CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW NO. 20

DEVELOPMENT AS A CONSERVATION TOOL: EVALUATING ECOLOGICAL, ECONOMIC, ATTITUDINAL, AND BEHAVIORAL OUTCOMES

REVIEW REPORT

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SYSTEMATIC REVIEW SUMMARY

Background

In the past 25 years, using development as a conservation tool has become central to policy and various strategies for linking conservation to development have become prominent. This reflects the recognition of the importance of local support for conservation and the associated assumption that conservation ultimately depends on development and vice versa. Despite sound arguments both for and against the effectiveness of these strategies (Wells 1992; Barrett & Arcese 1995; Oates 1999; du Toit 2004; McShane & Wells 2004), there have been few quantitative comparative evaluations of their successes and failures (Bruner et al. 2001; Salafsky et al. 2001; Struhsaker et al. 2005). As the focus on, and funding towards, conservation and development projects increases, it is essential that the paradigm be more rigorously examined. Here we test some of the assumptions of the conservation and development paradigm using four measures of success; ecological, economic, behavioral, and attitudinal.

Objective

The objective is to assess the characteristics of conservation projects that lead to successful ecological, economic, behavioral, and attitudinal outcomes and to determine the quality and quantity of monitoring efforts in the field. To achieve this, five questions were asked, the first of which addresses the quality of the data available, and the second through fifth of which are posed as hypotheses (see Methods, question formulation for justification of hypotheses):

1. To what extent do studies evaluate multiple measures of success?

2. Greater levels of utilization of natural resources and lower levels of protectionism will lead to success in all outcome measures.

3. Conservation projects that facilitate increased market integration will result in success for all outcome measures.

4. Greater local input in conservation decisions and greater community control over programs will lead to success in all outcome measures.

5. The more culturally homogeneous a community, the more successful the project will be in all outcome measures.

Study Inclusion Criteria

Studies were included if they fulfilled the relevance criteria below.

- *Type of study* – primary literature

- *Subjects studied* – any conservation and development project associated with a protected area. Papers reviewing the impact of a protected area on local communities in the absence of a specific conservation and development project were not included.

- *Outcomes* – ecological, economic, behavioral, attitudinal outcomes. At least two of the outcomes had to be measured for inclusion in the study.

Scope of the Search

The impetus for this project originated from case studies analyzed for Borgerhoff Mulder and Coppolillo (2005). We reviewed the bibliographies of these case studies for additional papers and bibliographies of integrated conservation and development projects (ICDP) (Brown 2002; Flintan 2000). In addition, we conducted web-based searches with ISI Web of Knowledge, Anthropology Plus, Biblioline, and JSTOR electronic databases. We searched for the terms *ICDP*, *integrated conservation and development project, community based conservation, and conservation and development* in each database.

Main Results

The results of this review are that (1) very few studies provide adequate quantitative measures of success across multiple outcomes to provide a strong test of the hypotheses, and (2) that two separate statistical approaches to the data indicate market selling opportunities are associated with attitudinal outcomes, and community involvement in decision making and implementation is associated with behavioral success.

Conclusions

As regards the first objective, it is clear that without far better monitoring schemes in place it is still impossible to provide a systematic evaluation of how different strategies are best suited to different conservation challenges. First, there is a paucity of high quality data. Second, few studies provide quantitative evaluations of success. Third, few studies evaluate across the full range of relevant outcomes – behavioral, attitudinal, economic and ecological. The second objective was to determine the impacts of market integration, utilization and protection, decentralization, and community homogeneity on conservation and development projects. It is clear that the predictions stemming from the integrated conservation and development philosophy, that emphasize utilization, decentralization, and market access as a means for achieving conservation success, do receive some statistical support in our sample.

1. BACKGROUND

The critique of protectionism that emerged in the 1980s has spawned an array of conservation strategies that promote, to various degrees, the welfare and cooperation of the people living in and around protected areas. As a result, using development as a conservation tool has become central to policy. Such strategies provide a mix of conservation and development objectives (Borgerhoff Mulder & Coppolillo 2005) and employ a range of tactics, such as providing appropriate development opportunities (Abbot et al. 2001), emphasizing local community involvement (Western 1994; Getz et al. 1999), adopting shared management (Murphree 1994), ensuring local autonomy (Muller 2003), guaranteeing rights to harvest (Fearnside 1989; Browder 1992), promoting knowledge (Jacobson 1998), awarding cash compensation (Ferraro 2002), and encouraging tourism (Honey 1999).

Despite the prominence of such strategies linking conservation and development as primary conservation tools, and strong arguments for and against their effectiveness (Wells 1992; Barrett & Arcese 1995; Oates 1999; McShane & Wells 2004), there have been few quantitative comparative evaluations of their successes and failures. There are, however, exceptions. Bruner et al. (2001) studied vegetational changes associated with protectionism (and its absence), and Salafsky et al. (2001) identified design features of enterprise strategies for community-based conservation projects that produce successful outcomes. More recently, Struhsaker et al. (2005) examined correlates of conservation success in Africa's forests and considered, among other factors, the presence of integrated conservation and development projects.

Following the call of Sutherland et al. (2004) and Saterson et al. (2004) for independent evaluation of the reasons why different strategies succeed and fail, we used data from 28 projects that purportedly link conservation and development, to test quantitatively some of the assumptions that underlie current conservation strategies. Although specific projects become known for specific strategies (e.g., ecotourism in the Galápagos or community-based conservation in southern Africa), in practice more than one strategy is used in any one project (Borgerhoff Mulder & Coppolillo 2005). Accordingly we focused not on specific strategies *per se*, but on the assumptions underlying the strategies currently embraced by many conservation organizations. In particular, we considered the utilization-protection continuum, market integration, decentralization and community homogeneity.

Much of the debate among those concerned with conservation strategy and policy results from an interest in different outcomes. Social scientists focus on a community's economic well-being and empowerment, whereas natural scientists pay closer attention to biological impacts of resource use. Consider, for example, the debate over extractive reserves. For Schwartzman et al. (2000*a*) a well-conserved forest is one that sequesters carbon, does not burn, has stable hydrology and soils, and provides a productive home for forest-living peoples. For others (e.g., Redford 1992) a well-conserved forest is one that harbors ecologically functional populations of all species within the ecosystem, thereby providing for the conservation of the full set of species, genes, and ecological relationships. Unsurprisingly, such authors disagree over the viability of extractive reserves (Schwarzman et al. 2000*b*), a disagreement that illustrates the different perspectives of social versus natural scientists (Naughton-Treves et al. 2005).

Recognizing these multiple perspectives, we included in our analysis four outcome measures as criteria for evaluating the success or failure of conservation and development projects:

ecological, economic, attitudinal and behavioral. We define *ecological success* in terms of the consequences for one or a set of species (or habitats) designated as targets of the conservation project. *Economic success* refers to the consequences for material welfare of the communities affected. Underlying these economic and ecological outcomes are the attitudes and behaviors of local residents: *attitudinal success* is defined in terms of the views of local residents to the goals of the conservation project, and *behavioral success* refers to changes in behavior likely to reduce threats to natural resources. Although changes in attitudes are an important consequence of a conservation project, positive attitudes do not ensure ecological success, and are not necessarily correlated with economic success (Holmes 2003). Furthermore if positive attitudes do not translate into conservation-friendly actions, then they are strictly irrelevant to ecological outcomes (Adams 2001; Holmes 2003). Ideally all four outcomes should be considered together when studying conservation and development projects, with the recognition that there may be a temporal aspect to their emergence; for example, positive behavioral outcomes might occur prior to the observation of positive ecological outcomes. Furthermore although we do not attempt to determine the sustainability of development-conservation projects in this review, we stress that success across multiple criteria is more likely to ensure sustainability.

Although our results provide some support for the intuitions driving the conservation and development approach, existing data are insufficient to make strong claims about the efficacy of the conservation and development paradigm as a whole, or about specific characteristics that may result in success for a particular project.

2. OBJECTIVE

We investigated whether various characteristics of individual projects predict success or failure in achieving a range of conservation goals. To achieve this, five questions were asked, the first of which addresses the quality of the data available, and the second through fifth of which are posed as hypotheses:

1. To what extent do studies evaluate multiple measures of success?

2. Greater levels of utilization of natural resources and lower levels of protectionism will lead to success in all outcome measures.

