Collaboration for Environmental Evidence

WORKING TITLE:

Effectiveness of protected areas in maintaining biodiversity and reducing habitat loss

Draft Review Protocol

CEE-10-007

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Cover Sheet

Title	**Working title:** *Effectiveness of protected areas in maintaining biodiversity and reducing habitat loss*
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1. Background

Protected areas cover around 10.1-15.5% of the planet's land surface (Soutullo 2010) and are perhaps the most important tool available to conservationists and other stakeholders to maintain habitat integrity and species diversity in a rapidly changing world (Coad *et al.* 2008; Jenkins & Joppa 2009). Besides protecting biodiversity and habitats (Rodrigues et al. 2004b), protected areas are also increasingly recognised for their role in protecting ecosystem services such as carbon, water, climate and soil stabilisation, and various timber and non-timber products (Kearns *et al.* 1998; Schroter *et al.* 2005; Armsworth *et al.* 2007; Klein *et al.* 2007; Naidoo *et al.* 2008; Hockings 2003; Raudsepp-Hearne *et al.* 2010).

However there is considerable debate on the extent to which protected areas deliver conservation outcomes in terms of species and habitat protection (Ferraro 2001; Ferraro & Simpson 2002; Meir *et al.* 2004; Rodrigues *et al.* 2004b;Whittaker *et al.* 2005; Brooks *et al.* 2006; O'Dea *et al.* 2006; Andam *et al.* 2008). It has been suggested that many of the worlds protected areas are present only 'on paper', having no effective management on the ground (Chape *et al.* 2005). Measuring the effectiveness of protected areas is hindered by a lack of quantitative data. Information on protected areas management is sparse; of the worlds 113,000 protected areas management data has been systematically collected for approximately 6,000 sites (Butchart *et al.* 2010), and few protected areas have collected long-term datasets for species populations. There has therefore been little quantitative research on the outcomes of protected area management in relation to the protection of biodiversity and habitats (Ervin 2003; Dudley *et al.* 2004; Quayle & Ramsay 2005; Ewers & Rodrigues 2008), and there is also a lack of consensus on how these outcomes might best be measured (Fazey *et al.* 2006; Bleher *et al.* 2006; Roman-Cuesta & Martinez-Vilalta 2006; Parr *et al.* 2009). A better understanding of the ability of protected areas to deliver conservation outcomes in terms of species protection and habitat preservation is essential to ensure that protected area and conservation funds are being spent in an optimal way (Kleiman *et al.* 2000; Brashares & Sam 2005; Rodrigues 2006; DeFries *et al.* 2007; Kapos *et al.* 2008; Kapos *et al.* 2009), and the impacts of protected area management practices and governance can be fully understood, allowing for adaptive management.

Protected area effectiveness in preserving species:

Most studies of species protection to date have focused on the measurement of the representativeness of protected area networks in terms of their coverage of species diversity, endemic species or threatened species (Rodrigues & Gaston 2001; Rodrigues *et al.* 2004a; Maiorano *et al.* 2006; Catullo *et al.* 2008). These gap analyses have been conducted at global, regional national and sub-national levels (Rouget *et al.* 2007; Larsen *et al.* 2008; Gallo *et al.* 2009; Parr *et al.* 2009). Gap analyses can be used to inform the design of protected area networks and increase the ecological representativeness of global, regional and national reserves networks. However, they do not provide information on the ability of these reserves to effectively protect and preserve species. Few studies have looked at whether protected areas have been able to maintain species diversity and populations better than if the areas has not been protected in the first place. For instance. several authors have shown greater species richness in parks compared to surrounding areas (Newmark 1995; Brashares *et al.* 2001; Lund 2002; Rodrigues *et al.* 2004a; Larsen *et al.* 2008; Growcock *et al.* 2009;

Caro *et al.* 2009) and others have shown higher abundance in PAs compared to surroundings(Gardner *et al.* 2007) but without information on the temporal trends these studies do not allow an assessment of PA efficacy. Very recently, a number of studies have begun to gather available data on species changes to assess if trends of increase or decline are higher or lower within protected areas in comparison with surrounding non-protected areas (Evans *et al.* 2006; Stoner *et al.* 2007a; Stoner *et al.* 2007b; Western *et al.* 2009).

