure system in rural areas. The land Use Act is mostly applicable in urban areas (Famoriyo, 1982). The property rights situation seldom give people the incentive to use environmental resources

sustainably or invest in long-term projects such as forestry. This contributes to deforestation, overgrazing and inefficient conversion of land to farmland. Although the value of sustainable alternatives may be higher, inadequate resources mostly limit people to invest in sustainable land use. If facilities (e.g. roads, oil extraction) associated with developments are not properly designed and managed they might lead to forest loss. For example, the expansion of some of the Nigerian road system, oil exploration and extraction contribute to forest and biodiversity loss (Ola–Adams, 1981; Anadu and Oates, 1982).

Forest and biodiversity conservation efforts in Nigeria

Various approaches have been applied to conserve forests and biodiversity in Nigeria. These can be classified into formal and non–formal approach. The formal approach is protected areas while non–formal approaches include traditional, community conservation work and environmental education.

Protected areas

Biodiversity conservation activities in Nigeria focus mainly on the establishment and maintenance of various types of protected areas such as national parks. Nigeria has seven national parks which cover about 3% of the total land area of the country. The main aim of the Nigerian national parks is protection and preservation of endangered species and wildlife of Nigeria. The national parks are controlled and managed by the federal government through the National Park Service. The establishment of network of a national parks system was introduced in Nigeria in 1979. These parks include a number of key wildlife habitats and representative ecosystems of Nigeria. In addition to the national parks, there are game and forest reserves that are managed by various state agencies. Within some of the forest reserves and national parks there are Strict Nature Reserves, i.e. areas set–aside to preserve representative forest habitats in an untouched state. Game reserves were established with the primary role to conserve animal species.

Traditional approach

Most local communities in Nigeria have various ways to conserve forests. In some communities, some tree species are preserved during farming activities due to their benefits, e.g. provision of shade and religious purposes.

The types of trees that are protected vary from one community to another. In some communities, there are natural forests dedicated to deities (gods), which are deemed to be sacred. They are protected from exploitation. The protection and management of these forest areas is based on regulations and taboos that are stipulated and approved by custom and by the local people. These natural forests serve as important reservoirs of living collections of useful plants from which local people can obtain various items such as food, medicine and other materials.

Community conservation work

Most advocates of nature conservation have the opinion that local communities should be involved in planning and implementing natural resource management (Shackleton and Shackleton, 2004: Shackleton and Campbell, 2001). In Nigeria, this is supported by NGOs who work in various habitats together with local communities. For example, the Savannah Conservation Nigeria works on various community development projects in areas around national parks and game reserves in the savannah belt of Nigeria. Their work includes resolution of conflicts between local communities and park managers, and various poverty alleviation schemes. In the southern forest belt of Nigeria, the Nigerian Conservation Foundation (NCF) and the Coalition for the Environment work with selected communities in and around rainforests. They use education, alternative sources of income and natural resource management regimes to involve local people in forest and biodiversity conservation.

Environmental education

In 1987, the NCF helped to develop and draft a national conservation education strategy that suggested that the subject be integrated in the primary and secondary schools' curricula. This was not very successful because of inadequate resources in most schools in the country, but the establishment of Conservation Clubs in many schools appear to be more effective (Nigerian Conservation Foundation, 2000). These clubs serve as an extracurricular activity to students. This gives them opportunities to learn more about natural environment and how to promote forest and biodiversity conservation. Other NGOs also include environmental education as one component of their conservation-based programme. There is an environmental education certificate and B.A. degree programme at various Nigerian universities, which provide teachers with appropriate

knowledge and skills to work with schools and various environmental NGOs.

Theoretical framework

Economic theory of individual preferences and the demand for goods and services assume that consumers are aware of what gives them utility (Gravelle and Rees, 2004). If a consumer prefers consumption bundle J over K, then it is assumed that consumption bundle J is the utility maximizing choice between the two alternatives (consumption bundles J and K). In perfect markets, individuals choose goods that maximize their utility subject to a budget constraint, i.e. when the consumers are faced with fixed prices and a budget restriction they choose quantities of different goods such that their utility is maximized. A higher price of a good results in less quantity of that good consumed and consequently a welfare loss to the individual (Dolan and Lindsey, 1988). On the opposite, a lower price results in higher quantity consumed and an increase in welfare of the individual. Welfare is based on market priced as well as non-market priced goods and services, and values today as well as values in the future. There should also be a fair and equitable distribution of welfare among people, or among populations in different regions.

Local communities near the Okwangwo Division (OD) in the Nigerian tropical rainforests are typical examples where the welfare of the people is based on a mixture of market priced goods (e.g. timber for own use, fuelwood, game meat, wild fruits and vegetables and agricultural products) and non-market priced goods and services (e.g. forest as climate regulator, provider of clean air and water, recreation, and biodiversity). However, this thesis focuses mainly on estimation of welfare changes of non-market priced goods. The compensating variation (CV), equivalent variation (EV) and consumer surplus (CS) are often used monetary measures of welfare change e.g. change in environmental quality (Champ et al., 2003).

The CV is the maximum amount of money an individual would be willing to pay to have an increase in environmental quality. The EV is the

minimum amount of money the individual would require to voluntarily forego the increase in environmental quality. The CV and EV translate to willingness to pay (WTP) and willingness to accept (WTA) compensation depending on the project (Champ et al., 2003). For an environmental improvement, CV is WTP and EV is WTA. For an environmental degradation, CV is WTA (the change) and EV is WTP (to avoid the change). The CV is defined relative to the initial utility level while the EV is defined relative to the final utility level. For example, if we consider an improvement in quality of facilities for ecotourism, the CV can be obtained by asking individuals the maximum amount of money they would be willing to pay in order to secure the improvement. In contrast the EV can be obtained by asking individuals the minimum amount of money of compensation that they would be willing to accept to forgo the improvement. The willingness to pay and willingness to accept measures reflect individuals' preferences.

The Marshallian demand curve specifies what the consumer would buy in each price and wealth situation assuming it perfectly solves the utility maximization problem. The CS is equal to the area under the Marshallian demand curve (relationship between price and quantity demanded) bounded by the horizontal price line (Nicholson, 2002). For each given quantity of the good, there is a difference between the market price and the maximum amount of money the individual is willing to pay for an additional (marginal) unit of the good. We can obtain the CS by summing up the surplus for all marginal units up to the equilibrium consumption level. The Hicksian (utility constant) demand curve is the demand of a consumer over a bundle of goods that minimizes his/her expenditure while delivering a fixed level of utility. The area under the Hicksian demand curve is the integral of WTP or WTA for different units of good. The Marshalian demand curve holds money and income constant. Cash income adjusted for inflation or deflation (real income) is constant along the Hicksian demand curve, which has the same effect as holding utility constant. The effect of a relative price change on the optimal consumption bundles leads to substitution and income effects. Substitution effect is the change in consumption that would prevail if the consumer was compensated in such a way that he/she maintained his/her original utility level. Income effect is the change in consumption that results from the gain (loss) of purchasing power. The Hicksian demand curve is associated with substitution effect, while the Marshallian demand curve is associated with both income and substitution effects. The smaller (larger) the proportion of income spent on a good, the smaller (larger) the income effect and the more similar (dissimilar) the

Hicksian and Marshallian demand curves is. The Hicksian and Marshallian demand curves are identical when the income effect is zero (Gravelle and Rees, 2004; Garrod and Willis, 1999). Consequently, when the income effect of a price change is zero, CS would be equal to EV and CV.

The WTP estimate tends to be lower than the WTA estimate (Gwendolyn, 1998; Brown and Gregory, 1999; Shogren et al., 1994), because the WTP is bounded by the individual income (the budget restriction), but not so for the WTA. Individuals' values of a loss are mostly higher than the comparable valuation of a gain, relative to initial endowment of assets. Environmental goods often have limited substitutes (Kahneman and Tversky, 1979; Knetsh and Sinden, 1984; Hanemann, 1991).

Many environmental goods and services provided by tropical forests are non-market priced, i.e. their economic values are not revealed in market prices. Hence, there may not be enough economic incentives to optimize the use of these natural resources. This contributes to undervaluation of environmental assets and consequently deforestation of tropical forests and biodiversity loss. The inability of markets to capture the complete value of natural resources leads to market failure (Garrod and Willis, 1999) which is discussed below.