3. Conservation projects that facilitate increased market integration will result in success for all outcome measures.

4. Greater local input in conservation decisions and greater community control over programs will lead to success in all outcome measures.

5. The more culturally homogeneous a community, the more successful the project will be in all outcome measures.

3. METHODS

3.1 Question formulation

The impetus for this project originated from debates addressing conservation and development, and relevant case studies, as presented in Borgerhoff Mulder and Coppolillo (2005). More specifically, our questions derived from detailed analysis of the history, interdisciplinary development, and implementation of conservation policy as analysed in that book. To evaluate the role of the conservation and development philosophy in securing conservation solutions it is necessary both to include multiple measures of success (economic, ecological, behavioral and attitudinal), and to test the assumptions on which integrated conservation and development projects are founded. We isolated key assumptions underlying the modern conservation and development philosophy, formulated these as hypotheses, and tested them with this dataset. We did not reformulate or modify any of our hypotheses during the process. We identified four such assumptions and posed them as hypotheses from the perspective of the social scientist. These pertain to market integration, utilization/protection, decentralization, and community homogeneity.

1). Utilization/Protection. We hypothesized that greater levels of utilization generate support for, and compliance with, conservation initiatives. Although high levels of protection contribute to ecological success (Caro et al. 1998; Bruner 2001), this may not be a general pattern and may compromise economic, attitudinal and behavioral success. This is particularly likely when protected areas have been established without local consultation or when their management is underfunded (Balmford 2003). In such cases local communities may resent losing access to (or receiving insufficient compensation for) the resources they used previously and accordingly increase illegal offtake (e.g., Lindsay 1987). The general assumption underlying our prediction is that because income-generation is linked to sustainable utilization of natural resources, local communities will recognize the importance of regulating resource use and their attitudes and behaviors toward conservation will change accordingly. Opening up areas to human use, whether as buffer zones or extractive reserves, may increase support for conservation while minimizing human impacts, yielding the prediction that projects emphasizing utilization will show increased economic, attitudinal, behavioral, and ultimately ecological success. This somewhat naïve prediction assumes that utilization generates income, is sustainable, and does not adversely affect other species (see discussion).

2). Market Integration. We hypothesized that where conservation projects facilitate increased market integration, there would be greater local support for resource management and conservation. Integration of local communities into larger regional or national markets entails many changes (e.g., alternative sources of income, access to substitute subsistence goods, new markets for local products, changed material aspirations) each with distinct potential conservation outcomes. The dynamic we focused on is developed most fully by Godoy et al. (1995; see also Hulme & Murphree 1999): increased external income offered by markets can decrease dependence on local forests either through substitution of commercial alternatives or by devaluing forest goods in comparison with income earned through wage labor. Both pathways decrease the incentive to extract resources for sale in the market. The prediction then is that greater market integration will show increased economic, attitudinal, behavioral, and ultimately ecological success, although we realize that negative effects are a possibility (see discussion).

3). Decentralization. We predicted that with greater local input in conservation decisions and greater community control over programs, the attitudes and behaviors of residents will change in a positive way. Some support for this view comes from a study of local enterprise initiatives linked to conservation projects in Southeast Asia (Salafsky et al. 2000). The idea that empowering local communities should make them more responsive to conservation initiatives lies at the heart of community-based conservation programs (Wyckoff-Baird 2000; Ribot 2004). The benefits of decentralization derive from the assumption that local bodies will be more responsive to conservation initiatives than national governments. Again multiple lines of logic are implied. First, local communities are thought to have greater knowledge of the intricate dynamics of their natural resource base than outsiders and to have more incentive to sustain it over time. They are also presumed to have lower discount rates than a commercial intruder. The prediction then is that decentralization, defined here primarily in terms of the extent to which project design and implementation is devolved to local communities, is associated with increased economic, attitudinal, behavioral, and ultimately ecological success. As we acknowledge in the discussion, successful decentralization depends on both the presence of functioning institutions within the community and on the socio-economic and political conditions prior to decentralization.

4). Community Homogeneity. We predicted that the more homogeneous a community, the more successful the project will be in all aspects. Cultural homogeneity is thought to facilitate the functioning of community institutions for resource management by increasing trust between community members and thus reducing transaction costs (Ostrom 1990) and has been identified as an important factor in success in the Zimbabwean CAMPFIRE program (Barrow & Murphree 2001). Compared with a more heterogeneous community, a culturally homogeneous community is expected to cooperate more often and more efficiently to solve collective action problems, such as common-pool resource management issues arising in and around project areas. Situations in which heterogeneity might boost rather than impede collective action are outlined in the discussion.

3.2 Search strategy

Electronic database and internet searches
The databases searched were: ISI Web of Knowledge (Web of Science), Anthropology Plus, Biblioline, and JSTOR.

Search terms were as follows:

- ICDP
- integrated conservation and development project
- community based conservation
- conservation and development

These terms were searched for only in English language publications.

Other searches
The bibliographies of the case studies revealed during research for Borgerhoff Mulder and Coppolillo (2005) were reviewed for additional papers. In addition, the bibliography of integrated conservation and development projects (ICDP) provided by Brown (2002), and Flintan (2000) were also searched for relevant papers.

3.3 Study Inclusion Criteria

Specific inclusion criteria were based on peer-reviewed publications, the presence of some form of conservation and development project, and the number of monitored outcomes. We originally intended to use only projects with data on all four dimensions, with the aim of analyzing the interdependencies among different measures of success. This stipulation was removed upon realization of the small sample of papers covering all four outcome measures.

- *Type of study* – primary literature

- *Subjects studied* – any conservation and development project associated with a protected area. Papers reviewing the impact of a protected area on local communities in the absence of a specific conservation and development project were not included.

- *Outcomes* – ecological, economic, behavioral, attitudinal outcomes. At least two of the outcomes had to be measured for inclusion in the study. Outcomes were categorized into quantitative measurement and qualitative measurement.

3.4 Study Quality Assessment

After an initial screening, 150 papers were accepted for full text viewing (See Results, Review Summary Statistics). Of these, 24 papers fulfilled the selection criteria for a total of 28 projects reviewed (one paper reviewed three projects while two other papers reviewed two projects each). Both primary researchers (JSB, MAF) independently assessed references for relevance at full text using the inclusion criteria. In cases of uncertainty, the researchers both read the reference in question and discussed its inclusion. All studies that fulfilled the selection criteria were included without weighing one type of study over another.

3.5 Data Extraction

Two researchers (JSB, MAF) coded each paper separately and then met to discuss their findings. Qualitative data was translated into ordinal or nominal categories. When coders disagreed, each made a case for their decision and the most appropriate response was chosen. Coders based their decisions only on the information presented in the paper and did not incorporate knowledge gained from other sources to add information. To test the procedure, the coding protocol was applied to Wells' (1999) review of ICDPs in Indonesia (this publication was not used in the study because it was not peer reviewed nor did it contain a sufficient number of monitored outcome variables, though it covered many of the independent variables of interest). Changes to the coding protocol were made based on discrepancies between reviewers and information in the literature.

3.6 Data Synthesis

Information was extracted from reviewed studies to create a dataset, and both qualitative and quantitative information was used. We created variables to describe a project's local environment, protected area, community (or communities) affected, threats to the local environment, monitoring information related to the success of the project, and the author's profession and discipline. We collected 60 pieces of information for each paper. Only those directly relevant to the major hypotheses will be discussed here. Due to the use of qualitative

material, our measures for the categorical variables were based on the subjective assessment of the two reviewers.

For the utilization/protection hypothesis (Table 1) we used two predictor variables; the protected area IUCN ranking (IUCN) and amount of resource use permitted in the project area (use). We supplemented the former with the latter measure because in some contexts the IUCN ranking is a poor indicator of actual usage patterns (Naughton-Treves et al., 2005). To test the market integration hypothesis, we used four predictor variables, each dealing with a different aspect of market incursion (sell, purchase, labor) and the scale of the threat resulting from resource extraction (threat). To test the decentralization hypothesis, we used three variables: implementation (level of the organization responsible for implementing the project), decision (level of community involvement in a project's day-to-day running once it was implemented), and benefits (targeted beneficiaries of the project). The community homogeneity hypothesis had only one predictor variable, population (whether or not the source of local population growth is from local residents or from immigration). Few papers included appropriate ethnographic, cultural and social data on the population(s) in the project area, making a more precise measure of this variable difficult to obtain. All variables consisted of categories ordered (see Table 1) so that positive associations between predictor and outcome measures provided evidence consistent with the four hypotheses.

