

FAUNA FOREVER TAMBOPATA: Monitoring and valuing changes in biodiversity and forest cover in an ecotourism destination area in the Peruvian Amazon.

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Summary

Only in the last decade or so, and as a consequence of studies and thinking at the juncture of ecology and economics, have we begun to appreciate the links between ecosystems and human well-being. Healthy, well functioning ecosystems are increasingly seen as natural capital assets, with use and non-use values benefitting societies from the local to global scale. Ecosystems therefore require careful evaluation when it comes to decisions that could affect their integrity. The accurate economic valuation of ecosystems is now considered an important input for cost-benefit analysis, a technique that is increasingly used by policy makers and others to inform the decision-making process, particularly where there exist trade-offs between, for example, two or more land-use options. Identifying and valuing what are termed ecosystem services and ecosystem benefits is the agreed process for quantifying the economic importance to society of ecosystems and changes to them. Ecosystem services are those aspects of ecosystems utilised (actively or passively) to produce human well-being; whilst ecosystem benefits are those outcomes that have an explicit and positive impact on changes in human welfare, and which frequently rely on the availability of multiple ecosystem services. The flow of ecosystem services and benefits are mediated by ecosystem processes and functions, such as water cycling (rainfall, run-off, evapotranspiration, etc.), trophic cycling (primary productivity, herbivory, predation, etc.), nutrient and carbon cycling. Many of these processes are, to a lesser or greater extent, influenced by biodiversity – a term that encapsulates species richness, viable populations, and the trophic complexities of communities. This, and the fact that biodiversity contributes directly to ecosystem stability, suggests that biodiversity per se is economically valuable and can be measured directly and indirectly from the perspective of ecosystem services and benefits.

Humid tropical forests, the vast majority of which are located in developing countries, are known to have high levels of biodiversity. However, there is still little empirical evidence of the economic value of biodiversity-rich ecosystems such as these. It is not surprising, therefore, that biodiversity is rarely included in the economic calculations of decision-makers in countries like Peru, a megadiverse nation of which 60% is Amazon rainforest. Although Peru has historically had a relatively low level of tropical deforestation compared to neighbouring countries like Bolivia and Brazil, sustained economic growth, expansion in agriculture and investment in major infrastructure projects over the last decade has significantly increased the baseline rate of deforestation.

This proposal is centred on the rainforests of Tambopata in SE Peru. The area is home to 70,000 people, whose economic security relies largely on gold mining, logging, agriculture, cattle ranching, Brazil nuts and ecotourism. The first four activities affect the integrity of the forest and usually lead to forest clearance (deforestation), a shift from a natural to a managed landscape which in turn invariably leads to a loss of biodiversity. Countering these activities is Brazil nut extraction and ecotourism (the focus of this study) both of which rely on intact rainforest and viable wildlife populations. In 2007, Tambopata attracted 50,000 ecotourists intent on observing the exceptional wildlife and wilderness qualities of the Tambopata National Reserve (TNR) and Bahuaja Sonene National Park (BSNP) and their buffer zones, and interacting with local mestizo and indigenous communities. Tambopata's ecotourism industry alone benefits Peru to the tune of US\$11.6 million per year, a third of which enters the local economy. All of the aforementioned activities have been growing strongly since 1995, though with relatively few adverse effects on each other to date, although the net effect on the forest as a whole has been negative, with deforestation in the TNR buffer zone alone increasing on average by 800 ha per year by 2005.

However, the socio-economic environment in Tambopata is about to change, and fast. A new multi-billion dollar infrastructure project involving the paving of the Interoceanic Highway, a westerly extension of Brazil's Trans-Amazon Highway, and the building of major bridges and electricity transmission lines, is currently underway and will be complete by 2010. This investment project, designed to boost economic development in the south of Peru, will significantly reduce transportation costs into and out of Tambopata, which in turn will give a further boost to all the aforementioned activities. In the next ten years, the competition for land between those activities that degrade or destroy forest and those that rely on intact forest and healthy ecosystems will intensify significantly. If historical rates and patterns of deforestation continue unabated in Tambopata, and conservation governance strategies are not improved, then more than 80% of the TNR buffer zone, large areas of the TNR itself, and many ecotourism-use areas, will be deforested by 2030, unless ecotourism operators actively protect the forests they need. Pressures on wildlife populations in remaining forest from the effects of bush-meat hunting is also likely to increase as the human population grows, as a result of immigration and reproduction, and demand for this forest product increases.

The economic value of intact forest and biodiversity in Tambopata, and the opportunity costs to society of deforestation in and around the TNR, BSNP and associated ecotourism areas, was not taken into account when the political decision was made to fund the construction of the Interoceanic Highway and related infrastructure. In this case, only the economic benefits were considered. Some say that the costs were not considered because insufficient or poor information was available. If this type of thinking and apparent lack of information continues, then future petitions for building or improving roads, the granting of mining and natural resource extraction rights in inappropriate areas, and even decisions not to prosecute illegal miners and natural resource extractors will in time significantly erode the integrity of forests in Tambopata, the supply of ecosystem services and benefits, including opportunities for ecotourism development and biodiversity conservation. Furthermore, the expected growth in the ecotourism sector in Tambopata, will also likely lead to greater forest-use intensity by ecotourists, as the number of visitors increases but the available area of appropriate forest and other attractions, like oxbow lakes, remains constant or declines. This could lead in turn to unsustainable pressure being placed on forest-based wildlife populations and species richness in ecotourism-use areas, with the potential to reduce the attractiveness of the area to visitors, which in turn could reduce the value of intact forest and biodiversity from an ecotourism perspective. The likely result of these two factors working in parallel is to lower than expected (sub-optimal) levels of economic development and human welfare.

The major question that urgently needs answering in Tambopata, is how much deforestation and degradation or loss of biodiversity, particularly in the vicinity of the TNR and ecotourism-use areas, is acceptable from a social and private economic point of view? To answer this, we need to understand (i) the net economic value of losing successive areas of forest in different locations (e.g. next to an oxbow lake versus next to a secondary road); (ii) the net economic value of changes in biodiversity (i.e. species richness, wildlife population abundance, community complexity) and the physical structure of forest (e.g. disturbed versus undisturbed forest); and (iii) the opportunity costs of ecotourism and state-led conservation (e.g. net economic returns to agriculture, ranching, logging, etc.).

We plan to answer this question by monitoring (i) the changing state of biodiversity within and outside ecotourism-use areas and the factors that affect these changes; (ii) the economic value of biodiversity within and outside ecotourism-use areas, based on the profits generated by ecotourism businesses and the preferences of visitors; and (iii) the net economic trade-offs between ecotourism and competing land-uses like agriculture and cattle ranching (i.e. ecotourism's opportunity costs). We will accomplish this by drawing upon (i) biodiversity data collected by (a) Fauna Forever Tambopata in 1997/98 and 2004/05, (b) one of the authors (CK) at other locations in Tambopata from 2006-2008, and (c) other projects who have made available their databases; (ii) economic data on ecotourism and competing land-uses, collected by one of the authors (CK) during the course of his PhD research from 2005-2008; and (iii) extending the methodologies used in (i) and (ii) into the future and incorporating new methods for the economic valuation of marginal changes in forest cover and biodiversity. To ensure the results of this Fauna Forever Tambopata programme are increasingly useful and reach the people that

matter (i.e. decision-makers and stakeholders interested in Tambopata), we will disseminate results through a number of channels at local, national and international levels.

Introduction

Wild nature and functioning ecosystems are vital and thus valuable, from a natural capital perspective, to human societies at many spatial scales, more specifically and operationally via the provision of ecosystem services and benefits (Balmford et al. 2002; Costanza et al. 1997; Daily 1997; Fisher & Turner 2008; Turner & Daily 2008). Ecosystem services, which can be either intermediate or final, are those aspects of ecosystems consumed or utilized, directly or indirectly, to produce human well-being, and include ecosystem organization (structure), operation (processes and functions), and outflows (products) (Fisher et al. in press). These include things like pollination of food crops (an intermediate service provided by many insect species), purification of water destined for human consumption (an intermediate service associated with aquatic plants and animals), carbon sequestration within the context of climate regulation (a final service provided by marine algae and terrestrial forests). Ecosystem benefits are those things or outcomes that have an explicit and positive impact on changes in human welfare, like more water, less risk from forest fires, better nature-based recreational experiences, and so forth. Ecosystem benefits frequently rely on multiple ecosystem services, and may require human and built capital to be fully realised.

A good working example of an ecosystem service emanating from an area of humid lowland tropical forest in the Amazon, concerns Brazil nuts (*Bertholletia excelsa*), a well known non-timber forest product gathered from intact forests and marketed throughout the world (Silvertown 2004). The final *provisioning service* in this case is the supply of food (nuts) to local, national and international consumers. An intermediate *pollination service* also exists, attributable to forest-obligate bee species on which the Brazil nut trees depend almost entirely for pollination and thus nut production (Brazil nut trees are dioecious), the value of which would be some fraction of the final service. Brazil nut trees, which are some of the oldest and largest trees in the Amazon (Brienen & Zuidema 2006), also provide an additional final *regulating service* in the form of the sequestered carbon in their trunks. They are also considered an ecosystem benefit from a recreational perspective, benefitting visiting ecotourists who marvel at seeing these ancient rainforest giants, although this would not be possible without places to stay like jungle lodges which are part of the recreational experience.

Despite the societal benefits from ecosystems, most decision-makers, from individuals to governments, continue to behave as if ecosystems have little or no value. The predictable result is that wild habitats and wildlife populations are declining and species' extinction risk increasing. This is particularly so in developing countries, that still rely heavily on natural resources for economic growth. Although ecosystem services and benefits are undoubtedly valuable in a general sense, without reliable estimates of economic value in a form that decision-makers can readily understand (i.e. monetary or exchange value), then these people will continue to largely ignore wild nature in their cost-benefit analyses of the trade-offs between alternative land-uses (e.g. conservation versus conversion of ecosystems).

Since the papers by Peters et al. (1989) and Costanza et al. (1997), on the theoretical valuation of a rainforest and on the economic value of the Planet's ecosystems, respectively, both of which sparked significant media interest at the time of their publication and a subsequent research boom into the valuation of natural areas and then ecosystem services and benefits more specifically, the literature on the economic valuation of wild nature, biodiversity and ecosystem services has grown substantially (Balmford et al. 2002; Hooper et al. 2005; MEA 2005; Mullan & Kontoleon 2008; Sukhdev 2008). The vast majority of the ecosystem valuation literature deals with estimating total economic value of an ecosystem, or part thereof. Nevertheless, it seems decision-makers have still to be swayed in any number by such valuations, even if very large, particularly in developing countries. It has been strongly argued, therefore, that in order to improve the usefulness of ecosystem valuation studies in the formulation of policy, it is necessary to take a more strict econometric approach based on the analysis of the *supply* and *demand* of ecosystem services and benefits and thus the value of *marginal changes* in ecosystems, i.e. the

value yielded by an additional unit of service or benefit (Fisher et al. in press). Most decisions made concerning natural resource exploitation or conversion of natural habitats are taken on the margin, therefore valuations of wild nature should also be made at this level. However, few valuations of marginal changes in ecosystems exist in the literature (Fisher et al. in press).