Market failure

In a competitive market – or a so called perfect market - the price of any good equals the private marginal cost of producing it (Dolan and Lindsey, 1988). At market clearing prices, marginal cost equals marginal revenue. In a perfect market we assume that the market price of a good or service reflects its opportunity cost, i.e. the value of a resource in its best alternative use. Consumers and producers have perfect information about prices and other relevant variables. We also implicitly assume that sellers in the market have well-defined property rights to the goods and services offered for sale. Given such conditions associated with a perfect market, the pursuit of self-interest by both consumers and producers results in an efficient allocation of resources. This efficiency is also known as Pareto optimality (Dolan and Lindsey, 1988), i.e. when the market reaches equilibrium it is impossible to make anyone better-off without, at the same time, making at least one other person worse-off. At the equilibrium point it is impossible to reallocate or redistribute resources in a more efficient way, seen from a societal welfare economic point of view.

Economic growth and population growth lead to an increase in demand for environmental resources (Tietenberg and Lewis, 2010). Most environmental goods are "normal goods" in the sense that the value that individuals place on them increases with income (Gravelle and Rees, 2004). The social value of environmental resources is likely to continue to rise, especially when one considers that the resources are becoming increasingly scarce. Many goods are marketed and thus priced, but many are not. The economic values of market priced goods are generally reflected in their prices on the market, and the mechanisms of competitive markets should (in theory) allocate resources efficiently. But this does not apply to non-market priced goods. Most environmental resources are not adequately valued through the market system. Complexity arises when an environmental resource yields multiple outputs where some of the outputs are valued by the market while others are not (Hanley, et al., 2007). For example, the resource forestland can be used to produce timber, which has readily observable market prices, but the same forestland can be used to sustain populations of native plants and animals which are not valued in markets. This may lead to misallocation of resources. Markets are often efficient in allocating resources to 'exploitation activities' but may fail with respect to investment in environmental conservation (Gravelle and Rees, 2004). For example, the commodity markets provide signals to individual landholders about the value of clearing land for agricultural production, but markets for conservation actions are mostly missing or inefficient. Moreover, when individuals make trade-offs across different activities, they mostly observe values that are priced through markets. This incompleteness of markets leads to distortion of resource allocation from the 'efficient', or value maximizing, outcome. Markets fail to allocate environmental resources through the price mechanism because it is unable to capture the full social costs for the use of environmental resources (Field, 1994), i.e. the equilibrium market prices fail to reflect the true social costs and benefits of resource use. Resource extraction may give rise to external effects. For example, extraction of timber may contribute to soil erosion and affect farming downstream. Hence, market prices of timber may not accurately reflect resource scarcity and resources may be used inefficiently and be misallocated. The markets for biodiversity are very rare, incomplete or distorted. As a result market prices may not reflect true social values. Markets work well when prices reflect all values, i.e. opportunity costs. Some of the factors that may lead to market failure include characteristics of the goods, externalities, information asymmetry, ill-defined property rights, and time preferences, as discussed below.

Characteristics of the goods

Goods can be broadly classified into private goods and public goods. Private goods are excludable and rival (Nicholson 2002), i.e. the owner of the good can exclude others from consumption (excludable) and the consumption of one economic agent reduces the amount of the good available to others (rival). Private goods tend to satisfy an individual's want. Public goods are both non-excludable and non-rival. A good is non-excludable if once produced it is impossible to prevent anyone from consuming it, i.e. if the good is supplied to one consumer, it is available for other consumers too. For example, no one can be excluded from enjoying ecosystem services such as clean air and water provided by trees in tropical forests. Because it is practically impossible to exclude people from using public goods, a free-rider problem arises, i.e. individuals refuse to pay or underestimate the maximum amount they would be willing to pay (willingness to pay) for the good. This is because they know that they can consume the good even if they do not pay (fully) for it. Hence, there is not sufficient incentive for the private sector to provide the good. A good is non-rival if the same unit of the good can be consumed by more than one person, i.e. more than one person can obtain benefits from a given level of supply at the same time. Because of both non-rival and non-excludable, actual markets for environmental goods such as biodiversity are unlikely to exist (Field, 1994). The absence of markets for environmental goods may result in production of too little or nothing without government intervention.

Externalities

When the production of an economic agent is affected by the actions of another there is an externality (Hanley, et al., 2007). It is a by-effect of production or consumption for which there is no market. For example, biodiversity loss as a result of conversion of forestland to agriculture, air pollution caused by a paper factory, and pleasure derived from a neighbour's beautiful garden. Externalities occur for reasons such as interdependencies (synergies) between producers and consumers or different groups of producers e.g. beekeepers that unintentionally provide pollination services for nearby fruit growers. Externalities may occur as a result of the use of a particular technology e.g. air pollution caused by smokestack industry. The off-site costs or benefits resulting from nature conservation represent externalities caused due to the conservation activities. These are off-site costs and benefits borne due to nature conservation that are not reflected in the market price because they affect other economic agents in the society.

When externalities are present, landowners who use nature destructive practices gain all the benefits but do not bear all the costs, and landowners who engage in activities that promote nature conservation bear all the costs but do not gain all the benefits. As a consequence, the resource use plan of private individuals may not lead to optimal results from societal perspectives. Private costs and benefits from nature conservation do not equal the social costs and social benefits because private individuals take into consideration only the direct costs and benefits accruing to them. From an economic perspective all direct and indirect costs and benefits from any activity need to be taken into account. Therefore, the presence of off-site costs results in a discrepancy between private and social optimal rates of nature conservation. When negative externalities are present in the production of a good, and if the market is left to its own device, it sets too low price for the good because it fails to take account of the cost to third parties of producing the good. As a result too much output is produced and leads to deadweight loss, i.e. each unit of additional output produced in excess of the equilibrium quantity. Externalities lead to inefficiency because it makes marginal social costs to exceed marginal social benefits. Investments in nature conservation under this situation are likely to benefit the society more than the private individuals. This may require appropriate government policy intervention.

Information asymmetry

Information is needed for markets to operate competitively and allocate resources efficiently (Nicholson, 2002). In many developing countries, as well as developed countries, access to information regarding benefits and costs of nature conservation to society is limited. Some ecosystem services provided by tropical forests such as biodiversity and climate regulation are post-experience goods, i.e. their consumption does not necessarily reveal information to consumers. The information needed is expensive to gather and individuals may be unwilling to pay for it, and third parties may not have the incentive to provide the necessary information. Government intervention to reduce information asymmetry associated with post-experience goods is likely to be efficiency-enhancing because learning through individual action does not always occur. The long-term period over which the effects of natural resource use and management decisions take place implies need of information about the future. When there is no adequate information, the long-term impacts of human activities on nature conservation may not be known. This may delay individuals from making information-based decisions about nature conservation.

Ill-defined property rights

If property rights are not well defined or absent in the economic system rational individuals may not have incentive to invest in an asset because they cannot appropriate the full benefits. This may lead to inefficient allocation of resources from societal point of view. For example, polluters who do not bear the costs of their activities, have no economic incentives to limit the amount of pollution especially if they know that the farmer at downstream has no property rights. Natural resource depletion by destructive exploitative practices implies redistribution of natural resource rate to the present. When there is poor specification of property rights over a natural resource, individuals are likely to have short planning horizons so that long-term effects of biodiversity loss will have less influence on natural resource use decisions. Therefore, they may use practices that are destructive to natural resources which will deplete the resource at present at the expense of the future. In addition, the most reliable indicator that individuals would have regarding the effects of biodiversity loss would be through land price. However, in countries like Nigeria where land is state-owned and not tradable, the market mechanism cannot help to provide information about the user cost of biodiversity, which hence leads to market failure. Well-defined property rights are exclusive (sole right to use a particular unit of good), transferable (right to transfer the good to another individual), secure and enforceable. Goods that have a complete set of property rights are typically private goods (excludable and rival goods). For the case of pure public goods, the conditions for property rights do not hold. Hence, governments mostly intervene in the market to correct market failure.