Table 1. Variables used in analysis of conservation and development projects and descriptions of variable categories[a]

Hypotheses and Variables	Explanations and Categories
Utilization/Protection	
IUCN[b]	IUCN ranking of the protected area from most protected to least, (http://www.iucn.org/themes/wcpa/ppa/protectedareas.htm), three categories strict nature reserve national park other (national monument, habitat/species management area, protected landscape, managed resource area)
use[b]	amount of resource use permitted in or around the protected area from least use to most, three categories ecotourism ICDP emphasizing substitution, compensation or some combination of the two ICDP where enhancement is emphasized in addition to any other goal Compensation refers to development projects, substitution refers to alternatives that remove pressure from the threatened resource, and enhancement refers to improving the market for the resource to increase value and control (for definitions see Abbott 2001 and Brandon 1997).
Market Integration	
sell	how involved the local community is in market sales, scored from least involvement to most, three categories

	minimal, moderate, large
purchase	how involved the local community is in market purchases, scored from least involvement to most, three categories minimal, moderate, large
labor	how involved the local community is in wage labor, scored from least involvement to most, three categories minimal, moderate, large
threat[b]	Threats to the protected area, three noted for each project, including commercial poaching, subsistence poaching, fuelwood poaching, grazing, subsistence agriculture, commercial agriculture, tourism, commercial industry, commerical timber. Coded by motivation (subsistence, cash) and severity (minimal, moderate, large). Subsistence / minimal, moderate or large, and cash / minimal = 1, cash / moderate = 2, cash / large = 3. Sum of three threats is total score (1-9) and is condensed into four categories 1-2, 3, 4-5, 6-9
Decentralization	
implementation[b]	administrative level of the organization responsible for implementing the project, scored from least community involvement to most, two categories national, international or some combination regional, community, household, individual
decision	level of community involvement with respect to day-to-day decision-making, scored from least community involvement to most (Berkes 1991), three categories no community control: locals informed of regulations, local concerns addressed some community involvement: advisory partnership, involvement of management boards, use of local knowledge and field assistants complete community control: power to community or joint management
benefits[b]	targeted beneficiaries - up to two beneficiaries noted for each project, scored from least community benefit to most, three categories no community: benefits are directed to either the regional level or above (regional, national, international) community/other: benefits are directed in part to the community level or below (household, individual) community: benefits are directed exclusively to the community level or below (community, household, individual)
Homogeneity	
population	source of population growth in the area, scored from least homogeneous to most, two categories immigrant local

Outcomes	
ecological	project outcomes with regard to ecological goals, three categories failure, limited success, success
economic	project outcomes with regard to the economic impact on the local people, three categories failure, limited success, success
attitudinal	project outcomes with respect to local attitudes toward conservation, three categories failure, limited success, success
behavioral	project outcomes with respect to decreasing the occurrence of illegal or targeted activities, three categories failure, limited success, success

a. The full coding protocol, data, and R script used in data analysis can be found at http://www.anthro.ucdavis.edu/faculty/monique/MBMWeb/Moniqueshomepage.htm
Most variables contain missing values. Abbreviations: IUCN, World Conservation Union; ICDP, Integrated Conservation and Development Project
b. Variables were analyzed using fewer ordered categories than in the original protocol. Because of the small sample size, variables with several (e.g., greater than five) categories in the original protocol tended to have few observations in each category. Adjacent categories were combined for such variables when appropriate given the natural ordering of the categories.

3.6.1 Analysis

We used categorical principal components analysis (catPCA, Gifi 1990; reviewed in Michailidis & de Leeuw 1998) to determine structure in the predictive variables, to display this structure in two dimensions, and to make qualitative tests of association between predictors and outcomes. We used only predictors to construct the principal components. Outcomes were mapped onto the first two dimensions. Under the null hypothesis of no association between predictors and outcomes, we expected to see no structure in the scatter plots displaying object scores (sample projects) in the two-dimensional space, labeled by an outcome (failure, limited success, success). If, however, structure in these plots was detected, we considered it evidence against the null hypothesis and in favor of some, limited, predictive value of the independent variables.

We also examined 2-dimensional contingency tables of predictors and outcomes, and used Monte-Carlo and false discovery rate methods (FDR; Benjamini & Hochberg 1995) to determine statistical significance. We used the Goodman-Kruskal gamma statistic (Goodman & Kruskal 1954; Agresti 1990) to summarize the association between a predictor and response and as a test statistic for Monte-Carlo significance tests. Gamma, which lies in the interval [-1, 1], is the difference between the sample frequencies of concordant and discordant pairs of observations, when the ordinations of both predictor and outcome are considered. Unlike other measures of ordinal association (e.g., Agresti 1990) gamma does not require that numerical "scores" be assigned by the observer (often arbitrarily) to the levels of a variable. Hypothesis tests based on gamma have known drawbacks (e.g., Cohen & Sackrowitz 1992), but they are balanced by the natural interpretability of gamma for the present data. Because of the way the variable categories were ordered (see Table 1) we

interpreted a value of gamma relatively close to 1 as evidence in favor of the hypothesis under consideration.

With 10 predictors and four outcomes, there were 40 two-dimensional tables to be tested; and correlations within the sets of predictors and outcomes were likely to be present. These considerations and the small sample size made it necessary to mitigate problems of multiple testing. We adjusted significance levels from the 40 hypothesis tests using "q values" (Storey 2002; reviewed in Roback & Askins 2005) to obtain approximate control of the FDR, defined as the expected proportion of false-positive tests among tests called significant. Storey (2002) describes algorithms which take ordered significance levels (p values) from multiple hypothesis tests, returning a corresponding sequence of q values connected to the FDR for the tests. Approximate control of the FDR is achieved by setting a threshold for the q values; for example, calling the tests having q values ≤ 0.05 significant implies that, of those tests, only about 5% are expected to be truly null-hypothesis cases.

We obtained a Monte Carlo p value and associated q value for each test of ordinal association as follows. For an observed table, 5000 random tables (having the same row and column sums as the observed table) were generated under the null-hypothesis of independence of predictor and outcome. These tables were generated using the function "r2dtable" in the statistical software R (2004, version 2.0.1). For each random table, the Goodman-Kruskal gamma statistic was calculated and stored. As the alternative hypothesis was directional (i.e., positive association between predictor and outcome), we calculated a "one-sided" p value as the number of random gamma statistics greater than or equal to the observed gamma, divided by 5000. The p values obtained in this way from the 40 observed tables were then supplied to the q value software (available at http://faculty.washington.edu/~jstorey/), which calculates q values for the Monte-Carlo significance tests. We used the bootstrap option in q value, and allowed the tuning parameter lambda to range in [0, p*], where p* was the 75th percentile of the Monte-Carlo p values.

3.6.2 Handling of missing data

Missing data are treated in the "passive" mode (Michailidis & de Leeuw 1998; Gifi 1990) in our analysis: an observation missing a particular variable is ignored in determining the optimal scaling of that variable, but can still be used to determine scalings of other variables. The present data would be severely reduced if observations missing a variable were to be deleted entirely; the passive mode allows observations to contribute to the final result, to the extent that they are complete. With missing values in the data set, the correlations between the independent variables and the new components of the catPCA are no longer exact correlations, but approximations (see Gifi 1980, pp. 136-140, from Kroonenberg et al. 1997).

4. RESULTS

4.1 Review summary statistics

After searching, 150 papers were accepted for full text viewing; we did not record the number of papers that were found and rejected *prior* to full text viewing based on their titles or abstracts. Of these, 126 papers were rejected for one of four reasons (see Table 2). Our final sample size was 28 projects from 24 papers (one paper reviewed three projects, while two other papers reviewed two projects each).

Table 2. Rejected papers and the reason for rejection.

Full Text Viewing	Rejected – Not Located	Rejected – No Protected Area	Rejected – CAMPFIRE/ADMADE*	Rejected – insufficient monitoring
150 papers	26 papers	27 papers	11 papers	62 papers

* For projects with multiple locations that could count as distinct cases (Hulme & Murphree 2001) only one site was used following the criteria of selection outlined above.