Well-functioning natural ecosystems, in contrast to human-managed systems, tend to be characterised by relatively high species richness (one of the measures of biodiversity) (Hooper et al. 2005; Loreau et al. 2001; Naeem 2008; Naeem & Li 1997; Naeem et al. 1994). Although there is growing empirical evidence in the literature of a relationship between species richness and ecosystem service provision and thus economic value (MEA 2005; Mullan & Kontoleon 2008), there is still precious little evidence for this link in the most biodiverse ecosystem on the planet - humid tropical rainforests, an ecosystem which is also disappearing at an alarming rate. Documenting cases where there is a relationship in this ecosystem is therefore important, so that decision-makers in tropical countries can also consider the biodiversity of their forests within their economic analyses of land-use changes and trade-offs.

Monitoring is recognised as a fundamental requirement in order to detect meaningful changes in biodiversity (e.g. species richness and population abundance), and provides the means to evaluate the successes and failures of policies, strategies, plans and programmes set up to achieve the conservation and sustainable use of biodiversity. Monitoring is important to enable those who are custodians of biological resources (e.g. protected area managers) to take appropriate action to conserve species. Since signing the commitments of the Convention on Biological Diversity in 1990 and those of the World Summit on Sustainable Development in 2002, many governments are now committed to reducing or even halting biodiversity loss at regional and national levels. Although some progress has been made with regards to monitoring biodiversity-rich areas such as the Amazon rainforest (Ferraz et al. 2008), sustaining monitoring efforts in such areas is costly and the professional and financial resources are often scarce (Danielsen et al. 2005; Danielsen et al. 2003). Identifying cost-effective biodiversity monitoring processes in ecosystems such as the Amazon is therefore important (Gardner et al. 2008).

The results and recommendations of research undertaken in developing countries that purports to shed light on environmental and socio-economic processes that affect biodiversity conservation, economic development, and poverty alleviation rarely reach the eyes and ears of decision-makers and the general public that may be in a position to act on such findings. This is largely the product of researchers using inappropriate mechanisms for disseminating their results to those that really matter. It is widely understood that only a fraction of research undertaken in developing countries is published in the white literature (e.g. peer reviewed journals), that most of this is authored by developed world nationals in a language (usually English) other than the national language of the country where the research was undertaken, and that people in developing countries rarely have access to such literature. At the other extreme, developing country researchers tend to present their results in grey literature formats (e.g. unpublished reports), and they frequently lack the resources to make sufficient hard copies of their work widely available or to post electronic copies of their work on the internet, such that relevant research in an appropriate language frequently ends up unread by those people who most need access to it (Pitman et al. 2006).

The problem

In the SW Amazon eco-region, in the SE corner of Peru, and within the Tropical Andes biodiversity hotspot (Myers et al. 2000), lies an area called Tambopata, well known for its high species richness (Foster et al. 1994). Tambopata is dominated by two protected areas, the Tambopata National Reserve (TNR) and Bahuaja-Sonene National Park (BSNP), which also constitute key links in the Vilcabamba-Amboro Conservation Corridor (Figs. 1 and 2). The area has a population of 70,000 people, centred on the provincial capital Puerto Maldonado, whose economic security relies largely on gold mining, logging, agriculture, cattle ranching, Brazil nuts and ecotourism. The first four activities affect the integrity of the forest and usually lead to forest clearance or deforestation and a shift from a natural to a managed landscape, which in turn invariably leads to a loss of biodiversity. Countering these activities is Brazil nut extraction and ecotourism both of which rely on intact rainforest and viable wildlife

populations. Tambopata now boasts the largest and fastest growing ecotourism industry in the Amazon (Kirkby et al. in prep.-a), which in 2007 attracted an estimated 50,000 foreign visitors (Fig. 3) who stayed in 37 ecotourism lodges (Fig. 1). In 2005, ecotourists visiting Tambopata generated an estimated US\$11.6 million in direct revenues for lodges (52%), airlines (45%) and the government (via taxes and protected area entrance fees, 3%). Of this, US\$3.7 million (33%) entered the local economy benefiting local people (Kirkby et al. in prep.-a).

In 2005, work began on paving of the Interoceanic Highway, a multi-billion dollar infrastructure development project located just north of the TNR, which on completion in 2010 will likely result in massive in-migration into the area and a general expansion of logging, forest clearance for agriculture and cattle ranching activities, and bush-meat hunting (Dourojeanni 2006; Oliveira et al. 2007; Soares-Filho et al. 2006). Large areas of intact forest within the TNR and bordering areas within its buffer zone, including areas of importance for current and future ecotourism development, are under serious threat of degradation or deforestation over the next ten to twenty years (Kirkby et al. in prep.-b). If these threats are played out in full, greenhouse gas emissions from deforestation and burning will also increase significantly causing additional negative externalities from a climate change perspective. Peruvian government officials are already indirectly encouraging the conversion of forest in Tambopata via the introduction of new land-use legislation that promotes widespread privatisation of forested lands currently owned by the State or indigenous communities, and by promoting agricultural development within the area of influence of the highway. Although the government has allocated some resources to mitigate the direct and indirect impacts of the highway on existing forests and forest users, it is recognised that such funds are wholly insufficient to tackle the magnitude of the expected impacts (Dourojeanni 2006). No government funding has been earmarked for dealing with the expected impacts in the ecotourism-use areas of Tambopata, suggesting that ecotourism lodges themselves will have to take on this responsibility on an individual basis. There is evidence to suggest that the most profitable lodges will be able to rebuff deforestation threats in their immediate area.

By lowering transportation costs, the highway is also expected to make ecotourism more profitable, and for the foreseeable future the sector is expected to grow and attract many more visitors than is currently the case today. Nevertheless, within a decade and with fewer areas of suitable intact forest expected to be left in the TNR buffer zone into which it can expand, due to encroaching deforestation from the direction of the highway, it is anticipated that ecotourism growth will lead to significant increases in land-use intensity by ecotourists. This will be particularly evident in the vicinity of forest trails (used for hiking), around oxbow lakes (used for boating) and around clay-licks (used for viewing parrots and large mammals). Some evidence already exists of the effects of ecotourism on certain components of biodiversity in Tambopata. For example, an unpublished report by one of the authors (Kirkby et al. 2000) and an independent MSc. thesis (Hodgkinson 2002) shows that in some locations, especially where both tourism and bush-meat hunting are prevalent, the abundance of some mammal species, including primates, are altered with knock-on effects for community structure. Similar evidence from other areas and other ecosystems is also growing (Ananthaswamy 2004; Coghlan 2008; Reed & Merenlender 2008; Schenck et al. 2003; Torre et al. 2000). One of the authors (CK) has also identified that the economic value of ecotourism areas in Tambopata can be high when compared to competing land-uses like agriculture (Kirkby et al. in prep.-c). However, nothing is yet known about the net economic impacts that may stem from the increasing rarity, and potential local extinction, of wildlife species in Tambopata due to deforestation as an indirect result of the Interoceanic Highway development on the one hand, and degradation of biological communities from ecotourism expansion and increased forest-use intensity on the other.

The solution

We plan to tackle the problem, in a way that also considers the themes mentioned earlier, by providing decision-makers with more useful, reliable and economically sound valuations of Tambopata's forest and biodiversity, with an emphasis on the magnitude of net economic gains or losses from expected marginal changes in forest cover and biodiversity (e.g. increased species rarity, local species extinctions, and altered community structure). We plan to use ecotourism, agricultural and natural resource economics in combination with rigorous biodiversity monitoring at multiple sites to collect the required information over the course of 14 months. The

results of this process, we believe, will go a long way to spur discussion at many levels to ensure the socially correct decisions are eventually taken regarding how much road-, agriculture- and natural resource-mediated deforestation on the one hand, and ecotourism-mediated degradation of biological communities on the other, may be acceptable in Tambopata from an environmental and socio-economic point of view.

Brazil nut dominated forests in Peru are now legally protected from clear-cutting, via the designation of protected status for the Brazil nut tree and the leasing of forest concessions for the extraction of Brazil nuts. This protection is the result of policy decisions taken in the 1990s and early 2000s based largely on the export value of this forest product and the large number of rural and urban poor that rely heavily on this natural resource as their main source of income. This goes to show that government decision-makers in Peru *can* be persuaded using economic and social welfare arguments to make the right decisions and opt for a conservation solution as part of an overall strategy for sustainable economic development in a tropical forest setting. It still remains to be seen, however, whether the beneficiaries of this legislation (i.e. Brazil nut collectors) will have the power, or economic means to test the strength of the laws when faced with either deforestation events or threats to their leased Brazil nut forests after the Interoceanic Highway is complete.

In order to achieve our goals of continuing the rigorous monitoring of biodiversity in Tambopata, and now to correctly value marginal changes in forest cover and biodiversity, we plan to collect reliable time-series information on (i) the rate of deforestation in Tambopata, particularly within the buffer zone of the TNR and near areas of ecotourism importance; (ii) the rate of change in species richness and population abundance in areas affected by habitat degradation (i.e. in zones bordering agricultural expansion), in ecotourism areas, and in *control* areas where human activities are negligible (i.e. well within the TNR); (iii) the economic returns to land and labour under ecotourism versus traditional activities like agriculture, ranching, logging, etc. and the relationship between these returns and transportation costs; (iv) the factors (e.g. environmental, economic, quality of services and facilities, etc.) that determine both the choice of Tambopata as a destination for ecotourists and the degree of satisfaction having visited the area; and (v) the non-use value of forests used for ecotourism (e.g. carbon storage and sequestration value). In addition, and in light of results, we plan an evaluation of (a) tourism development legislation and governance, with opinions also sought from ecotourism operators and protected area managers, to determine if existing legislation and governance regimes require improvements, and to suggest these where necessary; and (b) appropriate incentive structures that could be used by ecotourism operators and protected area managers in Tambopata to halt or reverse deforestation threats in those areas where the likely net effects on Peruvian society are found to be negative. Finally, we aim to attain these goals by training and incorporating into our research team a number of Peruvian and international volunteer field assistants. These people will help our core team of Peruvian and international biologists, environmental economists and social scientists to collect the necessary data. Project results and recommendations will be communicated at a national level via Spanish-language reports, published articles, lectures at Peruvian institutions (e.g. universities and government organisations) and via at least one radio programme. At the international level, a number of peer-reviewed articles will be prepared for publication in the biodiversity conservation and environmental economics literature. We also plan to take advantage of new media by producing a YouTube video (in both Spanish and English) summarising the project and its findings. All such material will also be made available via the project's website and those of sponsoring organisations.