Time preferences

Rational private individuals are expected to analyze the benefits over time of nature conservation activities and compare these benefits with expected benefits without conservation. Most private individuals will use a higher discount rate and shorter time planning horizon (Tietenberg and Lewis, 2010). But society uses a lower discount rate and longer time planning horizon which is favourable for nature conservation decisions as these will result in a higher net present value of future benefits. This is because the asset basis for society is larger than for individuals and minimizes risks through diversification. This divergence between private and social time preference leads individuals to discount future benefits excessively and thus to consume assets that society as a whole would prefer to have conserved. We will now discuss methods used to estimate economic values of non-market priced goods and services.

Economic valuation methods and review of literature

For the case of market priced goods such as timber and some of the non-timber forest products (e.g. mushrooms, game meat, wild fruits and vegetables and fuelwood) their values are reflected in their market prices and therefore the values can easily be assessed (Garrod and Willis, 1999). The assignment of economic values to non-market priced goods helps to make rational decisions on the use of natural resources e.g. forests (Garrod and Willis, 1999). Such valuation helps society to make informed choices with regard to trade-offs (Loomis, 2000). Decisions on logging, management or conversion of forestland are mostly determined on criteria such as the demand for timber, the need to export forest products to earn foreign exchange or the demand for agricultural products (Adger et al., 1995). But market transactions provide an incomplete picture of the total economic value of forests. Those forest benefits which are not normally exchanged on markets are mostly ignored or undervalued in decision making which introduces distortions in efficient resource allocation. Estimating the appropriate (shadow) prices of non-marketed or partially marketed forest functions, as well as developing appropriate mechanisms to capture the estimated economic values is required to improve the efficiency of resource allocation (Adger et al., 1995). Another justification for valuation of non-market priced goods like biodiversity is that all species have an inherent right to exist regardless of their material value to human, and that present generations have a social responsibility to conserve nature for the welfare of future generations (Gowdy, 1997; 2005; IUCN, 1990; Flint, 1992). Economic valuation of non-market priced goods provides a way of arriving at decisions that maximize, or at least improve, well-being. It provides a way of trading-off objectives and it is effective since it speaks in the economic language to which policy-makers listen (O'Connor and Spash, 1999).

Valuation of environmental resources enables planners and policy-makers to incorporate also such values in policies and strategies, and to select the course of action that yields the most to society.

Methods for valuing non-market priced (e.g. environmental) goods and services can be classified into revealed preference (indirect) and stated preference (direct) methods (Harris, 2006). The indirect methods make use of consumers purchasing habits to estimate the value of the non-market priced goods or services. The most frequently used indirect methods include the travel cost method, and the hedonic pricing method. The basic assumption of the travel cost method is that the travel cost that people incur to visit a site represent the value of access to the site. Hence, individuals' WTP to visit the site can be estimated based on the number of trips that they make at different travel costs. The hedonic pricing method is used to estimate economic values of ecosystem or environmental services that directly affect market prices. For example, it is applied to variations in housing prices resulting from variations in local environmental attributes. The main advantage of indirect methods is that they use data from actual market behaviour but their limitation is that they cannot be used to estimate non-use values e.g. existence value. This thesis uses direct methods and we will now elaborate more on these.

Stated preference methods

Stated preference (direct) methods are used to elicit values of non-market priced (e.g. environmental) goods and services directly from respondents by means of survey techniques (Garrod and Willis, 1999; Bateman et al., 2002; Carson et al., 1996; Mitchell and Carson, 1989). They can be used to estimate total economic value, i.e. use as well as non-use values. The direct methods mostly applied on valuation of non-market priced goods are contingent valuation and choice experiments (choice modelling).

Contingent valuation

The contingent valuation surveying was first proposed by Ciriacy-Wantrup (1947) and one of the pioneers in contingent valuation was Davis (1963a, 1963b, 1964). Contingent valuation involves survey techniques such as personal interviews or mail questionnaires to elicit individuals' valuation of the non-market priced good in question (Mitchell and Carson, 1989). Contingent valuation question format includes the iterative bidding, open-ended, payment-card, dichotomous choice, double-bounded question and

multiple-bounded question. The iterative bidding approach (Randall et al., 1974) involves querying the respondent at some initial monetary value and keep raising (or lowering) the value until the respondent declines (or accepts) to pay. This approach is well understood and more acceptable than other approaches by people in developing countries (Whittington et al., 1990a). This is because the people are used to negotiating over the price of any item they purchase on a market. Empirical data generated from iterative bidding have been traditionally analyzed using ordinary least squares regression techniques. Proponents of the tobit models argue that the tobit addresses the censoring, i.e. large number of zeros typically found in contingent valuation surveys, but linear models often ignore this censoring. The ordinary least squares regression model fails to account for qualitative differences between zero and positive WTP values (Greene, 2003) which may result in a biased estimate of the parameters of interest. This has led to widespread use of tobit models especially among economists (Floro and Miles, 2003; Kimmel and Connelly, 2007). The open-ended question (Hammack and Brown, 1974) asks respondents how much they would be willing to pay for a specified change in an environmental good. The payment-card question format (Cameron and Huppert, 1988) involves listing a number of possible WTP values on a card, and respondents are asked to pick the amount on the card that best represents their WTP. The chosen amount is a lower bound for the respondent's WTP, the upper bound being the next highest on the card. The dichotomous choice format (Bishop and Heberlein, 1979; Cameron, 1988; Li and Mattsson, 1995) is the most frequently used format. The payment question typically asks the respondent if he/she would pay $X for a specified increase in the quality of a good. There are only two possible responses to a dichotomous choice question, i.e. "yes," and "no". Since one only knows that the respondent's subjective valuation is lower or higher than a given cost/bid, econometric technique (Hanemann, 1984; Kristrom, 1990) such as logit or probit must be used to estimate the mean and median WTP. Most people in developing countries are not used to a take-it-or-leave-it (binary choice) kind of purchase, although it is becoming popular in some shops in cities and major towns. Some studies have used double-bound questions that include a second round of bids in which respondents are also asked to indicate if they would pay, a higher bid if 'yes' was the response to the initial bid or a lower if 'no' was the response to the initial bid (Hanemann et al., 1991). Some researchers have also used a multiple-bounded question that is a hybrid of a dichotomous-choice and payment-card question (Welsh and Poe, 1998; Boman et al., 2008).

Survey methods used in valuation of non–market priced goods include mail questionnaires (Schneemann, 1997), telephone interviews (Schuman, 1996), and personal interviews (Mitchell and Carson, 1989; National Oceanic and Atmospheric Administration, 1993). Other methods include mall intercepts (Boyle et al., 1994). In most developing countries the literacy level is low, telephones are not readily available for the majority of the population, and address listing of the people is not normally available. Hence, personal interviews tend to be the most reliable mode to collect data with regard to non-market priced goods valuation studies in developing countries. In this thesis the dichotomous choice and iterative bidding question formats were used and the survey method was personal interviews (see questions 8 and 17 in the Appendix).

Statistical models of contingent valuation can be derived from the economic theory of individual consumer behaviour (Hanemann, 1984; McFadden, 1974) and from the characteristics and nature of the data (Cameron, 1988; Haab and McConnell, 1998). The model that is derived from economic theory is based on the utility maximization principle, i.e. model obtained from the assumptions of random components in the utility function which helps to integrate the statistical model to the economic theory. The random utility maximization is composed of two parts, i.e. one part that is observable to the researcher (a systematic term, which depends on a vector of attributes) and another, random, part (random error) that is not observable. If the random error is assumed to be logistically distributed, then a logit model is used to model the data. But if the random error is assumed to be normally distributed with zero mean and constant variance, then probit, tobit and ordinary least squares regression can be used to model the data. The model derived by considering the characteristics and nature of the data focuses on the willingness to pay distribution rather than the stochastic part of the utility function.