4.2 Study Quality

Table 3. Number of projects measuring different numbers of outcomes

Number of Projects	Number of Outcomes Measured
8	4
13	3
7	2

Notable is not only the limited occurrence of comprehensive monitoring (Table 3), but also the small proportion of monitored studies that rely on quantitative measures. Only one project measured all four outcomes quantitatively, and ten projects had no quantitative monitoring at all (see Appendix for detailed information of the amount and quality of monitoring for each proeject). We appreciate that the number of outcomes monitored is only one index of study quality; other dimensions might include monitoring design, sampling accuracy, baseline surveys, and consideration of spatial and temporal scales and we suggest these might be the subject of a future systematic review. Here we focus on the number of outcomes measured because of its utility in revealing conservation and development trade-offs.

4.3 Study Characteristics

The projects reviewed are from 14 different countries. There were five from Indonesia, four from Madagascar, three each from Nepal and Costa Rica, two each from Brazil, Mozambique, and Guatemala, and one each from Cameroon, Zambia, Belize, Nigeria, Zimbabwe, Botswana, and Mexico.

4.4 Outcome of the review

4.4.1 Categorical PCA

Categorical analyses were used to provide a qualitative visual exploration of the data. First we will consider how predictor variables map onto the two dimensions. Factor loadings (Table 4) represent the approximate correlation coefficients describing the relationship between the optimally scaled predictor variables and the two constructed dimensions. These loadings are quite low for all variables, but are presented graphically (Figure 1a – 1g) to ease interpretation.

Table 4. Loadings for the optimally scaled variables on the first two dimensions. The loadings are approximate correlation coefficients between the optimally scaled variable and the two dimensions, respectively. The sum of squared loadings, given in the right-hand column, is sometimes called the "percent of variance" in the optimally scaled variable explained by the first two dimensions.

	Correlation Coefficients		**Percent Variance**
Variable Name	**Dimension 1**	**Dimension 2**	
IUCN	-0.35	-0.05	0.13
Decision	-0.29	-0.19	0.12
Labor	-0.12	0.32	0.12
Sell	-0.23	0.22	0.10
Threat	-0.27	0.15	0.09
Implementation	-0.17	-0.20	0.07
Use	-0.23	-0.10	0.06

Next we look at how the CatPCA reveals structure from which we can make tentative statements regarding our four hypotheses. Looking first at attitude success we see some, albeit minor, structure in the plot (Figure 2). Attitude failures, represented by the “x” are associated with positive values in Dimension 1 and negative values in Dimension 2. Referring back to the predictor variable plots, we can make some associations by noting variables with values in the same region. Specifically minimal and moderate levels of market penetration, as measured by selling (Figure 1e), labor (Figure 1f), and market threat level (Figure 1g) are also associated with positive values of dimension 1 and negative values of dimension 2. This suggests that there is some association between lower levels of market integration and attitudinal failure.

Turning now to behavioral success, denoted by the black square, we see that this is associated with negative values in dimensions 1 and 2 (Figure 2). Cross-referring again to the predictor variable plots, we can see that behavioral success is associated loosely with lower levels of protection (Figure 1a), higher levels of utilization (Figure 1b), more community control and involvement in implementation (Figure 1c) and decision making (Figure 1d). As regards ecological and economic success, we found no structure in either plot, and therefore it is not possible to make any claims about associations with independent variables.

Figures 1a – 1g. Plots of the optimally scaled predictor variables as they fit in relation to the constructed dimensions. For descriptions of the categories for each variable, see Table 1.
a. IUCN ranking (SNR= Strict Nature Reserve, NP= National Park, OTR= Other) **b.** Utlization/Protection axis (ETR= Ecotourism, SBC= Substitution/Compensation, ENH= Enhancement or a combination of substitution/compensation/enhancement) **c.** Centralization (R= Regional (includes 1 observation of community level), NI= National or International) **d.** Decision Making (no-community, some-community, and community) **e.** Market Penetration- Selling (Min= Minimal, Mod= Moderate, Lrg= Large) **f.** Market Penetration – Labor (Min= Minimal, Mod= Moderate, Lrg= Large) **g.** Threat Total (low = threat levels from 1-5, high = threat levels 6-9).

Figure 1

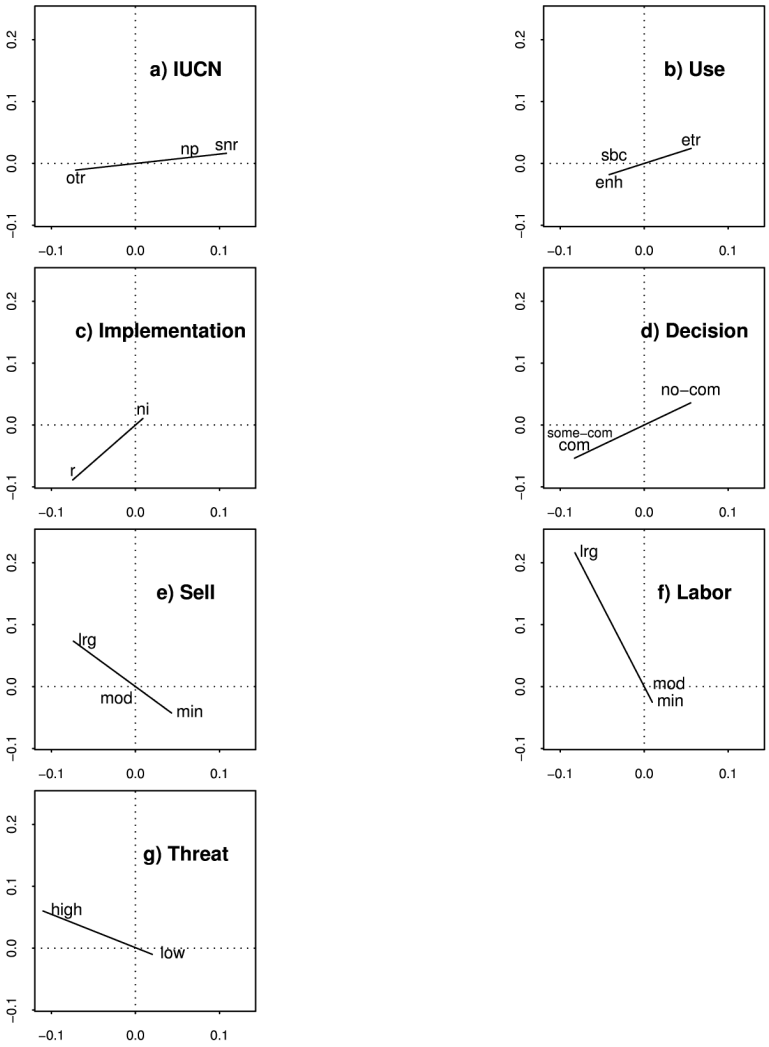
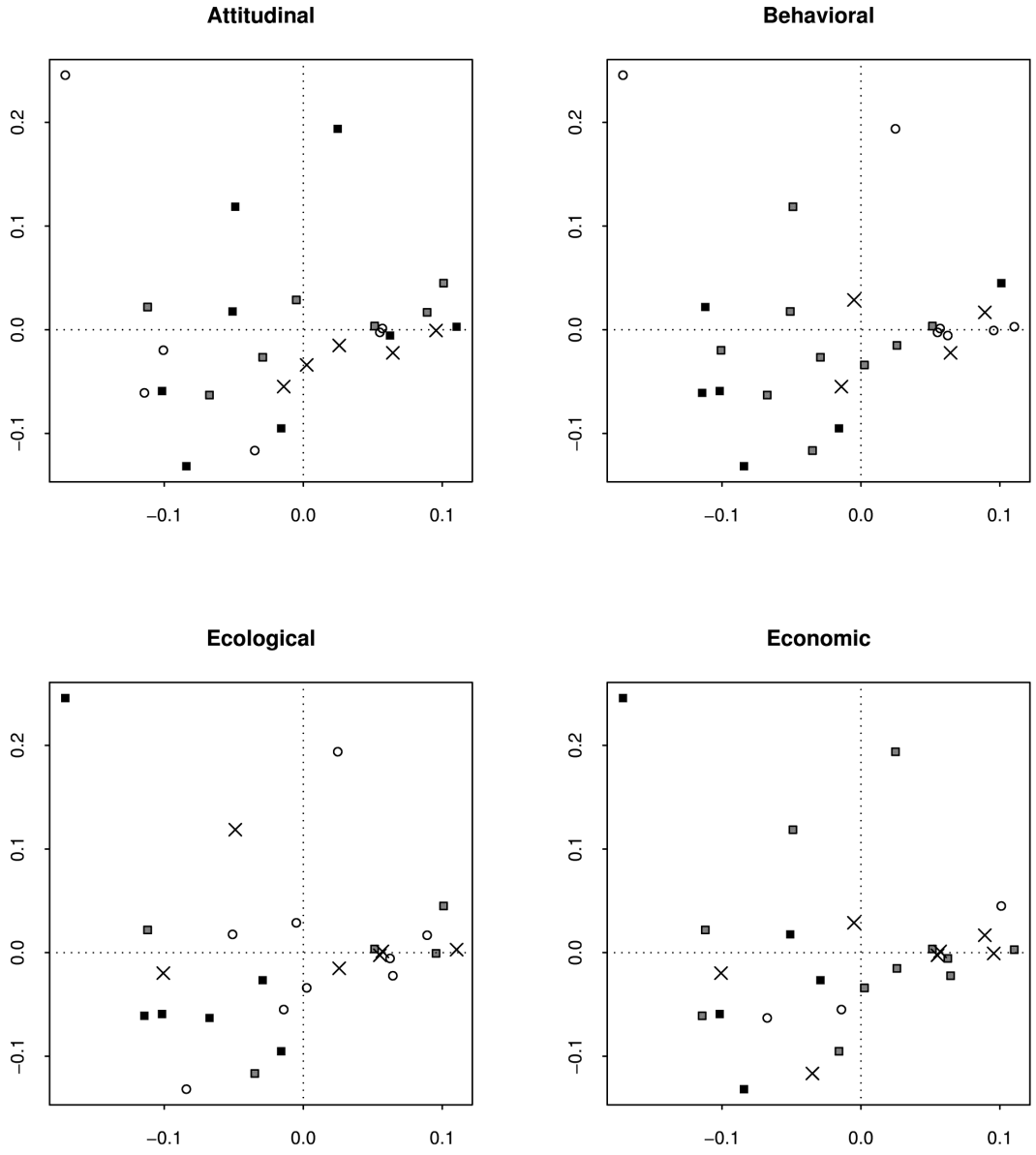