The History of Fauna Forever Tambopata

Fauna Forever Tambopata (FFT) has been undertaking rigorous monitoring of biodiversity (species richness and population abundance) for multiple taxa at multiple locations in Tambopata since 1997. The original research concept and project (which took place over two years from 1997-1998) was designed and led by one of the authors (CK), with the collaboration and assistance of professional colleagues from the UK, USA and Peru (Kirkby et al. 2000). Subsequent monitoring episodes at the same set of locations, as well as new locations, were undertaken in 2004 and 2005. The underlying aims of the project from 1997-2005 have been (i) to gather information on the population status of large- and medium-sized mammals (terrestrial and arboreal), forest under-storey birds, amphibians and reptiles, at sites which show variation in the intensity of use by ecotourists;

(ii) to identify ecotourism impacts on wildlife where present and to make ecotourism operators and protected area managers aware of these impacts so that they can take the necessary decisions for mitigation; (iii) to train young biologists from Peru and the international community in the techniques and protocols for monitoring rainforest wildlife; and (iv) to disseminate results as widely as possible so as to contribute to the general discussions of the economic value of biodiversity, the costs and benefits of conservation and deforestation, and the status of wildlife populations in the Amazon basin.

The following published articles are based exclusively on data collected by the project since 1997 (Doan 2000, 2003, 2004; Doan & Arizabal-Ariaga 2000; Doan & Arizabal-Arriaga 2002; Lloyd 2000a, b, 2003, 2004, in review), whilst the following books and articles make use of data provided by the project (BirdLife-International 2000; Duellman 2005; INRENA 2005, 2008; IUCN 2007; Kirkby et al. in prep.-a). In addition, to date, more than 60 unpublished project reports (in Spanish and English) (Kirkby et al. 2000) have been distributed within Peru; numerous talks and presentations have been given in both Peru and the UK; and finally one radio programme, produced by a Peruvian radio journalist, summarising the project and its findings to date was aired on local radio in Tambopata in 2005.

Financial and equipment support for FFT in the past has been provided by Albert Reckitt Trust (UK), Anglo-Peruvian Society (UK), Grand Circle Foundation (USA), IdeaWild (USA), Lindeth Charitable Trust (UK), as well as from central funds of the organising institutions TReeS and TReeS-Peru. A total of 62 international volunteer researchers and 34 Peruvian volunteer researchers have been trained in wildlife monitoring techniques by FFT since 1997. All international volunteers contributed funds to the project to cover their in-country costs of participation, whilst all Peruvian volunteers were fully subsidised by the project.

Methods

Deforestation: LANDSAT, ASTER and MODIS satellite imagery of the Tambopata area will be used to generate a time series of georeferenced maps showing land cover categories, including forested and deforested areas for the period 1986-2010. Additional georeferenced information on the boundaries and extent of land use categories (protected areas, ecotourism areas, agricultural lands, timber and Brazil nut concessions, etc.), transport networks (highways, secondary roads and navigable rivers), population centres (towns and villages), lakes and other water bodies, will be used to (i) gauge the extent of deforestation within protected areas, buffer zones, and ecotourism areas; and (ii) with the help of deforestation modelling techniques, as used in the recent past by one of the authors (Kirkby et al. in prep.-a; Kirkby et al. in prep.-b; Kirkby et al. in prep.-c), to determine (confirm) the probabilities of future deforestation events in these areas.

Biodiversity: The same wildlife monitoring techniques implemented in previous monitoring episodes of FFT will be continued, and will be repeated at the same locations as before, with an emphasis on areas of forest used by up to eight lodges. Additional locations will also be added, to include samples of forest areas with a high probability of deforestation over the next 3-5 years. In the case of large- and medium-sized mammals, the techniques include straight-line transects, footprint traps, sampling foraging scrapings, and remote camera traps based on published protocols (Peres 1999; Trolle et al. 2008). In addition, we will begin monitoring dung-beetle populations as part of the mammal studies, based on protocols developed by Larsen and Forsyth (2005), which have been used in the past by one of the authors (Kirkby 2004), and on recommendations by T. Gardner (Gardner et al. 2008). Understorey bird populations will be sampled using point counts and mist-net capture (for ringing and capture-recapture analysis) (Lloyd et al. 1998). The number and composition of mixed species flocks will also be counted along transects as they contribute significantly to forest avifauna diversity in the Neotropics (Powell 1989; Terborgh et al. 1990). Amphibian and reptile (herptile) populations will be sampled using line transects and ad-hoc searches of niche breeding habitats (e.g. seasonal bodies of water and the margins of permanent streams and lakes) (Doan 2003). Each wildlife group will also require the monitoring of a set of habitat/vegetation characteristics (e.g. forest structure, fruiting tree abundance, leaf litter depth, etc.).

Climate: Temperature, precipitation and humidity will be monitored at all locations using electronic gauges. A number of lodges and research stations in the area also collect this data year-round, and will be used to augment our own dataset (ATRIUM 2008). This information will help us control for the effects of annual climate differences when it comes to estimating changes in population abundance of species, particularly amphibians.

Economics and land-use: Information provided by participating lodges and ecotourism operators regarding their annual revenues, costs, profits, labour force and the geographic distribution (local, regional, national, international income and spending) of these variables will be used in conjunction with information on the lands owned, leased and directly used by these lodges (including lands within the TNR) to calculate the economic returns to land and labour from ecotourism activities in Tambopata. Interview and questionnaire data on rural household economics will be collected from rural-based families undertaking agriculture, ranching, timber, and non-timber forest product activities on lands within 10 km of participating lodges, which along with land area information in each case will be used similarly to calculate the economic returns to land and labour from these more traditional economic activities. The managers of the TNR will also provide data on the numbers of tourists that enter the reserve, the areas they use, and the magnitude of revenues obtained from entrance and concession fees. These methodologies will build on the work already undertaken by Kirkby (in prep.-a; in prep.-c), thus increasing the level of robustness and certainty of results, and will act as a means of monitoring the economics of the major land uses in the area. To identify those factors (environmental, economic, lodge service and facilities, etc.) that determine both the choice of Tambopata as a destination for ecotourists and their degree of satisfaction having visited the area, a detailed questionnaire will be administered to a randomly selected set of ecotourists at each participating lodge both shortly after their arrival and shortly before their departure. Importantly, these questionnaires will endeavour to determine whether there is any link between the biodiversity resources around each lodge (e.g. the wildlife species observed) and the satisfaction levels of visitors. To validate these results, a sub-set of tourists will be accompanied by observers to determine which wildlife species were actually observed and to gauge the quality of interpretation received by the lodge-based tour guides. Similar questionnaires (and some interviews) will also target tour conductors (i.e. the representatives of the tour agencies from whom the ecotourists purchased their holiday, who generally accompany groups on their excursions around Peru) and the managers of tour agencies themselves, in order to determine those factors that underpin their choice for doing business with lodges in Tambopata and the relative importance of biodiversity and environmental quality in particular. Interviews with lodge owners and managers will also gauge how sensitive their management policies are to the status of the wildlife species they offer to visiting ecotourists.

Schedule

| | |
|------------------------------------|-----------------------|
| Fundraising | Jul. 2008 – Dec. 2009 |
| Training and team building | Dec. 2008 – May 2009 |
| Preparation of research sites | May 2009 – Jun. 2009 |
| Field research (Phases 1-4) | Jul. 2009 – Jul. 2010 |
| Intermediate reports | Dec. 2009, Jul. 2010 |
| Final reports | Sep. 2010 |
| Radio programme and YouTube videos | Sep. 2010 |
| Talks and presentations | Sep. 2010 – Sep. 2011 |
| Peer reviewed articles published | Jun. 2011 – Jun. 2012 |

Budget

| | UK£ | US\$ |
|--|--------|--------|
| Food and accommodation | 32,600 | 61,900 |
| Remunerations | 20,300 | 38,600 |
| Administration costs in Peru | 5,700 | 10,800 |
| Equipment | 4,800 | 9,100 |
| Training, team building and preparations | 3,100 | 5,900 |
| Reports, seminars, radio programme | 2,000 | 3,800 |

| | | |
|--------------|---------------|----------------|
| Total | 68,500 | 130,100 |
|--------------|---------------|----------------|

| Sources of funds | UK£ | US\$ |
|--|---------------|----------------|
| TReeS-Peru | 1,000 | 1,900 |
| External funding (Charitable orgs, NGOs, etc.) | 15,000 | 28,500 |
| International volunteer contributions | 52,500 | 99,800 |
| Total | 68,500 | 130,200 |

The Coordinating Team

| | |
|---|---------------------------------|
| Project Director and Principal Investigator | Chris Kirkby |
| Project Manager | Adela Griffin |
| Lead Herpetologist | Rowland Griffin |
| Herptile Team Coordinator No. 1 | Name to be confirmed [Peruvian] |
| Mammal Team Coordinator No. 1 | Name to be confirmed [Peruvian] |
| Bird Team Coordinator No. 1 | Name to be confirmed [Peruvian] |