Choice experiments

Choice experiment is based on the Lancasterian consumer theory (Lancaster, 1966), i.e. consumers make choices not on the marginal rate of substitution between goods, but based on preferences for attributes of the goods. It predicts consumers' choice by determining the relative importance of various attributes in consumers' choice process (Hanemann and Kanninen, 1999) and combines the Lancaster theory with the random utility theory. Choice experiments evolved primarily from marketing economics and to some extent also from transport economics (Louviere and Hensher, 1982; Louviere and Woodworth, 1983) and have sometimes been considered as a

replacement for the contingent valuation method (Boxall et al., 1996; Adamowicz et al., 1998; Louviere et al., 2000). Choice experiments differ from contingent valuation in that respondents are presented with more alternatives involving different attributes and their levels, compared with contingent valuation. The values of respondents are inferred from the choices or trade-offs they make. In a choice experiment survey, the respondents are presented with several alternatives and are asked to choose their most preferred alternative. The alternatives consist of different combinations of attribute levels, and each set of alternatives is known as a choice set (Louviere et al., 2000; Alpizar et al., 2003; Ezebilo, E.E. 2010). Choice experiment originates from conjoint analysis (Green and Rao, 1971) which also includes contingent rating and contingent ranking that is mostly used in marketing research to elicit preference information. In contingent rating (Green and Rao, 1971), the respondents are requested to rate their preferences for several alternatives on a say ten-point scale. They are presented with a set of attributes associated with each alternative. The respondents' ratings are then regressed against the attributes. For the case of contingent ranking, (Champ et al., 2003) respondents are required to rank all the alternatives from least preferred to most preferred. The rankings can be converted to a rating scale and analyzed with a linear regression model like ordinary least squares regression. Based on observed rating and ranking, the researcher could statistically deduce the relative importance of the attributes and attribute levels from the subjects. Choice experiments have been analyzed using probabilistic choice models such as multinomial logit model, the multinomial probit model and the conditional logit model (Greene, 2003). With choice experiment one can estimate the marginal values of characteristics (Louviere et al., 2000; Bennett and Blamey, 2001). In this thesis choice experiment (see questions 20 to 22 in interview questionnaire in the Appendix) is used.

Short review of literature on economic valuation of nature conservation in Africa

Most economic studies on non-market values which have applied the contingent valuation method in Africa have focused on waste management, health and provision of water. For example, Fonta et al. (2008) studied the value of improved solid waste management facility in Nigeria. Altaf and Hughes (1994) studied the demand for improved sanitation services in Burkina Faso. Furthermore, Whittington et al. (1993) studied household demand for improved sanitation services in Ghana. Whittington et al. (1989)

studied the strategy for cost recovery in the rural water scheme in Nigeria. In another study Whittington et al. (1991) focused on willingness to pay for water in Onitsha, Nigeria. McPhail, (1994) studied why households in Tunis do not connect to the piped water system. Onwujekwe et al. (2001) studied the willingness to pay of a community for insecticides-treated nets in Nigeria. Swallow and Woudyalew (1994) study focused on willingness to contribute to tsetse fly control in Ethiopia. Only few contingent valuation studies have focused on local residents' willingness to pay for biodiversity conservation. For example, Turpie (2003) studied how interest in nature, experience, knowledge, income and perceived level of threat influence local willingness to pay for existence value of biodiversity in South Africa. Requier-Desjardins (2006) studied the economic costs of desertification in Africa. Mekonen (2000) studied local participation in community forestry in Ethiopia. This thesis (Paper III) contributes to the contingent valuation literature in Africa on local resident's value for biodiversity conservation to fill the knowledge 'gap' in Africa.

Most contingent valuation studies on tourism in Africa have focused on the willingness to pay of foreign visitors' for tourism, i.e. ecotourism. For example, Saayman and Saayman (2006) studied the contribution of visitor spending in the Kruger National Park in South Africa. Mathieu and Langford (2003) studied the value of marine parks in Seychelles. Navrud and Mungatana (1994) focused on the recreational value of wildlife viewing in South Africa. Moran (1994) estimated user surplus of Kenyan protected areas. However, there is no earlier literature that has focused on local residents' willingness to contribute to ecotourism. The thesis (Paper IV) contributes to contingent valuation literature in Africa on local residents' value for ecotourism.

Only few studies have applied choice experiments in economic valuation in Africa. For example, Owubah et al. (2001) used a binary choice model to predict the willingness to engage in preservation of indigenous, economically valuable trees, conservation of natural forests and establishment of forest plantations. Brannlund et al. (2009) used multinomial logit model (MNL) to predict households' willingness to engage in activities that are meant to promote sustainable forest management. Bogale et al. (2006) used MNL to identify determinants of household choice among alternative land property regimes to help mitigate consequences of scarcity-induced land related conflicts. Bekele and Drake (2003) used MNL to identify determinants of households' adoption of alternative soil and water conservation practices. Hassan and Nhemachena (2008) used MNL to predict determinants of farm-level climate adaptation measures in Africa.

However, there is no earlier literature on the preferences of a local community for nature conservation regimes.

Although non–timber forest products contribute to the income of households (Kumari, 1995; Murphy et al., 2005) this contribution is rarely included in national income account in most African countries. Inclusion of the value of non–timber forest products in national income would help to capture part of the true value of forests. The primary objective for establishment of protected areas is to conserve forests and biodiversity but it also has the potential for economic development of local communities adjacent to them. Only few studies have focused on social and economic impacts of protected areas (Badalamenti et al., 2000; Fortin and Gagnon, 1999). This thesis would fill some of the gaps in knowledge regarding economic valuation of nature conservation as well as socio–economic impacts of protected areas on livelihoods of local people in developing countries.

Study site and data collection

Nigeria has lost most of her natural rainforest habitat. The Federal Government of Nigeria established Cross River National Park in 1991 to conserve some of the natural rainforest. The park is located in the Cross River State in south-eastern Nigeria which harbours most of the rainforest habitat in the country. It covers approximately 4,000 km². The Cross River National Park is officially managed as two Divisions, the Oban Division in the south and the Okwangwo Division in the north. The Okwangwo Division (OD) of the Cross River National Park – which is the study area (see Figure 2) – is in the Boki Local Government Area. The OD is bordered to the east by the Takamanda Forest Reserve in the Republic of Cameroon. This implies that it is equally important for regional biodiversity conservation. The OD covers an area of 1,000 km² and it is one of the United Nation's biodiversity hotspots in the world (Biodiversity Hotspots, 2009). The OD is thus rich in biodiversity. For example, 1,545 plant species have been documented in the park and it also harbours about 78% of the primate species in Nigeria (Nigeria Park Service, 2009; Eniang, 2001). The OD has the highest diversity of primate species recorded at any single spot in Africa (Chukwuone and Okorji, 2008). The most endangered gorilla subspecies on earth, the Cross River gorilla (Gorilla gorilla diehli) is found only in the OD (Bassey and Oates, 2001). The park also houses other charismatic primate species such as the chimpanzee (Pan troglodytes) and drill (Mandrillus leucophaeus). Other animals found in the park include for example, red foxes, buffaloes, elephants, wild pigs and manatees. Sixty-nine of the plant species found in the OD has medicinal uses. Of these plant species; Ancistrocladus korupensis and Prunus africana are claimed (Nigeria Park Service, 2009) to be effective against HIV/AIDS, and prostate cancer, respectively. More than 1,000 species of butterfly have been recorded in the Park (Larson, 1997). Over 280 bird species have been recorded in the OD,

e.g. Picathartes oreas and Calyptocichla serina (BirdLife International, 2009). The park is important for regional watershed protection, conservation of biodiversity and ecotourism.

There are 66 villages located around the buffer zone of the OD. They have a total population of 36,000 people whereof 12,600 are adults (age ≥20 years) (Ite, 2004; Cross River State Government, 2008). For their livelihoods, these villages mostly depend on agriculture, hunting, fishing and gathering of non-timber forest products (NTFP) such as fuelwood, Gnetum africanum (afang), Irvingia gabonenesis (bush mango). Cash income for households' financial requirements mainly comes from the sale of crop products, livestock and NTFP. The villages once (before 1991) had access to the land presently occupied by the OD for their livelihood activities. The establishment of the OD restricts their access to the land. Although there are more than 60 park rangers who organize patrols and surveillance in and around the park, poaching continues unabated throughout the OD (Nkonyu and Dunn, 2009). Farming activities, cattle grazing by herdsmen and the use of poisonous chemicals such as gamalin 20 (herbicide) for fishing by some fishermen have been reported (BirdLife International, 2009). These chemicals have the potential to cause water pollution and consequently biodiversity loss. The extraction of forest products in the park has increased. Presently, there is concern that the needs of the villages compete strongly with the need for forest and biodiversity conservation. If their activities are not properly managed it may erode conservation efforts. The location of the study area is presented in Figure 2.