Figure 2. Plots of object scores for each project as labeled by the four different measures of success. Each symbol represents the result in that specific outcome measure for each project used in the study. Solid Squares represent Success, Grey Squares represent Limited Success, the X symbol represents failure, and Open Circles represent Missing Values.

Figure 2



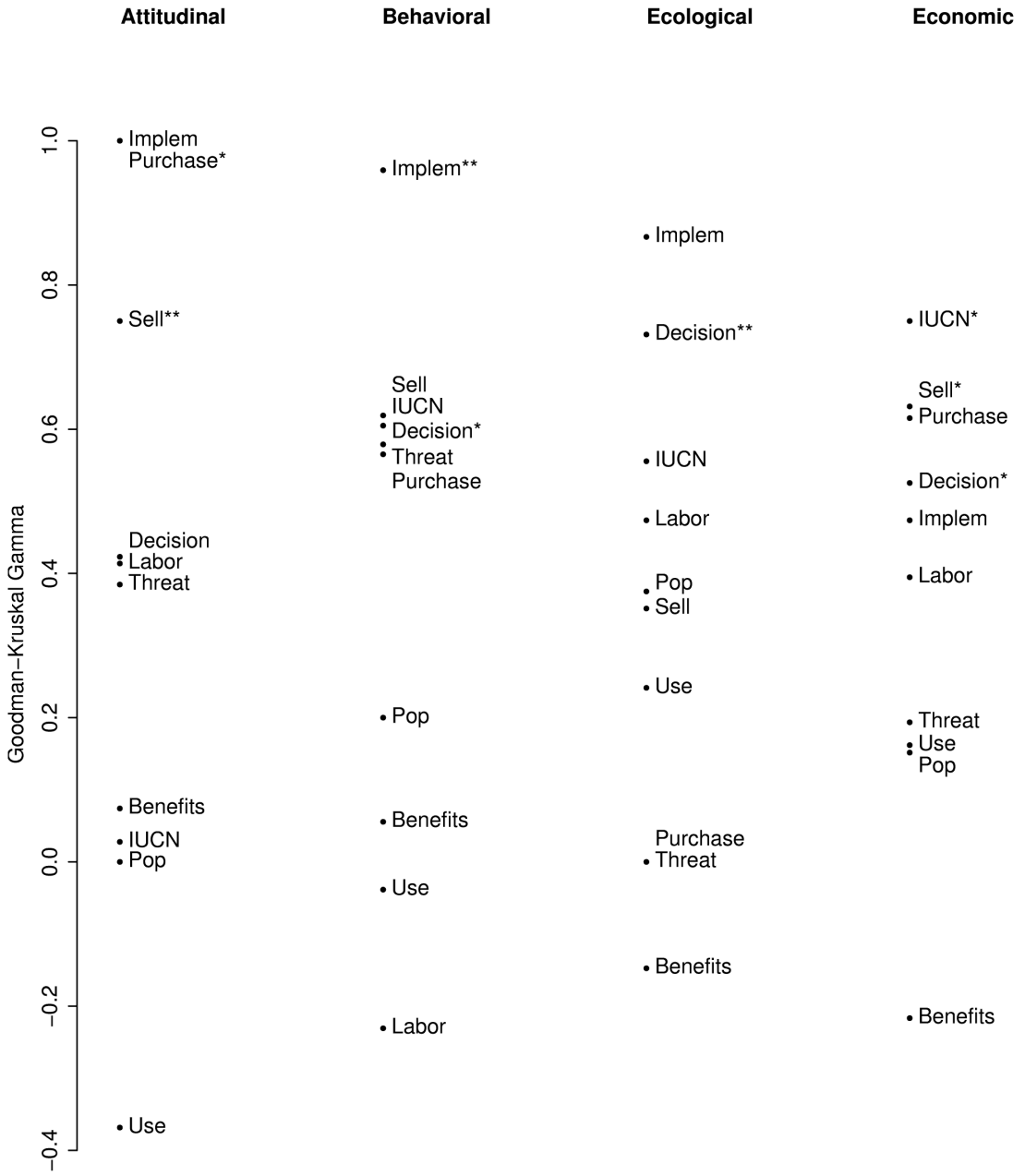
4.4.2 Monte Carlo and False Discovery Rate

Figure 3 shows Goodman-Kruskal Gamma statistics for the contingency tables of predictors and outcomes and indicates those tables presenting significant positive associations. Sample sizes for the tables range from n=7 (for Purchase x Ecological Success) to n=25 (for Threat x Economic Success), thus the statistical power to detect association may vary widely. We call the eight tests having one or two asterisks "significant": control of the FDR by q-values then implies that of these eight tests, at most one (0.1 x 8) is expected to be a truly null case.

The eight tables show evidence for greater attitudinal success among projects allowing for more purchasing and selling opportunities, greater behavioral success among projects that have more community involvement in the implementation of a project, greater ecological success among projects that involve the community in decisions about the project as it progresses, and greater economic success among projects with fewer restrictions on the use of the protected area.

Figure 3. Goodman-Kruskal gamma statistics for contingency tables of predictors (in columns) and outcomes (column headings). The value of gamma for the table is plotted along the y-axis. Gamma relatively close to 1 indicates a positive association between the ordinal levels of predictor and outcome. Double asterisks indicate tables having q values in [0, 0.05], single asterisks q values in [0.05, 0.1]. Significance levels are adjusted for the false discovery rate of the series of tests as described in the text ("Implem" denotes the variable *Implementation*, and "Pop" *Population*).

Figure 3



4.4.3 Combined Results

Both analytical results support the following conclusions: attitudinal outcomes are associated with selling opportunities (success with more selling opportunities, failure with fewer selling opportunities), and greater behavioral success is associated with community involvement in implementation and decision making. See Table 5 for a summary of the results of both analytical tests.

Table 5. Results of both the catPCA and Monte Carlo/False Discovery Rate Analyses as they apply to main questions of the review.