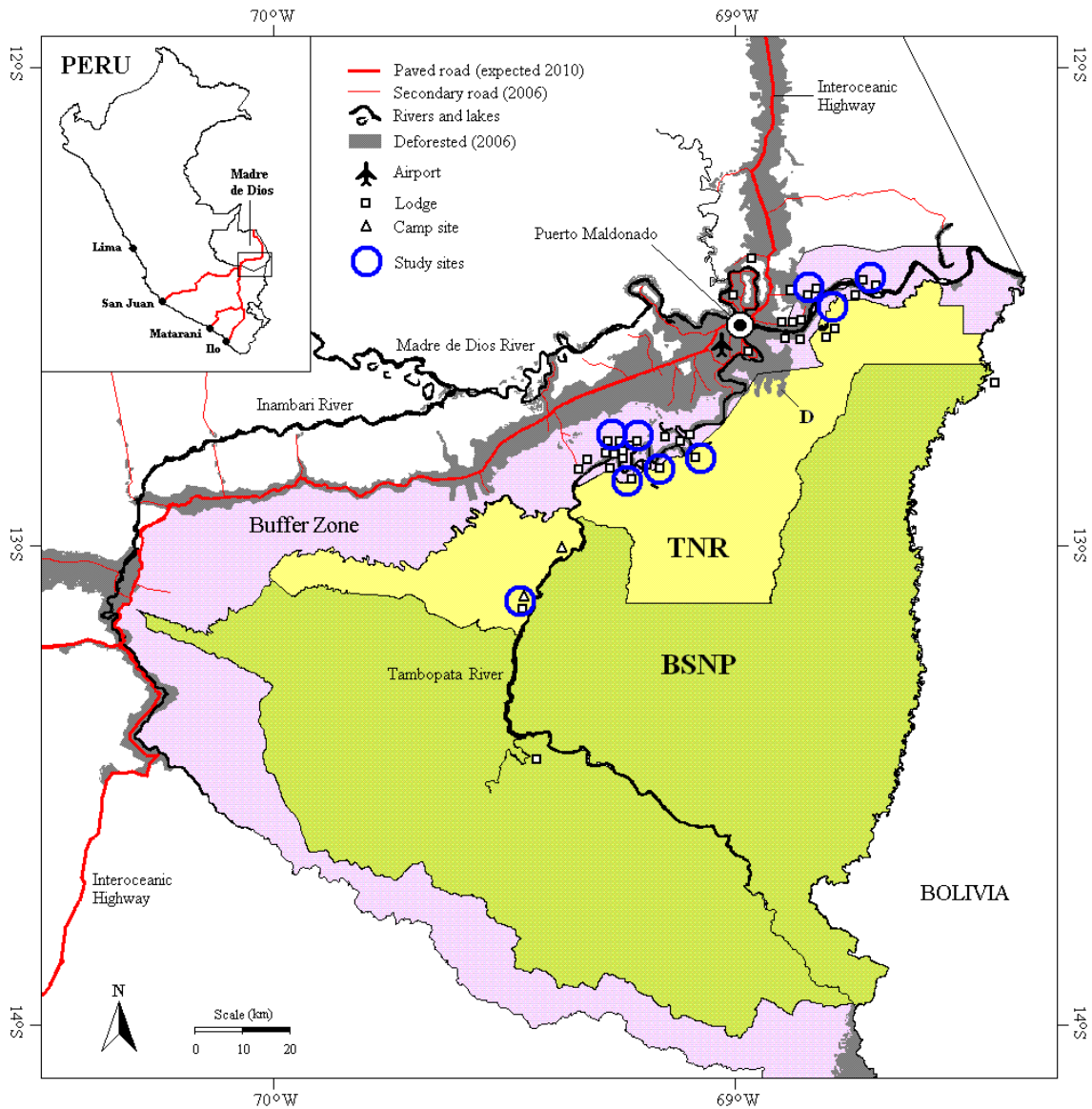


Figure 1. The Tambopata area showing the location of ecotourism lodges (squares), the Tambopata National Reserve, Bahuaaja Sonene National Park, the Buffer Zone, the Interoceanic Highway (thick red line), secondary roads (thin red lines), and deforestation up to 2006 (grey area). 'D' denotes deforestation within the TNR.



Figure 2. The Vilcabamba-Amboró Conservation Corridor and the route of the Interoceanic Highway that will bisect it. Protected areas (green): 1, Ashaninka Comunal Reserve; 2, Otishi National Park; 3, Matsigenka Comunal Reserve; 4, Machupicchu Sanctuary; 5, Megantoni Reserved Zone; 6, Manu National Park; 7, Alto Purus National Park; 8, State Reserve for Isolated Indigenous Peoples; 9, Los Amigos Conservation Concession; 10, Amarakaeri Comunal Reserve; 11, Tambopata National Reserve; 12, Bahuaja Sonene National Park; 13, Madidi National Park; 14, Apolobamba Biosphere Reserve; 15, Pílon Lajas, Biosphere Reserve; 16, Cotapata National Park; 17, Isiboro Secure National Park; 18, Carrasco National Park; 19, Amboró National Park. Buffer zones (yellow).

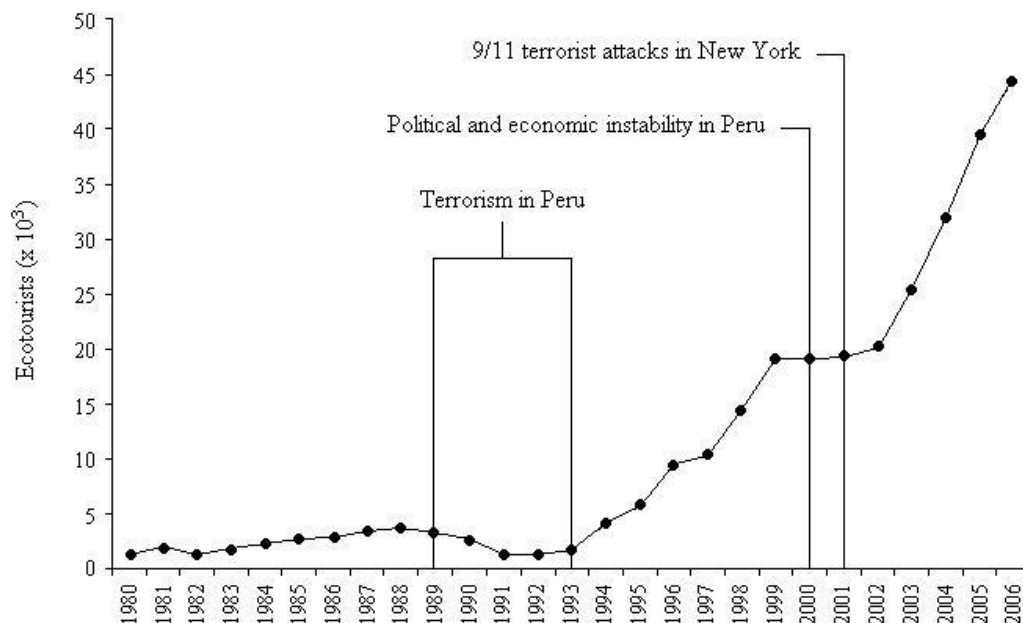


Figure 3. Growth in the number of ecotourist visitors to Tambopata between 1980-2006, from Kirkby et al. (in prep.-a).

References

- Ananthaswamy, A. 2004. Massive growth of ecotourism worries biologists. *New Scientist*, London.
- ATRIUM. 2008. Biodiversity Information System: Weather Stations. Andes to Amazon Biodiversity Program. Botanical Research Institute of Texas. Available from <http://atrium.andesamazon.org> (Accessed September 2008).
- Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner. 2002. Economic Reasons for Conserving Wild Nature. *Science* **297**:950-953.
- BirdLife-International 2000. Threatened birds of the World. .
- Brienen, R. J. W., and P. A. Zuidema. 2006. Lifetime growth patterns and ages of Bolivian rain forest trees obtained by tree ring analysis. *Journal of Ecology* **94**:481-493.
- Coghlan, A. 2008. Ecotourists scare away endangered wildlife. *New Scientist*, London.
- Costanza, R., R. d'Arge, R. d. Groot, S. Farberk, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R. V. O'Neill, J. Paruelo, R. G. Raskin, P. Suttonkk, and M. v. d. Belt. 1997. The value of the world's ecosystem services and natural capital. *Nature* **387**:253-260.
- Daily, G. 1997. *Nature's services : societal dependence on natural ecosystems*. Island Press, Washington DC.
- Danielsen, F., N. D. Burgess, and A. Balmford. 2005. Monitoring matters: examining the potential of locally-based approaches. *Biodiversity and Conservation* **14**:2507-2542.
- Danielsen, F., M. M. Mendoza, P. Alviola, D. S. Balete, M. Enghoff, M. K. Poulsen, and A. E. Jensen. 2003. Biodiversity monitoring in developing countries: what are we trying to achieve? *Oryx* **37**:407-409.
- Doan, T. M. 2000. The Effects of Ecotourism in Developing Nations: An Analysis of Case Studies. *Journal of Sustainable Tourism* **8**:288-304.
- Doan, T. M. 2003. Which Methods Are Most Effective for Surveying Rain Forest Herpetofauna? *Journal of Herpetology* **37**:72-81.
- Doan, T. M. 2004. Extreme weather events and the vertical microhabitat of rain forest anurans. *Journal of Herpetology* **38**:422-425.
- Doan, T. M., and W. Arizabal-Ariaga. 2000. New Herpetological Records for the Tambopata Province, Department of Madre de Dios, Perú. *Herpetological Review* **31**:188-189.