Protected area effectiveness in preserving habitat:

Most studies of the effectiveness of protected areas in preserving habitat have focused on protected area effectiveness in preserving tropical forest in developing counties. The most common method of measuring effectiveness has been the use of a buffer-analysis, comparing deforestation rates inside protected areas with the immediate surrounding area (Achard *et al.* 2002; Gaveau *et al.* 2007).More complex analyses aim to compare deforestation rates within protected areas with comparable habitat outside, using a landscape modelling approach (Bruner *et al.* 2001; Andam *et al.* 2008; Nelson & Chomitz 2009).

Although there is debate in the literature and we have not yet conducted a comprehensive review, it does appear that the bulk of evidence indicates that protected areas, in general, do help reduce the rate of deforestation (Pelkey *et al.* 2000; Cropper *et al.* 2001; Achard *et al.* 2002; Margaret F.K. *et al.* 2003; Gaveau *et al.* 2007). Whilst protected areas may reduce the rate of deforestation inside the protected area compared to outside, forests may still be cleared at high rates both in- and outside of the protected area (Clark *et al.* 2008; Sommerville 2010).

However, the existence of a protected area does not necessarily result in reduced deforestation. Protected area funding, staffing, planning, infrastructure and community involvement, among other protected area characteristics, may influence the ability of a protected area to reduce deforestation rates within its boundaries. Although there are a number of studies which have measured the effectiveness of individual reserves or reserves networks(Stoner *et al.* 2007a; Caro 2008; Parr, *et al.* 2009), few have been able to rigorously analyse which protected area characteristics appear to be influencing their effectiveness in combating deforestation and degradation, often due to sample size limitations. There is therefore potential for this systematic review to include a meta-analysis of individual studies, investigating whether there are any key protected area characteristics which influence effectiveness.

In conclusion, even though synthesis' highlighting challenges (Gaston *et al.* 2008), no systematic collection of case studies or available knowledge has been produced on the impact of protected areas on delivering conservation outcomes in terms of species diversity, species populations and trends, or forest cover and trends. This systematic review will bring together and review the state of knowledge from all peer reviewed papers, and the key grey literature and reports from practical conservation work in the field. It will aim to use meta-analysis techniques to address the question on how protected areas function to protect habitats and biodiversity, and how conservationists measure success of conservation efforts.

2. Objective of the Review

2.1 Primary question

What evidence is there that terrestrial protected areas have maintained biodiversity (in terms of species diversity and populations) and prevented deforestation or degradation?

2.2 Secondary question *(if applicable)*

Which protected area characteristics (e.g. management and governance regimes, spatial characteristics, budgets) influence protected area effectiveness in reducing deforestation and forest degradation and maintaining biodiversity values in terms of species diversity and populations?

Which wider landscape characteristics (e.g. proximity to roads and urban areas, altitude, slope, habitat, nation/region and background rate of deforestation and degradation) influence protected area effectiveness in reducing deforestation and forest degradation and maintaining biodiversity values in terms of species diversity and populations?

3. Methods

3.1 Search strategy

We will search for papers written in English, French, and Danish. If possible we will extend this to the Spanish literature.

A number of relevant terms and descriptive words have been compiled from the referenced literature and derived directly from the questions addressed in the review. Compilation of different terms and word has then been grouped into search criteria using Boolean separators where terms are either exclusive or inclusive:

TERMS:

Conservation, Biodiversity, Monitoring, Management, Deforestation, Forest, Degradation, Effectiveness, Outcome, Effect, Success, Species, Trend, Endemic, Composition, Red list, Habitat, Destruction, Output, Governance, Protected, Area, National, Park, Reserve, Community, Conserved, Indigenous and People, Performance, Efficacy, Animal, Mammal, Forest

GROUPING OF RELATED SEARCH-TERMS:

1. Biodiversity OR species trend OR Threatened species OR Endemic OR Species Composition OR Red list OR Red listed Species OR Monitoring
2. Deforestation OR Forest degradation OR Habitat destruction OR Habitat degradation
3. Conservation outcome OR Conservation success OR Conservation effect OR Conservation output
4. Management OR Management effectiveness OR Governance

5. Protected Area OR National Park OR Park OR Reserve OR community conserved area OR indigenous area OR Forest reserve

SEARCH ENGINES USED IN THE REVIEW:

General sources:

- ISI Web of Knowledge
- BIOSIS citation index
- Zoological records
- ASFA
- SCRIS
- Science Direct
- Directory of Open Access Journals
- Index to Theses Online
- CAB abstracts
- COPAC
- University of Oxford Libraries
- SCOPUS
- ProQuest Dissertations and Theses http://www.il.proquest.com/

Specialist sources:

- World Environment Library http://www.nzdl.org/fast-cgi-bin/library?a=p&p=about&c=envl
- Forestscience.info http://www.forestscience.info/
- Tropical forest conservation and development database http://forestry.lib.umn.edu/bib/trps.html
- Conservationevidence.org
- UN-REDD Web Platform http://unfccc.int/methods_science/redd/items/4531.php
- FAO online catalogue: http://www4.fao.org/faobib/

Websites:

- Google/Yahoo/chrome
- Google scholar
- IUCN website
- WWF website
- FAO website
- UNEP website
- CIFOR website
- Woods Hole research centre
- Conservation International
- WCS
- University search pages
- World Bank
- UNDP
- WCPA

3.2 Study inclusion criteria

Inclusion and exclusion criteria stated a priori in the finalised review protocol will be used at the level of the title, abstract and full text, to select relevant articles. The protocol will be checked for consistency using a Kappa analysis (Edwards *et al.* 2002).

- **Relevant subject(s):**
  - Protected areas globally
  - Forest habitats (for deforestation studies only; studies measuring effectiveness for species will be accepted for all habitats).
  - Terrestrial mammal and bird species
- **Types of intervention:**
  - Protected area management and governance characteristics.
- **Types of comparator:**
  - Unprotected landscape directly surrounding the protected area
  - Unprotected comparable habitat in landscape surrounding the protected area
  - Time series analyses of before and after protected status and changes in relationship to management practises.
- **Types of outcome:**
  - Differences in species diversity inside and outside protected areas
  - Changes in species numbers and abundance over time
  - Changes in species compositions and number of threatened species.
  - Changes in rate of deforestation or forest degradation
- **Types of study:**
  - All studies that deals with evaluating the effects of protected areas on habitat loss and biodiversity indicators.
  - Studies that deal with evaluating conservations efforts either globally and site specific studies.

3.3 Potential effect modifiers and reasons for heterogeneity:

Protected area characteristics:

- Shape, size, location, area to perimeter ratio
- Date of establishment
- Management (can be measured using IUCN management category system)
- Governance (can be measured using IUCN governance category system)
- Capacity (funding, staffing)
- Biodiversity data

Landscape characteristics:

- Base deforestation rate
- Proximity to urban areas/roads
- Habitat type
- Diversity of habitats within protected areas

National and regional scale:
Country, region, WB development index

3.4 Study quality assessment

All studies, reports and papers assessed in the systematic review will first be screened by one reviewer to control for 1) Subject comparability; 2) Types of questions being proposed; 3) Data, review or essay driven analyses, and 4) quality of analyses.

To ensure that studies of good quality are included in the systematic review, an analysis of experimental deigns methods will be carried out. Each study will be scored in terms of methodological rigour, following the methods outlined in (Pullin & Knight 2003). We are keen to include studies that have used a well-defined method for assessing impact, by defining baseline figures for their metrics, such as measurement of deforestation rates/biomass/carbon over time, or comparison of rates with a control area of similar characteristics. Where a number of high-quality analyses are available, others with less rigorous methods may be rejected from the review. However, for topics where literature is scare, this may not be possible.

3.5 Data extraction strategy

Data will be extracted to spreadsheets designed as part of the review, including information on:

1. Location
2. Study site characteristics (e.g. forest, grassland etc)
3. Intervention (e.g. protected area)
4. Measures (e.g. deforestation, species populations and diversity),
5. Methodology (e.g. temporal and spatial comparisons - buffer analyses, time-series),
6. Sources of bias
7. Outcomes (e.g. deforestation rate, changes in species population over time/space),
8. Notes and references.

Methods for data extraction and synthesis will be refined during the early phases of the review. The protocol will be amended as this process is undertaken.

3.6 Data synthesis and presentation

Information from each selected study will be synthesised in a spreadsheet, as outlined in section 3.5. This spreadsheet will be made available in the final review as an online appendix.

Where possible, meta-analyses will be carried out to further understand the predictors of protected area effectiveness in reducing deforestation and conserving species.

The review will present the methodologies currently in use to assess protected area effectiveness, followed by a review of the findings of the studies; this may be divided into geographic region, or by predictor (IUCN category, management, governance etc), depending on data availability. Common predictors of protected area effectiveness will be illustrated using figures and tables.

A discussion section will focus on 'lessons learned' in terms of methodologies used to measure protected area effectiveness, and conservation actions which appear to be increasing protected area effectiveness. The review will also highlight information gaps which call for further research and monitoring programs

4. Potential Conflicts of Interest and Sources of Support

None known.

People involved are supported by their home institutions.

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