Objectives – Question	catPCA	Monte Carlo/ False Discovery Rate
Utilization / Protection	Lower levels of protection and higher levels of utilization are associated with behavioral success	Lower levels of protectionism are associated with economic success
Market Integration	Lower market selling and wage labor, and lower market-based threat are associated with attitudinal failure	More market selling is associated with attitudinal and economic success. More market purchasing is associated with attitudinal success.
Decentralization	More community involvement in implementation and decision-making is associated with behavioral success	More community involvement in decision making is associated with ecological, economic, and behavioral success. More community involvement in implementation is associated with behavioral success
Homogeneity	Not included in analysis	No significant associations

5. DISCUSSION

The associations we observed consistently support predictions stemming from the social science framework that emphasizes utilization, decentralization, and market access as conservation strategies. These results suggest there are strengths to the integrated conservation and development program, at least under some circumstances, despite cogent critiques of some of its logic (e.g., Robinson & Redford 2004). We stress, however, that we view our results as provisional due to the paucity of reliable data on project characteristics and outcomes. As the majority of projects in our initial sample were inadequately monitored and assessed, the possibility remains that our final sample of 28 projects differs systematically with regard to characteristics and outcomes of "typical" ICDPs. Furthermore, the small size and incompleteness of some project records in our final sample make drawing conclusions a precarious task. The addition of even a few projects meeting our criteria would potentially change the results. These observations reflect the poor standards of monitoring and assessment – a shocking situation given the considerable budgets of many ICDPs. We now discuss our findings as they pertain to the four original hypotheses.

1. Utilization/Protection – The prediction was that greater levels of utilization would be associated with all four measures of success. It appears as though greater access to natural

resources within buffer zones or extractive reserves is linked to greater behavioral (catPCA) and greater economic success (Goodman-Kruskal) for conservation and development projects, providing some support for our hypothesis. This relationship may exist because some level of acceptable use results in more willingness to observe protected regions, and/or encourage sustainable use of a resource as a result of positive behavioral changes in community members. These behavioral changes would then in turn result in positive ecological outcomes. Campbell (1998) reported such a case in Costa Rica where legal collection of turtle eggs through a permit system reduced illegal offtake, increased community protection of the resource, and resulted in increased turtle numbers. While one would assume that positive attitudinal outcomes would also be present, no conclusions can be made regarding the link between utilization and attitudinal success. There was also no support for the hypothesis that utilization is associated with ecological success. An ideal test of the hypothesis is to explore links between the extent to which utilization is permitted, the effectiveness of policing, the returns to legal utilization, associated attitudes, and various measures of the success of the project. While some studies have begun to unravel some of these links at specific sites (Marcus 2001; Walpole 2001; Struhsaker et al. 2005), data are not available to do this in a comparative context.

The hypothesis that most ecologists favor, namely that utilization is associated with poor ecological outcomes, was not supported in this study. While there is undeniable evidence that many natural resources cannot withstand utilization (Alvard 1998; Robinson & Bennett 2000; MAF unpublished data) sustainable harvesting of some species (often plants and sometimes maritime resources) can be a viable strategy in some cases, where institutions regulating sustainable management are strong (as with fisheries comanagement, Katon et al. 1999) or when population sources remain protected (Hill et al. 1997).

2. Market Integration – The prediction was that higher levels of market integration would be associated with success in all four outcome measures. Indeed, our data provides support for an association between greater market access and attitudinal success (Goodman-Kruskal) and suggests a link between attitude failure and low levels of market penetration (catPCA). These findings support suggestions by Godoy that certain levels of market integration can reduce indigenous impacts on game (2001: chapter 6; and see Godoy 1995 for more tentative claims related to non-timber forest products).

There is, however, a great deal of evidence about how commercialization, road access, and technology acquired through the market negatively affect the sustainability of traditional resource exploitation patterns (Kaplan and Kopishke 1992; Panayotou & Ashton 1992; Freese 1997; Robinson & Bennett 2000; Lybbert et al. 2004). Ultimately, the impacts of economic development on local environments may depend on the nature of markets (sales, purchases, labor), and the nature of the use (forest clearance or hunting game) (Godoy 2001; Demmer et al. 2002; Apaza et al. 2003). Such distinctions could not be drawn because they were not addressed in sufficient detail in the literature. The finding that a lower threat level was associated with attitudinal failure suggests that in the absence of noticeably severe threats to an important resource community members have no need for concern (Leach 1972; Bennet 1976).

3. Decentralization – The prediction was that greater decentralization would be associated with success in all four outcome variables. The data suggest that more community input in implementation is indeed linked with behavioral success (catPCA and Goodman-Kruskal), and that greater involvement in decision making is associated with both behavioral success

(catPCA) and ecological success (Goodman-Kruskal) supporting the claims of community-based conservationists (e.g. Western & Wright 1994) and allied approaches (Getz et al. 1999).

Despite the associations in the predicted direction, decentralization is no guarantee of success. Successful decentralization depends on both the presence of functioning institutions within the community and on socio-economic and political conditions prior to decentralization (Borgerhoff Mulder & Coppollilo 2005). Without solid community-level institutions for regulating common-pool resource use, decentralization may simply shift control to the elite in the community doing little to solve the problem of resource exploitation (Wyckoff-Baird et al. 2000). Ultimately, when external funding dries up, the success of any project will depend on the ability of the local communities to manage their resources over the long term. This is often a function of the effectiveness of community institutions (Agrawal 2002; Ribot 2004) which are frequently impacted by our final variable, community homogeneity.

4. Community Homogeneity – Community homogeneity could not be properly addressed due to the high number of missing values in the one variable used to measure homogeneity. This caused it to be dropped from the catPCA analysis. Further, it was not significantly associated with any of the outcome variables in the contingency tables. While homogeneity among group members is often listed as a characteristic necessary for community-level institutions (Wade 1988; Ostrom 1990; Baland & Platteau 1996), some heterogeneity can actually be beneficial. The thinking here is that those with the most at stake may shoulder the costs of monitoring and enforcement and therefore contribute to the project's success (Olson 1965). Results from both modeling exercises and empirical investigations support this prediction (Agrawal & Yadama 1997; Ruttan & Borgerhoff Mulder 1999). While the commons literature has made tremendous strides in determining what community and environmental attributes contribute to successful resource regulation, there is still uncertainty as to the role that the cultural and economic homogeneity of the community plays.

5.1 Review Limitations – Data Quality

Our lack of strong findings points to the urgent need for better, quantitative monitoring of conservation and development initiatives (Stem et al. 2003; Sutherland et al. 2004). Less than a quarter of the originally reviewed articles could be used in this study. Of the 28 projects we did use, only eight monitored all four aspects of success, and of the remaining 20, seven monitored only two categories. Additionally, many of the project assessments lacked quantitative rigor. Only one project quantitatively monitored all four aspects of success, and only two projects quantitatively monitored three of the aspects. Ten projects had no quantitative monitoring, instead relying on qualitative findings that were, at best, only suggestive of success or failure. Furthermore there was no clear consistency among outcomes – with consistency (success, limited success, failure) occurring among outcomes in 75%, 31%, and 100% of projects with four, three, and two outcome measures, respectively. In addition, measures of ecological success (or limited success) were not ideal. Examples of ecological assessment in our study sample range from quantified measures of declining rates in deforestation (Community Initiative Program (CIP), Brazil), or linear regressions of the percent of land a household has in forest cover (Corcovado National Park / Pierdras Blancas National Park, Costa Rica), to qualitative observations regarding the decision to set aside land for a mahogany reserve (CI-Brasil Pinkaiti Research Station Project), success in managing grass collection inside a reserve (Royal Chitwan National Park, Nepal), or an effective tree-planting scheme (Kilum-Ijim Forest Cameroon). We did not include any grey literature in our

sample, only peer-reviewed articles, thus the possibility does exist that our results may be influenced by publication bias.

6. REVIEWERS' CONCLUSION

Implications for conservation

Provisional results suggest that there are strengths to the integrated conservation and development paradigm at least under some circumstances, despite cogent critiques of some of its logic (e.g., Robinson & Redford 2004). The associations we observed support the predictions stemming from the social science framework that emphasizes utilization, decentralization, and market access as a means for achieving conservation success. The hypothesis that most ecologists favor, that low protection and high utilization are associated with poor ecological outcomes, was not supported in our study. Although there is undeniable evidence that many natural resources cannot survive use (Alvard 1998; Robinson & Bennett 2000; MAF unpublished data), sustainable harvesting of some species (often plants and sometimes aquatic resources) can be a viable strategy in some cases, where institutions regulating sustainable management are strong, as in fisheries comanagement (Katon et al. 1999) or when population sources remain protected (Hill et al. 1997). Our results suggest that ICDPs are being set up at just such sites.