- Doan, T. M., and W. Arizabal-Arriaga. 2002. Microgeographic Variation in Species Composition of the Herpetofaunal Communities of Tambopata Region, Peru. *Biotropica* **34**:101-117.
- Dourojeanni, M. J. 2006. Estudio de caso sobre la carretera Interoceánica en la Amazonía sur del Perú. Bank Information Center, Washington D.C.
- Duellman, W. E. 2005. Cusco Amazónico: The Lives of Amphibians and Reptiles in an Amazonian Rainforest.
- Ferraz, G., C. E. Marinelli, and T. E. Lovejoy. 2008. Biological Monitoring in the Amazon: Recent Progress and Future Needs. *Biotropica* **40**:7-10.
- Fisher, B., and R. K. Turner. 2008. Ecosystem services: Classification for valuation. *Biological Conservation*.
- Fisher, B., K. Turner, M. Zylstra, R. Brouwer, R. Costanza, R. d. Groot, S. Farber, P. Ferraro, R. Green, D. Hadley, J. Harlow, P. Jefferiss, C. Kirkby, P. Morling, S. Mowatt, R. Naidoo, J. Paavola, B. Strassburg, D. Yu, and A. Balmford. in press. Integrating Ecosystem Services and Economic Theory: what can we do, what should we do, and what has been done? *Ecological Applications*.
- Foster, R. B., T. A. P. III, A. H. Gentry, L. H. Emmons, A. Chicchon, T. Schulenberg, L. Rodriguez, G. Lamas, H. Ortega, J. Icochea, W. Wust, M. Romo, J. A. Castillo, C. Reynel, A. Kratter, P. K. Donahue, and L. j. Barkley. 1994. Rapid Assessment of Biodiversity in South-Eastern Peru. Page 184. Rapid Assessment Program Working Paper. Conservation International, Washington D.C.
- Gardner, T. A., J. Barlow, I. S. Araujo, T. C. Avila-Pires, A. B. Bonaldo, J. E. Costa, M. C. Esposito, L. V. Ferreira, J. Hawes, M. I. M. Hernandez, M. S. Hoogmoed, R. N. Leite, N. F. Lo-Man-Hung, J. R. Malcolm, M. B. Martins, L. A. M. Mestre, R. Miranda-Santos, W. L. Overal, L. Parry, S. L. Peters, M. A. Ribeiro-Junior, M. N. F. d. Silva, C. d. S. Motta, and C. A. Peres. 2008. The cost-effectiveness of biodiversity surveys in tropical forests. *Ecology Letters* **11**:139-150.
- Hodgkinson, C. 2002. The Impact of Tourist Group Size and Trail-Use Frequency on Neotropical Primate Behaviour in Tambopata, Peru. MSc. Thesis, Division of Biology, Imperial College, London.
- Hooper, D. U., F. S. Chapin III, J. J. Ewel, A. Hector, P. Inchausti, S. Lavorel, J. H. Lawton, D. M. Lodge, M. Loreau, S. Naeem, B. Schmid, H. Setälä, A. J. Symstad, J. Vandermeer, and D. A. Wardle. 2005. Effects of biodiversity on ecosystem functioning: a consensus of current knowledge. *Ecological Monographs* **75**:3-35.
- INRENA 2005. Plan Maestro de la Reserva Nacional Tambopata. Lima, Peru. Instituto Nacional de Recursos Naturales, Lima.
- INRENA 2008. Plan de Uso Turístico de la Reserva Nacional Tambopata. Instituto Nacional de Recursos Naturales, Lima.
- IUCN. 2007. Threat status of the Blue-headed macaw (*Primolius couloni*). Red List of Threatened Species.
- Kirkby, C. 2004. Manual Metodológico para el Monitoreo Ambiental y Socioeconómico de la Reserva de Biosfera del Manu. ProManu, Cusco, Peru.
- Kirkby, C., B. Day, K. Turner, B. S. Soares-Filho, H. Oliveira, and D. W. Yu. in prep.-a. Closing the ecotourism-conservation loop in the Peruvian Amazon.
- Kirkby, C., T. M. Doan, H. Lloyd, A. Cornejo-Farfán, W. Arizabal-Arriaga, and A. Palomino-Marín. 2000. Tourism Development and the Status of Neotropical Lowland Wildlife in Tambopata, South-eastern Peru: Recommendations for Tourism and Conservation. Tambopata Reserve Society, Puerto Maldonado.
- Kirkby, C., R. Giudice, B. Day, K. Turner, B. S. Soares-Filho, H. Oliveira, and D. W. Yu. in prep.-b. Past and future road-mediated deforestation in Tambopata, Amazonian Peru.
- Kirkby, C., R. Giudice, B. Day, K. Turner, and D. W. Yu. in prep.-c. The economic benefits of ecotourism and conservation in Amazonian Peru outweigh the costs.
- Kirkby, C., A. Lee, and R. Giudice. in prep.-d. Changes in ecotourism development and wildlife population abundance in the rainforests of south-eastern Peru.
- Larsen, T. H., and A. Forsyth. 2005. Trap spacing and transect design for dung beetle biodiversity studies. *Biotropica* **37**:322-325.
- Lloyd, H. 2000a. Nesting behaviour of the Rufous-headed Woodpecker *Celeus spectabilis*. *Bulletin of the British Ornithologists Club* **120**:129-133.
- Lloyd, H. 2000b. Population densities of the Black-faced Cotinga (*Conioptilon mcilhennyi*) in southeast Perú. *Bird Conservation International* **10**:277-285.

- Lloyd, H. 2003. Population densities of some nocturnal raptors (Strigidae) in southeast Perú. *Journal of Field Ornithology* **74**:376-380.
- Lloyd, H. 2004. Habitat and population estimates of some threatened lowland bird species in Tambopata, southeast Perú. *Bird Conservation International* **14**:261-277.
- Lloyd, H. in review. Regional patterns of diversity, abundance and habitat selection by Amazonian birds. *Journal of Tropical Ecology*.
- Lloyd, H., A. J. Cahill, M. Jones, and S. J. Marsden. 1998. Estimating bird densities using distance sampling. in C. Bibby, M. Jones, and S. Marsden, editors. *Expedition Field Techniques: Bird Surveys*. Expedition Advisory Centre, London.
- Loreau, M., S. Naeem, P. Inchausti, J. Bengtsson, J. P. Grime, A. Hector, D. U. Hooper, M. A. Huston, D. Raffaelli, B. Schmid, D. Tilman, and D. A. Wardle. 2001. Biodiversity and Ecosystem Functioning: Current Knowledge and Future Challenges. *Science* **294**:804-808.
- MEA 2005. *Millennium Ecosystem Assessment*. Island Press, Washington DC.
- Mullan, K., and A. Kontoleon. 2008. Benefits and costs of forest biodiversity: Economic theory and case evidence. Department of Land Economy, University of Cambridge, Cambridge.
- Myers, N., R. A. Mittermeir, C. G. Mittermeir, G. A. B. d. Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. *Nature* **403**:853-858.
- Naeem, S. 2008. Advancing realism in biodiversity research. *Trends in Ecology and Evolution* **23**:414-416.
- Naeem, S., and S. Li. 1997. Biodiversity enhances ecosystem reliability. *Nature* **390**:507-509.
- Naeem, S., L. J. Thompson, S. P. Lawler, J. H. Lawton, and R. M. Woodfin. 1994. Declining biodiversity can alter the performance of ecosystems. *Nature* **368**:734-737.
- Oliveira, P. J. C., G. P. Asner, D. E. Knapp, A. Almeyda, R. Galván-Gildemeister, S. Keene, R. F. Raybin, and R. C. Smith. 2007. Land-Use Allocation Protects the Peruvian Amazon. *Science* **317**:1233-1236.
- ONERN. 1972. *Inventario, evaluación e integración de los recursos naturales de la Zona de los Ríos Inambari y Madre de Dios*. Oficina Nacional de Evaluación de Recursos Naturales, Lima.
- Peres, C. A. 1999. General guidelines for standardising line-transect surveys of tropical forest primates.
- Peters, C. M., A. H. Gentry, and R. O. Mendelsohn. 1989. Valuation of an Amazonian Rainforest. *Nature* **339**:655-656.
- Pitman, N., M. d. C. Loyola-Azaldegui, K. Salas, G. T. Vigo, and D. A. Lutz. 2006. Written Accounts of an Amazonian Landscape Over the Last 450 Years. *Conservation Biology* **21**:253-262.
- Powell, G. V. N. 1989. On the possible contribution of mixed species flocks to species richness in neotropical avifaunas. *Behavioural Ecology and Sociobiology* **24**:387-393.
- Reed, S. E., and A. M. Merenlender. 2008. Quiet, Nonconsumptive Recreation Reduces Protected Area Effectiveness. *Conservation Letters*:1-9.
- Schenck, C., J. Groenendijk, F. Hajek, E. Staib, and K. Frank. 2003. Giant otters in the Peruvian rainforest: Linking theory with practice in J. A. Bissonette, and I. Storch, editors. *Landscape Ecology and Resource Management*. Island Press, Washington DC.
- Silvertown, J. 2004. Sustainability in a nutshell. *Trends in Ecology and Evolution* **19**:276-278.
- Soares-Filho, B., D. Nepstad, L. Curran, G. Cerqueira, R. Garcia, C. Ramos, E. Voll, A. McDonald, P. Lefebvre, and P. Schlesinger. 2006. Modelling conservation in the Amazon Basin. *Nature* **440**:520-523.
- Stewart, P. D. 1988. Tambopata Reserve Zone, south-east Peru. *Oryx* **22**:95-99.
- Sukhdev, P. 2008. *The economics of ecosystems and biodiversity*. Banson Production, Cambridge.
- Terborgh, J., S. K. Robinson, T. A. P. III, C. A. Munn, and N. Pierpont. 1990. Structure and Organization of an Amazonian Forest Bird Community. *Ecological Monographs* **60**:213-238.
- Torre, S. d. I., C. T. Snowdon, and M. Bejarano. 2000. Effects of human activities on wild pygmy marmosets in Ecuadorian Amazonia. *Biological Conservation* **94**:153-163.
- Trolle, M., A. J. Noss, J. L. P. Cordeiro, and L. F. B. Oliveira. 2008. Brazilian Tapir Density in the Pantanal: A Comparison of Systematic Camera-Trapping and Line-Transect Surveys. *Biotropica* **40**:211-217.
- Turner, R. K., and G. Daily. 2008. The Ecosystem Services Framework and Natural Capital Conservation. *Environmental & Resource Economics* **39**:25-35.

Appendix 1: Further information about the study area

Protected areas

The protected areas at the centre of this proposal are the Tambopata National Reserve (TNR), created in 2001 with an area of 274,690 hectares, and the Bahuaja Sonene National Park (BSNP), first created in 1996 and subsequently extended in 2001 with a current area of 1.09 million hectares (Fig. 1). Both protected areas supersede the Tambopata Candamo Reserved Zone (TCRZ), created in 1990, which in turn superseded the Tambopata Reserve Zone (TRZ), which was created in 1979 (Stewart 1988). Both the TNR and BSNP derive their names from the Tambopata River which the local native Ese'ejá people call Bahuaja. This river is born high up in the Andes in the Sandia region of Puno and subsequently flows northwards into the Madre de Dios River at Puerto Maldonado. The Madre de Dios river flows east into the Beni river, which in turn flows into the Madeira river which is the principle tributary of the Amazon river.

Biodiversity and endangered species

Biodiversity inventories undertaken in Tambopata since 1979 have provided ample evidence that this area is arguably the most diverse corner of the Amazon basin. Puerto Maldonado was officially recognised by the Peruvian government as the Biodiversity Capital of the nation in 1994. Tambopata is home to approximately 7% of the world's bird species (~600) and 4% of the world's mammal species (~160). It is thought that the high levels of biodiversity observed are the result of the fact that Tambopata lies in a transitional zone between humid tropical and subtropical rainforest (ONERN 1972); the altitudinal gradient from north to south varies from 200 m to 2,000 m; precipitation varies considerably from year to year (mean 2,400 mm ± 600); rapid changes in temperature are common during the dry season (April-October), with a minimum of 8 °C to a maximum of 34 °C and a mean of 24 °C; and island savannah ecosystems and palm swamps are present to the east (known as the Pampas del Heath).