Figure 2. Location in south-eastern Nigeria (to the left) of Okwangwo Division of the Cross River National Park (shaded area to the right) and the villages in the survey (Bukalum, Butatong, and Wula).

Of the 66 villages located in the vicinity of the Okwangwo Division (OD), three were randomly selected, namely: Bukalum, Butatong, and Wula in the Boki area (see Figure 2). As with most rural areas in Africa, there was no address listing for local residents, no telephone facilities and low literacy level were also evident in these villages. Hence, face-to-face interview was the method of choice to collect data (see interview questionnaire in the Appendix). In each of the villages that were selected for the study, there was one main street and settlements were scattered along the main street – a characteristic found in most rural areas in Africa. Every other house along the main street was visited for interview. If a house was not occupied, then it was omitted and the next house was visited. The respondents alternated between the eldest male and the eldest female in each selected household. A total of 150 respondents were interviewed in the study area – 50 respondents in each village. There were 68 female and 82 male respondents. All individuals selected for the survey accepted the interview. The survey began by seeking approval from the village heads of the selected villages, which is in accordance with the tradition of the people. Pre-test interviews were conducted in November 2007 in a community outside the study area. Findings from the pre-test motivated some changes in the interview questionnaire such as the wording of valuation questions and conservation regimes. The main survey was conducted during April and May 2008. Two interviewers were recruited and trained for 2 days. They were fluent in the local language (Boki) of the people in the study area. Interviews were conducted in the Boki language. The initial plan regarding the study was to interview local people and the park administration, but bureaucracy would not allow us to interview the administration. We were asked to obtain permission from the Nigeria Park Service before the park administration can be interviewed. All our visits to the Nigeria Park Service office proved abortive. We were either told that the officer in charge was not on seat or he was too busy to attend to us.

The questionnaire comprised questions about socio-economic characteristics of respondents and their households (see questions i to xii in the Appendix), and questions about infrastructure (see questions 1, 2 and 3 in the Appendix; Paper I in Table 1). Furthermore, there were valuation questions regarding conservation of a leafy vegetable (afang) (see question 8 in the Appendix; Paper III in Table 1) and willingness to contribute money to ecotourism (questions 17 and 18; Paper IV in Table 1). There were questions regarding preferences for nature conservation regimes (questions 20, 21 and 22; Paper II in Table 1) and importance of the OD regarding biodiversity conservation and income from tourism (questions 7 and 19).

There were also questions about non-timber forest products (questions 4, 5 and 6; Paper V in Table 1), agriculture (questions 9, 10 and 11) and respondents' perceptions and adaptation to climate change (questions 25, 26, 27 and 28). A short description regarding the study reported in each of the papers (Papers I to V), goods valued and methods used are presented in Table 1.

Table 1. Goods valued and methodological approach

Paper	I	II	III	IV	V
Description	Contribution of the OD to local community development	Local people's preferences for nature conservation regimes	Decision to conserve an important leafy vegetable	Value of ecotourism to local people	Income from NTFP traded in local markets
Type of good(s)	Several NMP	One NMP	One NMP	One NMP	Several MP
Methodological approaches	Assessment of local residents perceptions	CE	CVM	CVM	Assessment of local residents' Income from NTFP

NTFP = Non-timber forest products; NMP = Non-market priced; MP = Market priced

CE = Choice experiment; CVM = Contingent valuation method

Summary of papers

Paper I: Socio-economic benefits of protected areas as perceived by local people around Cross River National Park, Nigeria

Biodiversity loss has led to the establishment of national parks all over the world (Geist and Lambin, 2002). This strategy has not been very successful in most developing countries where the livelihood activities of many people are strongly linked to natural resources. Many national park authorities in African countries have recognized the need to balance economic, social and environmental aspects of sustainability in natural resource management (Spangenberg, 2002) to improve effectiveness in biodiversity conservation. Most studies on impacts of protected areas have focused on conservation with only few on socio–economic impacts (Badalamenti et al., 2000). In this paper (see Paper I in Table 1) we have assessed the contribution of the Okwangwo Division (OD) to development of local communities in the vicinity of the park, i.e. provision of infrastructure, income from ecotourism and employment (see questions 1 to 3, 14, 15 and xii in the Appendix).

The results showed that the local communities in the vicinity of the OD benefit from infrastructure such as community town halls, a bridge and a classroom. The communities also benefit from income from tourism and employment in the OD. Some of the respondents report that they benefit from income from tourism but this was the case only in one of the villages in the study area. The OD also contributed to the provision of electric power supply and water supply but at the time of the study local residents did not benefit from these facilities because they were no more functioning. Some of the respondents did not report the infrastructure benefits to the interviewers. This suggests that they may have lost confidence in the park

authorities. Although the OD authorities have contributed to the provision of infrastructure to local communities adjacent to the park, some of the projects appear to be capital intensive both in the short and long run. For example, the electric power generating set requires fuel for its operation and attracts high maintenance cost. The water bore-hole is operated by electricity and also requires the services of professionals for maintenance. This suggests that the park authorities have supplied the infrastructure but have not considered the future maintenance of it.

Paper II: Local residents' preferences for nature conservation regimes in south-eastern Nigeria

Incorporation of local people's needs in nature conservation management plays an important role in sustainable management of protected areas (Heinen and Mehta, 2000). Most choice experiment studies on environmental valuation in Africa have focused on participation in forest management, soil conservation and adaptation to climate change (Brannlund et al., 2009; Bekele and Drake, 2003; Hassan and Nhemachena 2008). This paper aims at providing insights into aspects of nature conservation by eliciting local people's preferences for different nature conservation regimes (see Paper II in Table 1). Having identified local people's preferences for conservation regimes, factors that were assumed to determine their choice of regimes were analyzed.

Hypothetical nature conservation scenarios (see question 20 in the Appendix) were developed to describe nature conservation regimes that would promote biodiversity conservation as well as sustain the livelihood of individuals who live in the vicinity of the Okwangwo Division (OD). This would give individuals the opportunity to have access to sustainable livelihood with less land use related conflicts with nature conservation objectives. The scenarios were developed based on the suggestions and concerns raised by local people during the pre-test survey. The potential nature conservation regimes, i.e. INFRAST, COMMON and ACCESS (see questions 20 and 21 in the Appendix) were described to the respondents and they were asked to choose the one they most preferred.

The results showed that 59% of the respondents preferred the regime (INFRAST) that would give them access to infrastructure e.g. vocational training centre. The INFRAST regime would give local people access to livelihood opportunities that have less to do with forests. If local people depend less on forests the forestland area will increase and consequently biodiversity. Twenty-six percent of the respondents preferred the regime (COMMON) that would give them access to forest products in forests owned and managed by their community (community forest). The COMMON regime would increase local people's access to forest products outside the national park as well as increase the forestland area and

consequently biodiversity. It was 15% of the respondents who preferred the regime (ACCESS) that would give them access to non–timber forest products in the national park under the supervision of the park officials. The officials would help to monitor and control exploitation of the products to achieve sustainable exploitation. This would provide the local people access to livelihoods, as well as protect the environment against degradation.

The impact of different variables on the respondents' choice of nature conservation regimes was estimated with multinomial logit model. The results showed that the coefficient associated with education and commercial exploitation of bush mango was statistically significant and had positive impacts on choice of the INFRAST and the COMMON regimes, respectively. This suggests that the respondents who have formal education and those who engaged in commercial exploitation of bush mango were more likely to choose the INFRAST and COMMON regimes, respectively as opposed to the ACCESS regime. The coefficient associated with commercial cocoa farming was statistically significant and had positive impact on choice of the INFRAST regime. The coefficient associated with membership of an environmental group had positive impact on choice of the COMMON regime. This indicates that the respondents who engaged in commercial cocoa farming and those who are member of an environmental conservation group were more likely to choose the INFRAST and COMMON regimes, respectively as opposed to the ACCESS regime. The coefficient associated with income from non–timber forest products, and farmland size had negative impacts on choice of the INFRAST regime, while the coefficient associated with gender had a negative impact on choice of the COMMON regime. This suggests that the respondents who have more farmland, more income from non–timber forest products and are male were less likely to choose the INFRAST and COMMON regimes, respectively as opposed to the ACCESS regime. These factors need special consideration in designing policies and programmes to promote nature conservation in south–eastern Nigeria.