Our results are by no means conclusive, and suffer from the paucity of high quality data. Without far better monitoring schemes in place it is still impossible to provide a systematic evaluation of how different strategies are best suited to different conservation challenges. More attention and funding are required for collecting relevant monitoring data for each of the four outcome categories. Further, longitudinal rather than cross-sectional studies will be more effective in evaluating the success of any strategy.

Comparisons with other Studies

Our results pertaining to the decentralization hypothesis are largely consistent with those of Salafsky et al. (2001) who found that the extent to which community members are involved in the management and design of a project was particularly important for ecological success. Our results are inconsistent with Bruner et al.'s (2001) demonstration of the success of protectionism but are not strictly comparable because we evaluated a suite of alternative hypotheses and outcome measures, whereas Bruner et al. addressed only protectionism. Bruner et al. found that ecological success was associated with protectionism, but we found no such effect. Rather we found significant behavioral and economic success in the absence of protectionism. Struhsaker et al. (2004) found that ecological success was associated with many predictive variables (such as effective law enforcement, low population level, and large reserve size) but not with employment benefits, multiple forms of extension (such as conservation education and conservation clubs), or with the presence of integrated conservation and development initiatives in the area, findings that are again inconsistent with our results.

There are many reasons why our results might differ. First Struhsaker et al. (2004) look only at tropical forest ecosystems, and only in Africa. Most likely, different strategies will be suited to different kinds of conservation challenges. Second, it remains a strong possibility that ICDPs and other kinds of extension services are established precisely in

those areas where the most acute conservation challenges exist. This would account for the association between poor ecological outcomes and ICDPs in Struhsaker et al.'s (2004) study. Our study is immune to this particular problem because only ICDP sites were sampled. Third, their findings are inconsistent with evidence from Tanzania showing (through multiple logistic regression) that differences among individuals in their attitudes to Katavi National Park are largely a function of the perception of park outreach activities (Holmes 2003). This highlights the fact that although overall outreach may not be associated with success (in a between-project comparison such as in Struhsaker et al.), within-project variability in perception of outreach services can have major conservation impacts. This distinction must be kept clear when considering management implications of apparently contradictory studies. Fourth, Struhsaker et al. (2004) rely on questionnaires with managers and scientists, and personal observations, whereas we relied on published peer-reviewed reports. Which source of data is less problematic is an open question; both are clearly fraught with potential bias, although Struhsaker et al.'s strategy provides a much cleaner data set with fewer missing values, thereby affording greater statistical flexibility. Without independent measures of the various biases entailed in both strategies, it seems wise to pursue both approaches.

Implications for Research

Clearly we concur with Sutherland et al. (2004) that a comprehensive remedy lies in concentrating more funds and study into collecting relevant monitoring data. High priority should be given to longitudinal rather than cross-sectional studies in evaluating the success of any strategy because of the problem of endogeneity (such as ICDPs being set up in troubled areas). To facilitate comparative analyses in the future, primary researchers and evaluation teams need to be clear about the specific problem that the project is designed to address and the goals of the project in each of the four outcome areas.

We would also like to emphasize the importance of including multiple measures of success. Collecting cross-disciplinary data to evaluate conservation success remains a major priority. Such work is not easy. It requires collaborative efforts, since individual researchers often lack the training or interest to collect data outside of their field and funding is often lacking. There are also methodological difficulties in collecting both behavioral data and large-scale ecological data. Nevertheless, rigorously collected data that cover only one or two measures of success have limited analytical value because conservation and development projects almost inevitably have ecological, economic, and social consequences. Without measures of success that span these distinct dimensions, the effectiveness of the conservation and development paradigm cannot be determined.

We acknowledge that our review reflects the methodology and intellectual concerns of an anthropologist or conservationist, and we hope that people with direct experience in international development will expand our methodology and search criteria to revisit other assumptions within the conservation-development debate. Some interesting topics that could be addressed in a future systematic review include evidence of project sustainability, land ownership, community financial or labor input into projects, and breadth of outreach activities, and the role that these factors play in contributing to the success of conservation and development projects.

In the future primary researchers and evaluation teams need to be clear about 1) the specific problem that the project is designed to address; 2) the goals of the project in each

of the four important outcome areas; 3) the cultural make-up of the communities involved in the project; 4) the specific economic situation facing these communities and their degree of market involvement. This data needs to be collected in a rigorous, standardized fashion.

We originally intended to use only projects with data on all four dimensions, with the aim of analyzing the interdependencies among different measures of success. As noted earlier there was no clear evidence of consistency (or inconsistency) among outcomes, and there are too few studies of outcomes to permit statistical analysis of the consistencies and inconsistencies among these outcomes. Until a more statistically powerful study of the consistencies (and inconsistencies) among outcomes can be made, conservationists face a situation in which a particular project, for example an extractive reserve, may be judged a success by an economist based on increased income for local inhabitants, and a failure by an ecologist and an anthropologist based on, respectively, a critical population decline within the ecosystem and an absence of changed community values regarding conservation. Insofar as the conservation and development paradigm is founded on the assumption that human and ecological well-being are inextricably linked, proper support for this paradigm will need to demonstrate empirically such an interdependence of measures of success.

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APPENDIX. Table of included studies and corresponding measures of success.

Project Name	Location	Source
Kilum-Ijim Forest	Cameroon	Abbot, J. Abbot, J. I. O., D. H. L. Thomas, A. A. Gardner, S. E. Neba, and M. W. Khen. 2001. Understanding the links between conservation and development in the Bamenda highlands, Cameroon. World Development **29**:1115-1136.
Measures of success:	Attitude (quantitative limited success) Behavior (quantitative limited success) Ecological (qualitative success) Economic (qualitative success)	
Ecological measure:	respect of forest boundary and tree planting along forest boundary	
Community Initiative Program (CIP)	Brazil	Browder, J. O. 2002. Conservation and development projects in the Brazilian Amazon: Lessons from the community initiative program in Rondonia. Environmental Management **29**:750-762.
Measures of success:	Behavior (qualitative limited success) Ecological (quantitative limited success) Economic (qualitative failure)	
Ecological measure:	reduced rates of deforestation in areas with high percentage of projects (other forms of degradation persist)	
Ostional Egg Harvest Project	Costa Rica	Campbell, L. M. 1998. Use them or lose them? Conservation and the consumptive use of marine turtle eggs at Ostional, Costa Rica. Environmental Conservation **25**:305-319.
Measures of success:	Attitude (quantitative success) Behavior (quantitative success) Ecological (qualitative success) Economic (quantitative success)	
Ecological measure:	interviewees report increasing turtle numbers as a result of the project	
Tchuma Tchato	Mozambique	The Bawa Village Community. 1997. Mozambique's Tchuma Tchato initiative of resource management on the Zambezi: a community perspective. Society & Natural Resources **10**:409-413.
Measures of success:	Behavior (qualitative success) Ecological (qualitative success) Economic (qualitative limited success)	
Ecological measure:	community reports that wildlife numbers increased within one year of project start	
Isalo National Park	Madagascar	Durbin, J. C., and S. N. Ratrimoarisaona. 1996. Can tourism make a major contribution to the conservation of protected areas in Madagascar? Biodiversity and Conservation **5**:345-353.
Measures of success:	Attitude (qualitative success) Economic (quantitative limited success)	
Amber Mountain National Park	Madagascar	Durbin, J. C., and S. N. Ratrimoarisaona. 1996. Can tourism make a major contribution to the conservation of protected areas in Madagascar? Biodiversity and Conservation **5**:345-353.
Measures of success:	Attitude (qualitative success)	