Tambopata is home to 16 vertebrates listed in the IUCN Red List of Threatened Species: (1) Giant anteater (*Myrmecophaga tridactyla*), (2) Giant armadillo (*Priodontes maximus*), (3) Bush dog (*Speothus venaticus*), (4) Small-eared dog (*Atelocynus microtis*), (5) Pampas deer (*Blastocercus dichotomus*); (6) Maned wolf (*Chrysocyon brachyurus*); (7) Giant river otter (*Pteronura brasiliensis*), (8) Jaguarundi (*Herpailurus yaguarundi*), (9) Ocelot (*Leopardus pardalis*), (10) Jaguar (*Panthera onca*), (11) Spectacled bear (*Tremarctos ornatus*), (12) Crested eagle (*Morphous guianensis*), (13) Harpy eagle (*Harpia harpyja*), (14) Black caiman (*Melanosuchus niger*), (15) Spectacled caiman (*Caiman crocodilus*), and (16) Yellow-spotted side-necked turtle (*Podocnemis unifilis*).

Some of the participating ecotourism lodges

EXPLORERS' INN (EI)

This lodge is located on the southern bank of the Tambopata River (12°50'15''S, 69°17'30''W) at the confluence with the La Torre River at a distance of 30 km SSW of Puerto Maldonado. The EI was built and began operating in 1975. It was the first ecotourism venture to operate along the Tambopata River at the time. In 1977, the Peruvian government granted private protected area status to 5.5 km² of rainforest around the lodge which became known as the Tambopata Reserve Zone (Stewart 1988). Through its Resident Naturalist Program, which offered free room and board to graduate biologists in exchange for guiding guests, the EI has been very successful in combining tourism with research. Investigations undertaken in the late 1970s and early 1980s found that this area is unique and harbours high levels of species richness. The total length of the trail system habitually used by tourists at this lodge is 40 km, and is the oldest and most extensive in the area. A total of nine distinct forest types can be clearly recognised around this lodge.

RESERVA AMAZONICA (RA)

This lodge is located on the northern bank of the Madre de Dios River (12°32'30''S, 69°03'20''W) at a distance of 15 km ENE of Puerto Maldonado. The RA was built and began operating in 1976, shortly after the EI. It was the first tourist lodge to be built along the Madre de Dios River. As in the case of EI, in 1977 the government approved the establishment of a private reserve around the lodge totalling 10 km². The status of the reserve prohibited the extraction or conversion of natural resources by the local inhabitants. However, in the late 1980s the government failed to renew the reserve status and subsequently previously forested lands close to the lodge were colonised by subsistence farmers and much riverine forest was converted to agriculture. Scientific research of mammals, birds, herpetofauna and plants was also undertaken periodically (Duellman 2005). Such research, complementary to that undertaken at the EI, further reaffirmed the biodiversity importance of the Tambopata area and was cited as one of the reasons for establishing the TCRZ. The tourist trail system around the lodge is 10 km long, and is the least extensive in the area. The lodge recently built a canopy walkway so that visitors could access the tree tops where most of the forest's fauna actually lives.

SACHAVACAYOC CENTRE (SACHA)

The Sachavacayoc Centre is located on the southern bank of the Tambopata River (12°51'15''S, 69°22'00''W) at a distance of 35 km SSW of Puerto Maldonado. It was constructed in 1994 by Newton College, an private international school in Lima, as a centre for conservation and education. The Centre caters mainly for student groups from all over the world, who stay for 7-14 days, although normal tourists also use the facilities on occasions. The forest is accessed via a network of trails totalling 18 km. Other lodges including Caiman Lodge and Libertador Tambopata Lodge also use these trails to access the Sachavacayoc Lake, an oxbow lake.

TAMBOPATA RESEARCH CENTER (TRC)

This lodge is located on the western bank of the Tambopata River (13°08'10''S, 69°36'40''W) at a distance of 75 km SSW of Puerto Maldonado in an isolated area of the TNR bordering the BSNP. It was constructed in 1989, within 200m of a macaw clay lick. Initial activities at this time were dedicated to macaw research, although as of 1994 the principle activity switched to ecotourism. A significant amount of research has been undertaken at this site over the last 20 years and comprehensive inventories of some taxa have been undertaken. The trail system is 20 km long. No permanent settlements exist within 40 km of this lodge and hunting pressure is nil.

Appendix 2: About the authors

Chris Kirkby

Project Director

Personal Information

Nationality: British
Date of birth: 09 February 1972
Marital status (children): Married (1)
E-mail: chris_kirkby@yahoo.com
Home page: www.geocities.com/chris_kirkby

Education

(current) PhD candidate. The University of East Anglia, UK (2005-08).
Masters of Research (MRes) with Distinction in Ecology & Environmental Management, The University of York, UK (2001).
Bachelor of Science (BSc) with Honours in Ecological Science (2:1), The University of Edinburgh, UK (1994).
International Baccalaureate Diploma, 36/45 points, St. Clare's Oxford, UK. (1990).

Professional and Research Experience

Jan. 2002 – Present Member of the Board of Directors of TReeS-Peru, a Peruvian not-for-profit organisation, based in Puerto Maldonado, that works towards tropical rainforest conservation and appropriate management of natural resources in the Peruvian Amazon by providing technical and financial assistance for: rural community-led projects, scientific investigation, environmental education and training initiatives. Voluntary un-remunerated position.

Jun. 1996 – Present Director and Principal Investigator of Fauna Forever (FF) programmes, which are designed to train young environmental scientists from Peru and around the World in wildlife and biodiversity assessment techniques and to contribute personnel and funding to long-term environmental monitoring programmes and impact assessments in Peru. To date Fauna Forever programmes have operated in the Tambopata (FFT) and Manu (FFM) areas in south-east Peru. To date FF programmes have been supported by TReeS, TReeS-Peru and CREES.

Mar. 2008 Consultant to Oxford Analytica (Washington D.C. office) on issues concerning ecosystem services and environmental valuation in Latin America.

Apr. 2007 – Sep. 2007 Member of the Technical Advisory Committee of the Tourism Management Plan for the Tambopata National Reserve in Madre de Dios, Peru. Responsible for providing opinion and data on tourism, economic and environmental topics related to the plan.

Sep. 2003 – Dec. 2005 Field Studies Director and Resident Naturalist Coordinator for the Explorer's Inn, an ecotourist lodge and research station located in the Tambopata National Reserve in south-east Peru. Responsible for liaising with and orientation of visiting field researchers and volunteer Resident Naturalists, and supervision of field research projects.

- May. 2005 – Sep. 2005
 Consultant to the Native Federation of Madre de Dios (FENAMAD). Responsible for evaluating the tourism potential of the Amarakaeri Comunal Reserve and adjacent lands in Madre de Dios, Peru. Financed jointly by the United Nations Development Program (UNDP) and the Global Environment Facility (GEF).
- Sep. 2004 – Sep. 2005
 Consultant to the Rainforest Education and Resource Centre (CREES), a Peruvian not-for-profit organisation, based in Cusco, that designs, develops and implements education and research programmes that promote improved sustainable natural resource management practices and co-operative conservation strategies in tropical environments, with an emphasis on the Manu Biosphere Reserve in Madre de Dios, Peru. Responsible for assisting in the design and management of environmental projects and associated fundraising activities.
- May 2003 – Sep. 2005
 Member of the Technical Advisory Committee (Monitoring Division) of the Bahuaja Sonene National Park and Tambopata National Reserve, two protected areas located in Madre de Dios, Peru. Responsible for providing opinion on environmental and socio-economic monitoring plans proposed by the government administrators of these areas (INRENA).
- Oct. 1999 – Sep. 2005
 Committee Member of the Tambopata Reserve Society (TReeS), a not-for-profit organisation and UK Charity (No. 298054) that works towards tropical rainforest conservation and appropriate natural resource management in the Peruvian Amazon by providing technical and financial assistance for rural community-led projects, scientific investigation, environmental education and training initiatives. Voluntary unremunerated position.
- Mar. 2003 – Sep. 2004
 Consultant to Pro-Manu, a not-for-profit organisation set up as a bilateral agreement between the Peruvian Government and the European Union. Responsible for leading and implementing the Environmental and Socio-economic Monitoring Programme of the Manu Biosphere Reserve, Peru. Major aims included identifying environmental and socio-economic indicators and designing appropriate field protocols for each, training local field assistants, developing a database and Geographic Information System in which to store and visualise data.
- Nov. 2003 – Sep. 2004
 General Manager of Gone Wild Peru SAC, a small company based in Puerto Maldonado in south-east Peru dedicated to the management and export of tropical ornamental fish and ornamental plants.
- Jan. 2003 – Feb. 2004
 Tropical Ecology Instructor on ecotourism guide training courses, on various occasions, organised by Rainforest Expeditions and Inkaterra, two renowned Peruvian tourism operators with lodges located in the Tambopata area, south-east Peru.
- Jan. 2003 – Apr. 2003
 Consultant to the National Institute of Natural Resources (INRENA), Conservation International Peru and ProNaturaleza. Responsible for evaluating the tourism potential of the upper Tambopata river valley and the route connecting the city of Puno with the Bahuaja Sonene National Park. The principle aim of the study was to determine whether tourism was a viable alternative activity for the local population, a percentage of who grow and commercialise coca.

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| Sep. 2002 – Nov. 2002 | Consultant to Pro-Manu in an evaluation of the status of wildlife populations around Salvación and Aguanos in the Manu Biosphere Reserve. Responsible for analysing the abundance of large mammal species, identifying potential tourist attractions, designing appropriate tourist routes and providing recommendations to encourage participation of local peoples in the ecotourism industry as an alternative use of local wildlife. |
| Feb. 2002 – Jun. 2002 | Consultant to the Peru Program of World Wide Fund for Nature (WWF-OPP) and INRENA in a study of ecotourism standards, a new tourism entrance fee system for the Tambopata National Reserve and Bahuaja Sonene National Park, and an evaluation of the economic impact of tourism in the tourism gateway town of Puerto Maldonado, Madre de Dios, Peru. |
| Jun. 2001 – Sep. 2001 | Principal Investigator in a study of the distribution and abundance of <i>Guadua cf. angustifolia</i> , Bambuseae, a potential non-wood forest product in Madre de Dios, Peru. A study undertaken in the Los Amigos Conservation Concession in fulfilment of a Master of Research thesis. Research part-funded by the University of York and the Amazon Conservation Association (ACA). |
| May 2001 – Jun. 2001 | Consultant to Proyecto Castañales (of ACA), to identify faunal indicator species of Brazil-nut (<i>Bertholletia excelsa</i>) dominated forests in Madre de Dios, Peru. The results of this study subsequently formed part of a successful forest certification proposal accepted by the Forest Stewardship Council (FSC). Position funded by ACA. |
| Jun. 2000 – Sep. 2000 | Assistant Project Officer for NPI Red Alert North West, based at the Cumbria Wildlife Trust (CWT), Brockhole, Windermere, UK. Responsible for various duties associated with Red squirrel (<i>Sciurus vulgaris</i>) conservation initiatives and environmental education in Cumbria in NW England., UK |

