Conservation Bridge – Cornell University

APPENDIX VIII-A

Methods for Addressing Human-Wildlife Conflicts in Bhutan

Management Strategies from Cornell University's Undergraduate Course in International Eco-Agriculture and Environmental Conservation

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Table of Contents

Introduction

Over the past two decades, Bhutan has been internationally recognized for its efforts in conservationism. The country sits at the intersection of four biogeographic divisions, making it an ecological and biodiversity hotspot. In order to protect its unique ecosystem, Bhutan initiated a series of conservation programs in the 1990's. Over 40% of the country's land has been set aside for conservation, and 60% has been mandated to be under permanent forest cover. These strategies are part of a larger cultural development philosophy in Bhutan to promote the Gross National Happiness (GNI) of the Bhutanese people. Bhutan has earned conservation awards from both the United Nations and the World Wildlife Fund for these recent accomplishments in conservationism.

Though Bhutan has been heralded as a global leader in conservation, its success has been accompanied by an increase in conflicts between humans and wildlife populations. Based on a 1995 Forest and Nature Conservation Act, farmers are permitted to live inside protected areas. As a result, farmers have been experiencing increasing amounts of damages to both their crops and livestock. Some farmers have retaliated with violence against wildlife populations, and reports of killings have become more common.

In order to protect both farmer's resources and Bhutan's recent investments in conservation, the country must address the issue of human-wildlife conflicts. The report titled *Bhutan National Human-Wildlife Conflicts Management Strategy,* published in 2008, demonstrates recent government efforts to mitigate the problem. Since the strategy's release, there have been advances in the areas of conservation management, which this report aims to include as an addendum to the previous publication. This report seeks to outline a comprehensive strategy for addressing Bhutan's human-wildlife conflicts that is compatible with the country's recent transition to democracy and its efforts to promote peaceful co-existence of people

and the environment. Our report recommends using participatory management strategies such as SMART and possibly implementing market-based strategies such as payments for ecosystem services in order to address Bhutan's increasing incidence of human-wildlife conflicts.

Participatory Management

Introduction

As Bhutan continues its transition from a monarchy to a democracy, it will face many new challenges in determining the role and process of good governance. One of the most important issues to address is the inclusion of the public in the decision-making process. In the United States, one popular method for decision-making in natural resource policy is "adaptive management", a method that uses the fundamental principles of the scientific process to address complex management issues. However adaptive management can be a very time consuming and expensive process that involves the implementation of various solutions and long-term monitoring. Because we are unsure of the feasibility of adequate data collection for monitoring programs in remote areas of Bhutan, we believe that a similar method termed "rational planning" is more appropriate. The following chapter discusses why local participation in the decision-making process is importance, and how rational planning can be used to achieve this.

Participatory Management

Participatory co-management has many advantages that are absent from top-down approaches to conservation. Numerous studies have found that by enhancing a sense of ownership, participatory co-management encourages more responsible use of resources by the public. It also allows for a more accurate inclusion of local socio-economic restraints in the planning process, improves management through the use of local knowledge, leads to greater compliance with the regulations eventually decided upon, and improves monitoring of the ecological situation (Gutiérrez et al. 2010).

Involving local communities ensures that all stakeholders understand the multifaceted nature of complex issues such as human-wildlife conflict. And by assessing the knowledge and priorities of local communities, it not only creates a more comprehensive knowledge of the differing issues from community to community, but also demonstrates the government's intent to address the needs of both people and wildlife. This involvement leads to a sense of fairness in the decision-making process, which garners local support for the new regulations.

While participatory management provides many opportunities to improve the management process, it also faces many challenges. Minority groups may be underrepresented by the local community officials that interact with experts and politicians, which results in a façade of representation. Additionally, private companies and agencies under criticism from activist groups and NGOs can attempt to use the co-management process to make it appear as if they are including local communities in their policies and actions. But in actuality, these companies may not consider local opinion when making their ultimate decisions. A study from British Columbia (Mabee and Hoburg 2006) found that several logging companies were able to procure access to indigenous owned lands by establishing a "co-management" framework that appeased previously outspoken activist groups. But in practice, this framework brought no real power to the community, which thereby led to the forest degradation.

If local communities are to be truly empowered in the decision-making process, it is imperative to establish a framework that ensures their involvement throughout each stage in a fair and effective manner. Below, we outline a framework that may help the Bhutanese government transition to a more democratic and participatory management process; this framework can be used for addressing human-wildlife conflicts as well as a whole array of other social or natural resource management issues.

The Rational Planning Decision-Making Process

What is rational planning? Also call "rational decision-making", it is a process of realizing a problem, establishing and evaluating planning criteria, determining

methods (often referred to as alternatives) to address the issue, implementing alternatives, and monitoring and evaluating the progress and outcome of the alternatives. Most simply described, it is a structured way to make logically sound decisions.