	Economic (quantitative limited success)	
ADMADE	Zambia	Gibson, C. C., and S. A. Marks. 1995. Transforming Rural Hunters into Conservationists - an Assessment of Community-Based Wildlife Management Programs in Africa. World Development **23**:941-957.
Measures of success:	Attitude (implied failure) Behavior (quantitative limited success) Economic (quantitative limited success)	
Maya Biosphere Reserve (Gatherings™)	Guatemala	Gould, K., A. F. Howard, and G. Rodriguez. 1998. Sustainable production of non-timber forest products: Natural dye extraction from El Cruce Dos Aaguadas, Peten, Guatemala. Forest Ecology and Management **111**:69-82.
Measures of success:	Behavior (qualitative limited success) Ecological (quantitative failure) Economic (qualitative failure)	
Ecological measure:	estimated future over-harvesting and depletion of two dye-tree populations	
Community Baboon Sanctuary (CBS)	Belize	Hartup, B. K. 1994. Community Conservation in Belize - Demography, Resource Use, and Attitudes of Participating Landowners. Biological Conservation **69**:235-241.
Measures of success:	Attitude (quantitative success) Behavior (quantitative success) Ecological (implied success) Economic (qualitative limited success)	
Ecological measure:	author mentions an increase in the number of howler monkeys	
Cross River National Park (CRNP)	Nigeria	Ite, U. E. 1996. Community perceptions of the Cross River National Park, Nigeria. Environmental Conservation **23**:351-357.
Measures of success:	Attitude (quantitative failure) Behavior (qualitative failure) Economic (quantitative limited success)	
Private Wildlife Refuge Program	Costa Rica	Langholz, J., J. Lassoie, and J. Schelhas. 2000. Incentives for biological conservation: Costa Rica's Private Wildlife Refuge Program. Conservation Biology **14**:1735-1743.
Measures of success:	Attitude (qualitative limited success) Behavior (implied limited success) Ecological (implied success)	
Ecological measure:	increased preservation of important habitat through expansion of private wildlife refuges	
Royal Chitwan National Park (Grassland Ecology and Human Use)	Nepal	Lehmkuhl, J. F., R. K. Upreti, and U. R. Sharma. 1988. National-Parks and Local Development - Grasses and People in Royal-Chitwan-National-Park, Nepal. Environmental Conservation **15**:143-148.
Measures of success:	Attitude (quantitative limited success) Behavior (qualitative limited success) Ecological (qualitative limited success)	

	Economic (quantitative limited success)	
Ecological measure:	management of legal grass collection inside park	
National Environmental Action Plan	Madagascar	Marcus, R. R. 2001. Seeing the forest for the trees: Integrated conservation and development projects and local perceptions of conservation in Madagascar. Human Ecology **29**:381-397.
Measures of success:	Attitude (quantitative limited success) Behavior (quantitative failure) Economic (quantitative failure)	
CAMPFIRE (Masoka)	Zimbabwe	Matzke, G. E., and N. Nabane. 1996. Outcomes of a community controlled wildlife utilization program in a Zambezi valley community. Human Ecology **24**:65-85.
Measures of success:	Attitude (implied success) Behavior (qualitative success) Economic (quantitative success)	
Annapurna Conservation Area (ACA)	Nepal	Mehta, J. N., and J. T. Heinen. 2001. Does community-based conservation shape favorable attitudes among locals? An empirical study from Nepal. Environmental Management **28**:165-177.
Measures of success:	Attitude (quantitative success) Behavior (qualitative limited success) Economic (qualitative success)	
Makalu-Barun National Park and Conservation Area (MBNPCA)	Nepal	Mehta, J. N., and S. R. Kellert. 1998. Local attitudes toward community-based conservation policy and programmes in Nepal: a case study in the Makalu-Barun Conservation Area. Environmental Conservation **25**:320-333.
Measures of success:	Attitude (quantitative limited success) Behavior (qualitative failure) Economic (quantitative failure)	
Ranomafana National Park Project	Madagascar	Peters, J. 1998. Transforming the integrated conservation and development project (ICDP) approach: Observations from the Ranomafana National Park Project, Madagascar. Journal of Agricultural & Environmental Ethics **11**:17-47.
Measures of success:	Ecological (qualitative failure) Economic (quantitative failure)	
Ecological measure:	agricultural fields found within park boundary around much of the perimeter	
Bunaken National Park	Indonesia	Ross, S., and G. Wall. 1999. Evaluating ecotourism: The case of North Sulawesi, Indonesia. Tourism Management **20**:673-682.
Measures of success:	Attitude (implied failure) Ecological (implied failure) Economic (implied limited success)	
Ecological measure:	little conservation resulting from ecotourism (natural ecosystem not protected)	
Bogani Nani Wartabone National Park	Indonesia	Ross, S., and G. Wall. 1999. Evaluating ecotourism: The case of North Sulawesi, Indonesia. Tourism Management **20**:673-682.

Measures of success:	Attitude (implied failure) Ecological (implied limited success) Economic (implied failure)	
Ecological measure:	limited achievement of ecosystem protection	
Tangkoko DuaSudara Nature Reserve	Indonesia	Ross, S., and G. Wall. 1999. Evaluating ecotourism: The case of North Sulawesi, Indonesia. Tourism Management **20**:673-682.
Measures of success:	Attitude (qualitative success) Ecological (implied failure) Economic (implied limited success)	
Ecological measure:	little conservation resulting from ecotourism (no biodiversity protection)	
Maya Biosphere Reserve	Guatemala	Salafsky, N., B. L. Dugelby, and J. W. Terborgh. 1993. Can Extractive Reserves Save the Rain-Forest - an Ecological and Socioeconomic Comparison of Nontimber Forest Product Extraction Systems in Peten, Guatemala, and West Kalimantan, Indonesia. Conservation Biology **7**:39-52.
Measures of success:	Ecological (qualitative success) Economic (qualitative success)	
Ecological measure:	harvesting methods are not destructive and a decade of harvesting has not resulted in overexploitation of the target species	
Gunung Palung National Park	Indonesia	Salafsky, N., B. L. Dugelby, and J. W. Terborgh. 1993. Can Extractive Reserves Save the Rain-Forest - an Ecological and Socioeconomic Comparison of Nontimber Forest Product Extraction Systems in Peten, Guatemala, and West Kalimantan, Indonesia. Conservation Biology **7**:39-52.
Measures of success:	Ecological (qualitative failure) Economic (qualitative failure)	
Ecological measure:	harvest practices deemed unsustainable because many involve destruction of the individual or removal of reproductive parts	
Moribane Forest Reserve	Mozambique	Schafer, J., and R. Bell. 2002. The state and community-based natural resource management: the case of the Moribane Forest Reserve, Mozambique. Journal of Southern African Studies **28**:401-420.
Measures of success:	Attitude (implied failure) Behavior (qualitative failure)	
Corcovado National Park / Piedras Blancas National Park	Costa Rica	Stem, C. J., J. P. Lassoie, D. R. Lee, D. D. Deshler, and J. W. Schelhas. 2003. Community participation in ecotourism benefits: The link to conservation practices and perspectives. Society & Natural Resources **16**:387-413.
Measures of success:	Attitude (quantitative limited success) Behavior (quantitative success) Ecological (quantitative limited success) Economic (quantitative limited success)	
Ecological measure:	linear regression showing significant positive relationship between involvement in	

	(or exposure to) tourism and the percent of household land in forest cover	
Okwa Wildlife Management Area	Botswana	Twyman, C. 2000. Livelihood opportunity and diversity in Kalahari Wildlife Management Areas, Botswana: Rethinking community resource management. Journal of Southern African Studies **26**:783-806.
Measures of success:	Attitude (implied failure) Behavior (implied limited success) Ecological (qualitative failure) Economic (implied limited success)	
Ecological measure:	interviewees report fewer animals in the area	
Komodo National Park	Indonesia	Walpole, M. J., and H. J. Goodwin. 2001. Local attitudes towards conservation and tourism around Komodo National Park, Indonesia. Environmental Conservation **28**:160-166.
Measures of success:	Attitude (quantitative success) Economic (quantitative limited success)	
El Vizcaino Biosphere Reserve	Baja, Mexico	Young, E. H. 1999. Balancing conservation with development in small-scale fisheries: Is ecotourism an empty promise? Human Ecology **27**:581-620.
Measures of success:	Attitude (qualitative success) Behavior (implied limited success) Ecological (qualitative failure) Economic (qualitative limited success)	
Ecological measure:	interviewees report depleted fish stocks; increase in boats potentially harmful	
CI-Brasil Pinkaití Research Station Project	Brazil	Zimmerman, B., C. A. Peres, J. R. Malcolm, and T. Turner. 2001. Conservation and development alliances with the Kayapo of south-eastern Amazonia, a tropical forest indigenous people. Environmental Conservation **28**:10-22.
Measures of success:	Attitude (implied limited success) Behavior (quantitative success) Ecological (qualitative limited success) Economic (qualitative limited success)	
Ecological measure:	establishment of a mahogany reserve	