Skills

| | |
|--------------------------|---|
| Information Technology | Excellent knowledge of Windows XP, MS Office XP, SPSS, JMP, GPOWER, DISTANCE, TRANSECT, CAPTURE, ESTIMATES, AcView, ArcGIS. |
| GPS | Good knowledge of Garmin and Magellan hardware. |
| Bird capture and ringing | Completed a field course directed by the Centre for Conservation Biology (Stanford University). Experience: ~300 net-hours. |
| Tree climbing | Good knowledge of rope techniques for accessing tree canopies. |
| Remote photography | Good knowledge of Trail Master and Trail Scan remote photography systems used for monitoring nocturnal wildlife. |
| Driving | Full UK driving licence since 1989 |
| Languages | English (fluent), Spanish (fluent), Portuguese (basic), French (basic), Swahili (basic). |

Workshops Taught and Selected Presentations Given

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| 2008 | Ecotourism finances biodiversity protection in the Peruvian Amazon. At: Society for Conservation Biology annual meeting (Chattanooga, USA). |
| 2008 | Ecotourism finances biodiversity protection in the Peruvian Amazon. At: Student Conference of Conservation Science, University of Cambridge (Cambridge, UK). |
| 2005 | Monitoring biodiversity and environmental health indicators in the Manu Biosphere Reserve. At: Manu Learning Centre (Manu, Peru). |
| 2004 | Environmental and socio-economic monitoring in the Manu Biosphere Reserve, results of an 18-month investigation and prospects for the future. At: Pro-Manu (Cusco, Peru). |

- 2003 Field methodologies and analytical techniques for monitoring abundance and diversity of rainforest mammal populations. At: Manu Learning Centre (Manu, Peru).
- 2003 The economic impact of tourism in Puerto Maldonado. At: Apaktone (Puerto Maldonado, Peru). Tour guide course. At: Rainforest Expeditions and Inkaterra (Tambopata, Peru).
- 2002 The diversity and conservation of fauna in Madre de Dios. At: The Amazon University of Madre de Dios (Puerto Maldonado, Peru).
- 2002 Ecotourism standards for the protected areas of Tambopata. At: Apaktone (Puerto Maldonado, Peru).
- 2001 The distribution, abundance, and prospects for future management of Marona (*Guadua cf. angustifolia*) bamboo in the Los Amigos watershed. At: The Amazon University of Madre de Dios (Puerto Maldonado, Peru); The University of Cusco (Cusco, Peru); The University of York (York, UK).
- 2000 The impact of tourism on wildlife populations in Tambopata, Madre de Dios, Peru. At: INRENA (Puerto Maldonado, Peru); Durrell Institute of Conservation Ecology (Canterbury, UK); The Royal Geographical Society (London, UK); The Tambopata Reserve Society (Oxford, UK); The University of Edinburgh (Edinburgh, UK); The University of the West of England (Bristol, UK).
- 1999 The future of tourism in the Tambopata Candamo Reserved Zone and Bahuaja Sonene National Park. At: INRENA (Puerto Maldonado, Peru).

Publications and Reports

- Kirkby, C.A., R. Giudice, B. Day, K. Turner, B. S. Soares-Filho, H. Oliveira, and D. W. Yu. (in prep.)** Closing the ecotourism-conservation loop in the Peruvian Amazon.
- Kirkby, C.A., R. Giudice, B. Day, K. Turner, B. S. Soares-Filho, H. Oliveira, and D. W. Yu. (in prep.)** Past and future road-mediated deforestation in Tambopata, Amazonian Peru.
- Kirkby, C.A., R. Giudice, B. Day, K. Turner, and D. W. Yu. (in prep.)** The economic benefits of ecotourism and conservation in Amazonian Peru outweigh the costs.
- Hodgkinson, C., **Kirkby, C.A.** & E.J. Milner-Gulland (**in prep.**) The Impact of Tourist Group Size and Trail-Use Frequency on Neotropical Primate Behaviour in Tambopata, Peru.
- Fisher, B., K. Turner, M. Zylstra, R. Brouwer, R. Costanza, R. d. Groot, S. Farber, P. Ferraro, R. Green, D. Hadley, J. Harlow, P. Jefferiss, **C. Kirkby**, P. Morling, S. Mowatt, R. Naidoo, J. Paavola, B. Strassburg, D. Yu, and A. Balmford. (**in press**) Integrating Ecosystem Services and Economic Theory: what can we do, what should we do, and what has been done? Ecological Applications.
- Ohl-Schacherer, J., E. Mannigel, **C. Kirkby**, G. Shepard-Jr., and D. W. Yu. (**2008**) Indigenous ecotourism in the Amazon: a case study of 'Casa Matsigenka' in Manu National Park, Peru. *Environmental Conservation* 35:14-25.
- Kirkby, C.A. (2005)** El potencial turístico de la Reserva Comunal Amarakaeri y tierras indígenas aledañas. FENAMAD, Puerto Maldonado.
- Kirkby, C.A. (2004a)** Manual Metodológico para el Monitoreo Ambiental y Socioeconómico de la Reserva de Biosfera del Manu. Pro-Manu, Cusco.
- Kirkby, C.A. (2004b)** Implementación del Plan de Monitoreo de la Reserva de Biosfera del Manu. Pro-Manu, Cusco. Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. & M. Fernandez (2003)** Evaluación del estado poblacional de la fauna silvestre y el potencial turístico en los bosques de Salvación y Yunguyo, Reserva de Biosfera del Manu, Madre de Dios, Peru. Pro-Manu, Cusco.
Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. (2002a)** Estándares Ecoturísticos para la Reserva Nacional Tambopata, el Parque Nacional Bahuaja Sonene, y sus Zonas de Amortiguamiento, Madre de Dios, Peru. WWF-Peru/INRENA, Lima. Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. (2002b)** Análisis Inicial del Impacto Económico del Turismo en Puerto Maldonado y Periferia, Madre de Dios, Peru. WWF-Peru/INRENA, Lima.
- Kirkby, C.A. (2002c)** Optimización de la Tarifa de Entrada para la Reserva Nacional Tambopata y el Parque Nacional Bahuaja Sonene, Madre de Dios, Peru. WWF-Peru/INRENA, Lima. Link: http://geocities.com/chris_kirkby/publicaciones.htm

- Kirkby, C.A. (2001a)** The distribution, abundance, clump characteristics and techniques for managing *Guadua cf. angustifolia*, Bambuseae, a potential non-wood forest product, in Madre de Dios, Peru. Masters thesis, The University of York.
Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. (2001b)** Responses of individual *Arabidopsis thaliana* plants to changes in the number and spatial distribution of conspecific neighbours. The University of York.
Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. (2001c)** Estimation of home range, core area, and habitat utilisation of urban foxes (*Vulpes vulpes*) using a fixed kernel technique in a GIS environment. The University of York. Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A., Doan, T.M., Lloyd, H., Cornejo, A., Arizabal, W. & A. Palomino (2000)** A study of tourism development and the population status of Neotropical lowland rainforest wildlife in Tambopata, south-eastern Peru: Recommendations for tourism and conservation. Tambopata Reserve Society, London.
Link: http://geocities.com/chris_kirkby/publicaciones.htm
- Kirkby, C.A. (1999)** An evaluation of the impacts of Brazil-nut (*Bertholletia excelsa*) harvesting on large mammal populations in the Tambopata Candamo Reserved Zone, Madre de Dios, Peru. Amazon Conservation Association, Puerto Maldonado.
- Kirkby, C.A. & P. Padilla (1998a)** An evaluation of the population and management of *Tayassu tajacu* and *T. pecari* in Madre de Dios, Peru. INRENA/CITES, Lima.
- Kirkby, C.A. & P. Padilla (1998b)** Management of export quotas for *Tayassu tajacu* and *T. pecari* in the Peruvian Amazon. INRENA/CITES, Lima.
- Kirkby, C.A. (1996)** The Tambopata Jungle Lodge: A guide to the rainforests of Tambopata, Madre de Dios, Peru. Peruvian Andean Treks, Cusco.

References

1. **Alfredo García Altamirano**, TReeS-Peru, Jr. Lambayeque 438, Puerto Maldonado, Madre de Dios, Peru. E-mail: amgarcia@iiap.org.pe
2. **Douglas Yu**, School of School of Biological Sciences, Univeristy of East Anglia, Norwich NR4 7TJ, UK. E-mail: douglas.yu@uea.ac.uk
3. **Max Gunther**, Peruvian Safaris, Alcanfores 459, Miraflores, Lima 18, P.O.Box 10088, Lima, Peru. E-mail: safaris@amauta.rcp.net.pe
4. **Ernesto Raez**, Interoceanica Working Group, Av. Malecón de la Reserva 281, Miraflores, Lima 18, Peru. E-mail: eraezluna@yahoo.com

Adela Griffin (nee Hepworth)

Project Manager

Personal Information

Nationality: British
Date of birth: 21 May 1972
Marital status: Married
E-mail: adela_griffin@yahoo.com

Education

Environmental Control and Public Health (T210). The Open University, UK (2005).
Masters of Research (MRes) in Ecology & Environmental Management, The University of York, UK (2001).
Bachelor of Science (BSc) with Honours in Ecology and Conservation (2:1), The University of Sussex, UK (2000).

Professional and Research Experience

May. 2008 – Present Communications and Community Manager for the Forestry Commission, New Forest District, Hampshire, UK. Responsible for developing, managing and monitoring communication and interpretation strategies for the New Forest District and to promote and explain the activities of the Forestry Commission to local communities, visitors and partners.

Apr. 2007 – Apr. 2008 Environmental Standby Team Co-ordinator for Wastewater Networks of Southern Water, Sussex, UK. Responsible for (i) providing environmental input for environmental assessments for all major pollution incidents, including evidence and expert witness statements for legal mitigation; (ii) project and resource management for river management projects including management of external consultants providing specialist technical input to projects; (iii) management of Southern Water's 24-hour Environmental Standby rota to ensure adequate personnel cover in the case of a reported pollution event, requiring supervision of a team of 12 people and dealing with health and safety issues.

Aug. 2004 – Apr. 2007 Ecologist for the Environment Team of Southern Water (SW), Sussex, UK. Responsible for (i) managing SW Sites of Special Scientific Interest to bring them into "favourable condition" by 2010; (ii) managing the development and delivery of SW's Biodiversity Action Plan; (iii) collating ecological data and updating SW's environmental Geographical Information System; (iv) managing financial resources and budgets

Sep. 2006 Researcher at the Explorer's Inn lodge and research station in Tambopata, Peru. Co-leader of a comparative study of herpetological survey techniques in lowland tropical rainforest in Tambopata. Data was used to compare herpetofauna communities and to help improve techniques for eventual use in Fauna Forever Tambopata 2009. Work supported by Chris Kirkby.