Paper III: Conservation of a leafy vegetable important for communities in the Nigerian rainforest

The Gnetum africanum Welw (afang) is an indigenous leafy vegetable in south–eastern Nigeria. Afang leaf and seed have medicinal uses such as treatment of enlarged spleen, sore throats and management of excessive urination in infantile diabetic patients (Smith, 1983). Afang leaf is rich in protein and has the potential to contribute to the protein requirements of rural dwellers in south–eastern Nigeria (Mialoundama, 1993). The leaves are either eaten raw or finely shredded and added to soups and stews (Burkill,

1994). Although afang contributes to livelihoods of many local communities in south-eastern Nigeria, there is no tradition amongst the people to cultivate it. The afang leaves are mostly harvested from natural forest. This may cause risk of driving the afang plant to extinction because afang leaves are harvested in large quantities to maximize benefit. In addition, unsustainable harvesting technique is often used. For example, the trees that the afang vine climbs are mostly felled and afang plant uprooted. This has negative impacts on natural regeneration of the afang plant, contributes to deforestation and consequently biodiversity loss. Presently, local communities in the vicinity of the Okwangwo Division (OD) exploit the afang plant in the buffer zone. But if there would be a depletion of the afang plant in the buffer zone these communities may extend their activities to the OD. The paper examines community's willingness to conserve afang plant and how their decision is influenced by socio-economic factors (see Paper III in Table 1).

The dichotomous choice question format was applied to elicit the value that local communities attach to conservation of afang plant. The hypothetical market scenario (see question 8 in the Appendix) was developed to describe the conservation of afang plant on 'private lands' in order to increase its availability in the long-run. Before this study we had doubt whether the payment vehicle − conservation cost − would be applicable to the study area. It is the tradition of the people to bargain the price of anything they buy, but they are not used to "take-it-or-leave-it" kind of purchase which is common in the developed countries. So we were doubtful whether the valuation question format (dichotomous choice) would be very successful in the study area.

The binary logit model was used to analyze the impacts of the respondents' socio-economic characteristics on their willingness to pay to conserve afang. Since the respondents' willingness to pay to conserve afang is latent, i.e. not observable (yes = 1; no = 0), the logit model was used to estimate the mean willingness to pay.

The results showed that about 60% of the respondents were willing to conserve the afang plant. The mean willingness to pay of the respondents was 1422.76 Nigerian Naira (NGN), i.e. US$ 9.485 per year. This corresponded to 7% of their income from non-timber forest products. Aggregating the mean willingness to pay over the relevant adult population (12,600) in all communities in the vicinity of the Okwangwo Division (OD), the total perceived welfare benefit from the conservation of afang plant to local residents was NGN 17,926,776 (US$ 119, 511.84) each year. The results also showed that income from non-timber forest products,

distance of respondent's residence to the OD, and educational level were statistically significant and had positive impacts on the willingness to pay to conserve afang. Expected cost associated with conservation and respondents' occupation had negative impacts on the willingness to conserve afang. The dichotomous choice question (take-it-or-leave-it) format is a new "way of thinking" for most people in the study area but the study indicates that this valuation approach can still be successfully applied in south-eastern Nigeria.

Paper IV: Economic Value of Ecotourism to Local Communities in the Nigerian Rainforest Zone

In most developing countries, local people are rarely involved in planning and management of development projects (e.g. on ecotourism) that may have impacts on their livelihoods. This mostly results in low level of acceptance by local people and might generate a conflict situation between them and project managers. Prior identification of the preferences of local people with regard to the usefulness of a development project may help to gear the project towards the needs of different groups of local people. This will help policy-makers to design more acceptable and cost effective development projects. Most contingent valuation studies (Lee and Mjelde, 2007; Asafu and Tapsuwan, 2008) on ecotourism in developing countries have focused on values which eco-tourists attach to ecotourism but values of ecotourism development to local people are rarely studied. It is important to have knowledge about the value that local people attach to ecotourism projects, because for the project to be successful it requires the support of local people. In this paper we have used the contingent valuation method to estimate how much local communities would be willing to contribute to support an ecotourism project and also the determinants of these values (see Paper IV in Table 1).

The hypothetical market scenario (see question 17 and 18 in the Appendix) was developed to describe improvement in the quality of services in ecotourism in order to attract more eco-tourists to the Okwangwo Division (OD). This would give more individuals in the local community the opportunity to derive income from ecotourism. It would also help to improve infrastructure such as better road network. The payment vehicle was an annual contribution to a community development fund. This payment vehicle is not new to the local people in south-eastern Nigeria because they often contribute to provision of infrastructure (e.g. community school classrooms) in their community. We have also used the iterative bidding value elicitation technique, which is similar to what the local people

in the study area are used to when purchasing goods. For example, they mostly bargain the price of commodities they are willing to purchase. We have analyzed the impacts of the respondents' characteristics on willingness to contribute (WTC) using the ordinary least squares (OLS) and the tobit model, respectively.

The results showed that 94% of the respondents were willing to contribute money to support the ecotourism project. This indicates that most of the respondents preferred the improvement of quality of facilities in the ecotourism project. The mean willingness to contribute amount (MWTC) of the respondents was 1,047 Nigerian Naira (NGN), i.e. US$ 6.98 per year which was about 1% of the mean annual income of the respondents. Aggregating the MWTC over the relevant adult population (12,600) in all communities in the vicinity of the OD, the total perceived welfare benefit for the ecotourism projects to local residents was NGN 13,192,200 (US$ 87,948) each year.

The tobit, and the OLS estimates showed similar effects. For both models, coefficients associated with income, post-high school education, occupation and membership of environmental conservation group were statistically significant and had positive impacts on respondents' willingness to contribute amount. The distance of respondent's residence to the OD was statistically significant and had negative impact on respondents' willingness to contribute amount. Six percent of the respondents did not support the ecotourism project. The most important reason was that they thought that the project would decimate their land and thus dissipate their source of livelihoods. Another important reason was that they raised doubt about the capacity of the park authorities to successfully implement the ecotourism project, and they also raised concerns regarding the sustainability of the project.

Paper V: Contribution of non-timber forest products to livelihoods of communities in southeast Nigeria

Non-timber-oriented management of tropical forests promotes sustainable forestry, because exploitation of non-timber forest products (NTFP) might result in integration of the use and conservation of forests (Gradwohl and Greenberg, 1988). NTFP contributes to the livelihoods of many people in developing countries and can be harvested with relatively little negative impact on the forest environment (Arnold and Ruiz Perez, 1998). In most developing countries there is seldom information on the NTFP that are traded on local markets and those consumed for sustenance (Murphy et al.,

2005). In this paper we have estimated the income from NTFP and how it is influenced by socio-economic factors in local communities adjacent to the Okwangwo Division (OD) (see Paper V in Table 1). We also discussed the impacts of commercialisation of NTFP on biodiversity conservation. We assessed the income that respondents generated from sales of NTFP in local markets (see questions 4 to 6 in the Appendix). The ordinary least squares (OLS) regression model was used to analyze the influence of the respondents' socio-economic characteristics on their income from NTFP.

The results showed that bush mango, afang (a leafy vegetable), and game meat (bush meat) were the major NTFP traded in local markets. Income from NTFP accounts for about 13% of the total annual income of the respondents. The OLS model estimates showed that coefficients associated with income from non-traditional employment (e.g. nursing, teaching), distance of respondent's residence to the OD and age were statistically significant and had negative impacts on income from NTFP. The coefficient associated with income from farming activities had a positive impact on income from NTFP. Benefits from NTFP accrue to local communities adjacent to the OD, but an increase in demand for NTFP may result in a shift from small-scale to a large-scale NTFP extraction activities. Commercialisation of NTFP might have negative impacts on species diversity because individuals who depend on NTFP for their livelihoods may want to maximise benefits, and in so doing, might compromise the sustainability of production of NTFP.