Jul. 2005 Resident Naturalist researcher at the Manu Learning Centre (MLC), Manu, Peru. Participated in Fauna Forever Manu programme carrying out a number of wildlife surveys including aquatic invertebrates. The MLC is managed by the Rainforest Education and Resource Centre (CREES), a not-for-profit organisation

based in Cusco, Peru, which designs, develops and implements education and research programmes that promote sustainable natural resource management practices and co-operative conservation strategies in tropical environments, with an emphasis on the Manu Biosphere Reserve.

- Aug. 2003 – Aug. 2004 Billing administrator for the Mistral Internet Group Ltd, Brighton, Sussex, UK.
- Feb. 2003 – Jul. 2003 IT Commercial Assistant for Business Systems, Southern Water, Sussex, UK.
- Dec. 2002 – Feb. 2003 Principal Investigator on a project to determine the economic valuation of *Dipteryx micrantha* in the Native Community of Infierno (NCI), Tambopata, Peru. The study investigated the dilemma facing the population of NCI, either to extract mature Dipteryx trees for charcoal production and sale, or to protect them as macaw breeding habitat where macaws are valuable from an ecotourism perspective. Research supported by Rainforest Expeditions and by Dr. D. Brightsmith (Duke University). Project based out of Posada Amazonas Lodge.
- Dec. 2002 – Feb. 2003 Voluntary research assistant to Dr. D. Brightsmith (Duke University) on an avian geophagy project based out of Posada Amazonas Lodge.
- Sep. 2002 – Nov. 2002 Voluntary research assistant to Chris Kirkby on an mammal monitoring programme in the Salvación area of the Manu Biosphere Reserve, Peru.
- Mar. 2002 – Aug. 2002 Principal Investigator on a project to determine the importance as a nest site of *Dipteryx micrantha* to macaw species in Tambopata, Peru. Supported research being carried out by dr. D. Brightsmith (Duke University).
- Jul. 2001 – Sep. 2001 Internship as researcher at the Posada Amazonas Lodge in Tambopata, Peru. Undertook a study to determine deforestation rates and land-use change in the Native Community of Infierno (NCI) using remote sensing and GIS. Research supervised jointly by Dr. D. Brightsmith (Duke University) and Dr. Peter Halls (University of York). Research was written up in the form of a Master's Thesis.
- Sep. 1999 – May 2000 Principal Investigator on an assessment of the marine curio trade in south-east England, UK. Included research into the sale of endangered species. Research supervised by Dr. David Hill (University of Sussex).
- Jun. 1998 – Sep. 1998 Volunteer assistant in a British Council Higher Education Link scheme between the University of North London and the University of Udayana, Bali, Indonesia, researching the impact of ecotourism on the cultural heritage of Bali.
- Jun. 1997 – Sep. 1997 Volunteer field assistant for the Ministry of Forests (PHPA) in the Bukit Baransan National Park, Sumatra, Indonesia, on a project to establish a research station to provide a base of operations for student training and conservation research in the Park.

Skills

| | |
|------------------------|---|
| Information Technology | Advanced MS Office 2000 (Word, Excel, PowerPoint, etc.), Web design (MS Frontpage 2000); Statistics (SPSS, Minitab) |
| GIS | Good knowledge of ArcInfo and MapInfo. |
| Biological surveying | Good knowledge of mammal and hertile surveying techniques. |
| Driving | Full UK driving licence since 1992. |
| Mammal surveying | Experience of neotropical mammal surveying over the last 8 years in Peru |
| Languages | English (fluent), French (fluent), Spanish (advanced) |
| Other | Diving (PADI Beginner and Advanced) |

Memberships

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| 2001 – present | Member of the Tambopata Reserve Society (TReeS), a not-for-profit organization and UK Charity (No. 298054) that works towards tropical rainforest conservation in the Peruvian Amazon. |
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Presentations Given

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| 2001 | The ecological importance of <i>Dipteryx micrantha</i> to nesting macaws in Tambopata, Madre de Dios, Peru: A comparison of natural nesting cavities in five species of emergent trees. At: Anglo-Peruvian Society (London, UK). |
|------|--|

Publications and Reports

- Hepworth, A.** (2002) The ecological importance of *Dipteryx micrantha* to nesting macaws in Tambopata, Madre de Dios, Peru: A comparison of natural nesting cavities in five species of emergent trees.
- Hepworth, A.** (2001) A study of deforestation rates and land-use change in the Native Community of Infierno, Madre de Dios, Peru, using remote sensing and geographic information systems (GIS). Master's Thesis, University of York.
- Hepworth, A.** (2001) Exploring factors affecting range size in Indo-Pacific reef fishes using Geographic Information Systems (GIS).
- Hepworth, A.** (2000) Using combined analysis of molecular sequencing techniques and morphological data to resolve phylogenetic relationships between parasitic wasps. University of York.

References

- 1 **Henri Brocklebank**, Sussex Biodiversity Record Centre, Woods Mill, Henfield, West Sussex, UK BN5 9SD. Email HenriBrocklebank@sussexwt.org.uk
- 2 **Graham Roberts**, Hampshire Wildlife Trust, Beechcroft, Vicarage Lane, Curdrige, Nr Botley, Hampshire, UK SO32 2DP. Email GrahamR@hwt.org.uk
- 3 **Prof. Sandy Baldauf**, University of York, Heslington, York, UK YO10 5DD. Email: slb14@york.ac.uk
- 4 **Jorg Albrecht**, Peru Discovery, Larapa Grande Quisuares E-1-10, Cusco, Peru. Email: reservas@perudiscovery.com

Rowland Griffin

Lead Herpetologist

Personal Information

Nationality: British
Date of birth: 09 April 1978
Marital Status: Married
E-mail: rowland_griffin@yahoo.co.uk

Education

BSc. Ecology & Conservation (Hons) 2i, University of Sussex (2006 - 2008).

BTEC National Diploma Environmental Science, West Kent College (1994-1996) Pass.

Professional Experience

Jul. 2008 - present Consultant to the New Forest Reptile Centre on issues regarding animal husbandry, and volunteer training.

Nov. 2007 - present Partner and principle herpetologist for Fauna Forever Tambopata - a long term wildlife monitoring project in Peru.

Oct. 2006 - present Hon. Secretary of Sussex Amphibian and Reptile Group - a local NGO focussed on the conservation of native British reptiles and amphibians.

Mar. 2006 - present Freelance herpetologist. Working on a variety of projects as a protected species specialist, including consulting for the Environment Agency, local councils, and utility companies, carrying out appropriate surveys and providing guidance on suitable mitigation.

Feb. 2007 - Oct. 2007 Principle investigator for a long term reptile monitoring project carried out as part of Ecology and Conservation BSc, supervised by Prof. Trevor Beebee. Investigating preference for refugia materials in reptiles, with particular focus on adder identification.

2007 Assisted with the training programme for the National Amphibian and Reptile Recording Scheme (NARRS), the first properly co-ordinated national survey of the widespread UK species of reptile and amphibian, which is implemented by the Herpetological Conservation Trust (HCT) and carried out by a network of volunteer surveyors.

Sep. 2006 Principle investigator in a study of herpetological survey techniques in lowland rainforest, Explorer's Inn, Tambopata, Peru.

Skills

Information Technology Advanced MSOffice 2000 (Word, Excel, and PowerPoint), Statistix for Windows, PAST, GPS (Garmin), GIS (MapInfo).

Reptile handling Training and experience of venomous reptile handling, including adders (UK), rattlesnakes (Neotropical) and cobra (India)

Herpetofauna Strong identification skills and extensive knowledge of reptiles, in particular Neotropical pitvipers, and amphibians.

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| Data management | Strong statistical skills and experience with using PDAs, GPS (Garmin). |
| Driving | Full UK driving licence since 1994 |
| Languages | English (fluent), Spanish (basic) |

Workshops Taught and Selected Presentations Given

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| June 2008 | Herpetofaunal surveying in lowland tropical rainforest -East Sussex Reptile and Amphibian Society (ESRAS) |
| May 2008 | Reptile and amphibian surveying - Methods in Ecology Course BSc (University of Sussex) |
| April 2008 | Herpetological surveying techniques - for Biodiversity Recording Masters course (University of Sussex) |
| Feb 2008 | Year of the Frog - presentation on threats to amphibian diversity in Peru at Blackpool Zoo. |
| Nov 2007 | Presentation and display on herptile monitoring in tropical rainforest, at the Amphibian and Reptile Group (ARG-UK) southern region conference. |
| July 2007 | Workshop on the UK species of reptile and amphibian to promote herptile conservation to members of the general public, representing the Sussex Amphibian and Reptile Group (SARG), at BBC Springwatch. |

Memberships

| | |
|----------------|--|
| 2006 - present | Member of the Sussex Amphibian and Reptile Group, a local NGO focussed on the conservation of native British reptiles and amphibians. |
| 2006 - present | Member of the Tambopata Reserve Society (TReeS), a not-for-profit organization and UK Charity (No. 298054) that works towards tropical rainforest conservation in the Peruvian Amazon. |
| 1998 - present | Member of the British Herpetological Society, one of the oldest and largest UK herpetological societies. |

Publications and Reports

Griffin, R. (in prep.) Preference in refugia material demonstrated by widespread British reptile species. Herpetological bulletin of the British Herpetological Society.

Griffin, R. (2008) Preference in refugia material demonstrated by widespread British reptile species. BSc. Thesis. University of Sussex.

References

- 1 Professor Trevor Beebee**, President British Herpetological Society, JMS Building 2c24, University of Sussex, Falmer, Brighton, BN1 9QG, UK. Email: T.J.C.Beebee@sussex.ac.uk
- 2 Dr. Alan Stuart**, Senior Lecturer in Ecology, JMS Building 5b19, University of Sussex, Falmer, Brighton, BN1 9QG, UK. Email: A.J.A.Stewart@sussex.ac.uk
- 3 Barry Kemp**, Records and Survey Officer, Sussex Amphibian and Reptile Group (SARG), 'Amblehurst' Nevill Road, Crowborough, East Sussex, TN6 2RA, UK. Email: barry@viper.demon.co.uk
- 4 Jorg Albrecht**, Peru Discovery, Larapa Grande Quisuares E-1-10, Cusco, Peru. Email: reservas@perudiscovery.com