Discussion and conclusions

Assessments and economic valuations of impacts of forest and biodiversity conservation policies on livelihoods of local people in Africa are relatively rare in the literature. When available, they can provide useful knowledge to policy-makers with regard to how to develop appropriate conservation management strategies. The main theme of this thesis has been to assess the contribution of a conservation policy (e.g. establishment of national park) to livelihoods of local people, and to analyze its economic values using empirical methods for policy and decision purposes. The thesis contributes with estimates and analyses in relation to natural resource management. The applications relates to the growing concern for forest and biodiversity conservation. The estimates provided and analyses can be used to identify how to manage our natural resources more efficiently.

   Regarding biodiversity conservation combined with rural economic development, the results obtained suggest that the conservation strategy can be successfully applied in south-eastern Nigeria, and probably also in other parts of the country as well as other less developed countries. Local people in the vicinity of a national park can derive social and economic benefits from the park directly or indirectly, e.g. employment in the park, income from tourism and hard infrastructure such as bridges, community town halls, water and electric power supply. However, the primary objective of a national park is not to generate income but to conserve biodiversity. For an infrastructure to be sustainable it requires maintenance and local people may not be willing to pay for services provided by the infrastructure. It might be more cost efficient if national park authorities focus on the provision of infrastructure that local people can maintain. For example, most local people in rural Nigeria are used to "water-wells" and if these are provided to local communities the local people can easily maintain them. There is also a need to provide infrastructure that addresses the immediate needs of the local

people. If this is not done, the project might not be accepted by the local people. This calls for the involvement of local people in identifying their priorities as regards to infrastructure. Income from tourism was meant to make up for the reduction in traditional livelihoods of the local people as a result of the Okwangwo Division (OD). Even the respondents who have not benefited from tourism would need to earn additional income to reach their initial utility level, i.e. the level before the OD was established. In so doing they might engage in activities which may risk the primary objectives of the OD. From a community perspective, tourism is expected to provide equitable benefits that consequently enhance local support for conservation. If benefits from tourism are unequally distributed, like for the villages studied, it might influence the people's attitudes towards lowering their support for the OD. In combining biodiversity conservation with economic development there is a need to exercise caution, because if not handled appropriately, economic development may result in biodiversity loss. For example, provision of infrastructure may attract more people in the areas around the buffer zone of a national park. More people require more land for settlements and agriculture, which often compete with land for conservation. There is a need to have an appropriate threshold with regard to economic development around national parks. This study contributes to knowledge on how to efficiently combine biodiversity conservation and economic development, which could help policy-makers to design nature conservation policies appropriate to tropical regions.

Most of the respondents were willing to contribute to the ecotourism project. This suggests that if facilities in the ecotourism are improved, more of the local people may benefit from the project. But the benefits do not cut across all groups of the local people. For example, the people who may benefit more from the ecotourism project include people who have more money, post-high school education, reside closer to the national park, engage in traditional occupation (e.g. agriculture) and are members of an environmental group. All interest groups in local communities should be involved in planning and management of an ecotourism project. This would give each group the opportunity to come up with ideas on how to modify the project so that they can all benefit from it. The park authorities can also provide facilities to train local people to get more income from ecotourism projects. This would empower local people with knowledge concerning ecotourism businesses that require less investment costs. Sensitive issues, such as the impacts of ecotourism on the traditions of the people, need to be taken into account in planning an ecotourism project. The planning and management of the project require involvement of local people. This would

give them more access to information about the ecotourism project, and may influence more of the local people to accept the project. If more local people derive income from ecotourism they may depend less on traditional income generating activities such as agriculture, which may in turn allow forest and biodiversity to increase. The knowledge about the value that local people attach to ecotourism would help to package ecotourism projects to benefit more of the local people.

Regarding local people's willingness to conserve an indigenous vegetable plant (afang), the results obtained suggest that more than half of the respondents were willing to conserve the plant. Since a project on conservation of afang will attract costs to landholders, there is a need to have incentives for them. For biodiversity conservation to be sustainable, it may require a multidimensional approach, i.e. conservation on both protected areas and 'private lands'. For example, if plant species which contribute to livelihoods is domesticated and local people are encouraged to conserve them, it would reduce pressure exerted on the wild species. Afang is one of the important vegetables that contribute to the livelihoods of most people in south-eastern Nigeria. The increasing human population in the area increases the demand for afang which may threaten afang plant. This calls for an introduction of afang into the farming system in order to reduce the pressure exerted on the wild afang population. This type of biodiversity conservation may be appropriate for south-eastern Nigeria because much of the people depend heavily on natural resources for their livelihoods. Moreover, it may be more costly to provide local people with livelihood sources that are not linked to use of natural resources. Local people should be involved in planning and management of biodiversity conservation because they often know much about the natural resources around them.

During the period of this study income generating activities from non-timber forest products (NTFP) appear not to pose much threat to biodiversity conservation in the Okwangwo Division (OD). But if there would be an increase in market demand for the products coupled with the increasing human population in the area, NTFP extraction activities may extend to central area of the OD. It may be more beneficial to the society if precautionary measures are taken to minimize such encroachment. For example, local people should be trained on processing NTFP to add value on the products which would give the people, opportunities to earn more money from lower quantity harvested. NTFP that are extracted from wild population should not be commercialised because it may contribute to biodiversity loss. Local people should be trained on sustainable harvesting

techniques. This would help to reduce wastages of NTFP, thus promoting sustainable use of the products.

Regarding local preferences for nature conservation regimes, the results suggest that more than half of the respondents prefer the regime that gives them access to infrastructure. This suggests that nature conservation combined with economic development might motivate local people to support nature conservation policy. Local people are rarely involved in choosing nature conservation regimes even though these may have impacts on their livelihood activities. If local people are involved, it may result in a win-win situation where they collaborate with national park managers in a harmonious atmosphere. The results suggest that there is a need for infrastructure that may give more local people access to formal education and for promotion of environmental conservation groups. In south-eastern Nigeria, women are more dependent than men on non-timber forest products for their livelihoods. This implies that nature conservation policy that restricts access to such products may likely affect women. The results indicate that nature conservation policy may be more successful if women are also represented when designing the policy. This study could help policy-makers to design nature conservation management regimes that may be more acceptable to local people. This may strengthen local people's cooperation with national park managers and thus improve effectiveness of nature conservation.

The role which environmental resources play in the Nigerian economy is often overlooked by policy-makers (Federal Environmental Protection Agency, 2003). This may result in a lack of economic incentives for authorities to invest in environmental resource management and conservation. Moreover, conventional measures of national income normally fail to recognize the unsustainable depletion of biological resources as a loss to the country's wealth.

Although forests provide raw materials and inputs for rural enterprises and play an important role to livelihoods of many people in Nigeria, economic valuation of natural resources has been in favour of resources such as oil. Recognition of the value of forests and biodiversity is important for social and economic development as well as the Nigerian environment. Effective valuation practices could reduce land use conflicts and degradation of environmental resources in Nigeria. Effective conservation of tropical forests and other natural resources in Nigeria requires a strategy that meets the needs of the human population today as well as the long-term sustainability of the natural resources. Agricultural practices need further improvement to increase crop yields on existing agricultural lands, thus

helping to reduce the loss of more forests. This should be combined with introduction of sustainable forestry techniques and agroforestry practices that promote diversity of useful indigenous species. Local communities should be empowered in natural resource management, sustainable harvesting of non-timber forest products, fisheries, and other aspects of community-based natural resource management. Protected areas need further strengthening to ensure their adequate safeguarding. Park officials need more training in conservation and community liaison work. Environmental awareness need to be strengthened at all levels in Nigeria. Public awareness campaigns should be strongly encouraged to help develop further the effectiveness of forest conservation in Nigeria. Further research is needed in areas such as local participation regarding adaptation to climate change and institutional and organisational processes to manage the use of natural resources.

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Acknowledgements

Appendix: Interview questionnaire used in the survey

Land use and nature conservation regimes survey

Village name: ……………….. Date……………………
Respondent number…… …… Gender: Male / Female

We are a group of researchers from the Swedish University of Agricultural Sciences, Sweden. We are interviewing people to know their opinion concerning national park in relation to nature conservation, livelihoods and community development. We also wish to know their opinion regarding climate change.

   You are part of selected people in the village for the interview. The interview will last for 1 to 1½ hour. The interview is for research purposes and we would appreciate if you would participate in the survey.

We assure you that only results for large groups will be reported, and that your responses will be held strictly in confidence.

We thank you in anticipation for your cooperation.

Respondent's characteristics

i) Are you a native of this village? (yes / no)
ii) If 'no' to question i) how long have you lived in this village? .... (years).
iii) What is your permanent and temporary occupation? Rank them according to time spent on them. a) …………… b) ……………… c) …………
iv) Respondent's age (years) ……..
v) Respondent's household size (No. of person) ………………

vi) Respondent's educational level: (a) Primary (b) High school (c) Post–high school.

vii) The distance of the respondent's residence to Okwangwo Division border is ……………
(Kilometre).

viii) Respondent's farmland size ……… (hectare).

ix) Respondent's average annual income …………. (Nigerian Naira).

x) Respondent is a member of an environmental conservation group (yes / no)

xi) Before the establishment of the Okwangwo Division did you have land in the area
presently occupied by the park? (yes / no)

xii) Respondent has relative employed by the Okwangwo Division authority (yes / no)

Social infrastructure

1) Mention the types of infrastructure that were available in your community before the
establishment of Okwangwo Division.(a) electric power supply (b) telephone services (c)
portable water supply (d) health care (e) good road network (f) other ………………

2) Mention the types of infrastructure that the Okwangwo Division has contributed to
introduce in your community. (a) electric power supply (b) telephone services (c) portable
water supply (d) health care (e) good road network (f) other …………..

3) In your opinion how important is the Okwangwo Division with regard to future
provision of infrastructure to your community? (a) Very important (b) Rather important (c)
Rather unimportant (d) Totally unimportant.

Non–timber forest products e.g. fuelwood, bush meat, leafy vegetable (afang)

4) Mention the non–timber forest product (NTFP) that has the highest contribution to your
yearly income. (a) fuelwood (b) bush mango (c) afang (d) bush meat (e) other ……….

5) Around how much money did you realise last year from the sale of the product you have
mentioned in question 4)? ………… Nigerian Naira (NGN).

6) Mention the total amount of money you realised last year from the sale of non–timber
forest products …………… NGN.

7) In your opinion how important is the Okwangwo Division to forest and biological
diversity conservation? (a) Very important (b) Rather important (c) Rather unimportant
(d) Totally unimportant

8) The afang plant is an important vegetable for local communities in southeast Nigeria. It
contributes to livelihoods of many people but the plant is becoming increasingly scarce and
may disappear totally from forests. If afang is protected this would increase its availability,
sustain the afang business and our successive generations would also benefit from the afang
plant.

Suppose that it is proposed that every landholder in your community should set-aside 2% of their farmland to conserve the afang plant. If set-aside would cost you ……….. (10, 100, 250, 500, 750, 1000, 1500, and 2000 NGN) yearly, would you be willing to conserve afang? (yes / no).

Crop production

9) Mention the crop that has the highest contribution to your yearly income. (a) cassava (b) banana (c) maize (d) cocoa (e) other ……………
10) Around how much money did you realise last year from the sale of the crop mentioned in 9)? ………… NGN.
11) Mention the total amount of money you realised last year from the sale of farm products …………… NGN.

12) Suppose that an annual development levy is proposed to support activities of a vocational training centre in your community. The levy would be managed by individuals chosen by members of the community. Successful implementation of the programme could increase literacy rate and provide training opportunities in areas such as food processing and preservation. It is expected that every adult in the community pays equal share to the programme.

Would you participate in the programme? (yes / no)
If 'yes' go to question 12a); if 'no' go to question 13).

12a) If it would cost you ……….. (100, 250, 500, 750, 1000, 1500, 2000, 2500, 3000, and 3500 NGN) yearly, would you still be willing to participate in the programme?
yes / no.

13. If you would not participate in the programme described in question 12). Please state your reason(s): _____
_____

Tourism

14) Do you engage in any tourism income generating activity? (yes / no).
 If 'yes' to question 14) which type of activity do you engage in?
(a)   tourist guide (b) transportation (c) catering (d) accommodation
(e) other…………………
15) Around how much money did you realise last year from the tourism income generating activity you mentioned in question 14)? ………… NGN.

16) In your opinion what is the main purpose of the establishment of the Okwangwo Division? (a) environmental and biodiversity conservation (b) creating more employment opportunities (c) tourism (d) I don't know   (e) other ………….

17) Suppose that a development levy is proposed to improve quality of services in ecotourism sector in your community. The levy would be managed by individuals chosen by members of the community. Successful implementation of the project could increase income from ecotourism for your community and would improve infrastructure such as better road network. It is expected that every adult in your community pays equal share towards the project.

Would you support the project? (yes / no)
If 'no' go to question 18)
If 'yes' what is the highest amount (NGN) you would contribute every year to the project?
(100, 500, 1000, 1500, 2000, 3000, 4000, 5000, 6000 NGN)
18) If you would not contribute to the project described in question 17). Please state your reason(s): _____

_____

19) In your opinion how important is the Okwangwo Division in terms of its contributions towards provision of income from tourism in the future? (a) Very important (b) Rather important (c)Rather unimportant (d) Totally unimportant

Preferences for nature conservation regimes

20) Let assume that there are three alternative regimes to promote nature conservation in the Okwangwo Division as well as sustain livelihoods of your community. The regimes are described below:

ACCESS
Members of your community would be allowed to collect non-timber forest products such as wild fruits and leafy vegetables from the national park under the supervision of park officials. It is expected that this would help to promote sustainable exploitation of non-timber forest products.

How satisfied are you towards the ACCESS regime?
(a) Very satisfied (b) Rather satisfied (c) Indifference (d) Rather unsatisfied
(e) Totally unsatisfied

COMMON

Your community would be allocated a piece of land outside the national park and encouraged to cultivate forest tree species for their own use. The park officials would provide tree seedlings and technical support with regard to sustainable forest management. It is expected that this measure would help to increase forestland area, improve biodiversity and increase availability of forest products to your community.

How satisfied are you towards the COMMON regime?
(a) Very satisfied (b) Rather satisfied (c) Indifference (d) Rather unsatisfied
(e) Totally unsatisfied

INFRAST

Infrastructure such as primary health care centre, vocational training centre and better road network would be provided to your community. It is expected that the infrastructure would prepare members of your community for livelihood activities that depend less on natural resources. This would reduce the pressure exerted on forests, and help to conserve forests and biodiversity as well as sustain livelihoods of your community.

 How satisfied are you towards the INFRAST regime?
(a) Very satisfied (b) Rather satisfied (c) Indifference (d) Rather unsatisfied
(e) Totally unsatisfied
21) Among the alternative strategies described in question 20) which one do you prefer most? (a) ACCESS (b) COMMON (c) INFRAST
22) Among the alternative strategies described in question 20) which one do you prefer least? (a) ACCESS (b) COMMON (c) INFRAST

Climate change

23) Mention the media you mostly get information from. (a) Radio (b) Television (c) Newspaper (d) Personal contact such as from friends
(e) Other …………………
24) Have you heard or read about climate change? (yes / no). If 'yes,' state the media ………………..
25) Based on your past experience about the climate of your area would you say that the climate has changed totally? (yes / no) If 'no' go to question 28
 If 'yes,' to question 25) what do you expect would be the impacts of climate change on you and your household?

_____

_____

26) In your opinion in what ways have the climate of your area changed?

_____

_____

27) Have you adapted in order to cope with climate change? (yes / no) If 'yes,' explain how you have adapted.

_____

_____

28) If 'no,' to question 25) what would say about the climate of your area?

_____

_____

29. Please feel free to give any comment concerning the interview.

_____

_____