There are four main steps in the rational planning model, all of which may include stakeholder input. The first step is "Inventory", where the details of the current situation are assessed. This can be thought of as the "where are we?" aspect of the process. The next step is "Strategic Planning", where the overall goals and objectives of the project are determined, and the importance of individual issues is addressed. At this point we ask, "where do we want to be in the future?". The third step is "Operational Planning", where methods of reaching the goals and objectives are determined. In this stage we ask, "how do we get to where we want to be?". The final stage is "Evaluation", where reflect upon the implemented methods to conclude their efficacy, thereby determining if and how we must alter them to achieve our goals.

1. Inventory.

Before any management plan can be drafted, it is essential to understand the details of the current situation. There are four key areas that should be addressed in this process: ecological inventory, political inventory, economic inventory, and socio-cultural inventory.

Ecological inventory: It is imperative to understand the physical and biological functions and processes of the ecosystem within which the management issue is occurring. In addition to scientific research, garnering input from local people ensures our knowledge of site-specific details and indigenous knowledge that may otherwise escape western scientific methods.

Political inventory: This step includes examining what laws and regulations are already in place within the area of interest; this ensures managers do not implement redundant or ineffective decisions. It is important to talk with local communities to determine to what extent the current laws and regulations are followed and if they are effective.

Economic inventory: This aspect of the process determines what costs are being incurred by the situation and whom they affect. There may be unseen or unnoticed costs being incurred by local people. Discussion between stakeholders and managers allows for these issues to be addressed and fully understood.

Socio-cultural inventory: This step requires an assessment of the beliefs, values, traditions, and practices of the communities and individuals involved. This is not just limited to local people, but also to government institutions and outside interest groups such as environmental or humanitarian NGOs.

2. Strategic Planning

It is very important in the rational planning process to not immediately determine solutions for the main problem at hand. Instead, first determine the smaller issues that compose the greater problem. Beginning with general, broader-scale goals allows managers to focus the proposed plan; once focused, it is possible address the details of each goal and target specific objectives. These are objectives, not solutions.

For example, the following is a goal: protect the livelihoods of local livestock owners. An objective that would help managers reach that goal would be to reduce the number of cattle killed by wildlife annually by 50%. The goals should broad and qualitative, while the objectives are more specific and quantitative. Managers should determine goals and objectives with input from stakeholders, such as livestock owners.

3. Operational Planning

Once goals and objectives are determined we can begin formulating methods to achieve them. These methods are often referred to as 'treatments', 'alternatives', or 'strategies'. In this stage, local community input may help to identify flaws in strategies that may make them unfeasible. Some goals and objectives will need to be targeted by multiple strategies, while other strategies may address several issues. One way to determine which strategies to use is a tool called the Simple Multi-

Attribute Ranking Technique, or "SMART". An example of how to use the "SMART" technique is explained in great detail in the following chapter.

4. Evaluation

The final step of the rational planning process is to evaluate the efficacy of the treatments at realizing the objectives. In situations where scientific monitoring is possible, it can provide direct evidence of how successful a treatment has been. Assessing objectives as indicators of progress towards the main goal can indicate which aspects of the management plan have been most effective, and which ones have not. Once an evaluation has taken place, objectives and treatments can be assessed and altered to improve the reimplementation of the plan.

S.M.A.R.T.

Simple Multi-Attribute Ranking Technique

Why use SMART?

This technique is a structured tool used by managers to solve complex, multiple-objective problems. The following text will introduce the basic concepts of SMART, and is followed by a plausible, simplified example that pertains to human-wildlife conflict in Bhutan.

Why do we use such structured methods? Because comparing drastically different treatment options, which are often measured using different units or on different scales, is hard! The SMART process functions by converting the consequences of all treatment options on a common, comparable scale. Additionally, human-wildlife conflict is a very complex issue with multiple stakeholder input and many facets. The structure provide by SMART improves thinking and decisions by "decomposing" the decision into individual options that focus on fundamental

objectives. It provides clear rationale and transparency about all proposed aspects being addressed.

How to perform a SMART analysis: A worked example for Bhutanese human-wildlife conflict

The following is a worked SMART example. This example is very simplified, with only five objectives and three treatment options. It is intended for teaching purposes only. A real-world example would be much more complex and would likely include many more objectives and treatment options. Please refer to the attached Excel spreadsheet for equations and output.

Consider we are a park manager for the Department of Forest and Park Services. The primary goal of our new management plan is to help reduce human-wildlife conflict at the edge of one of Bhutan's national parks. One of the most integral steps in the structured decision making process is to define the objectives and methods ("treatments") of the plan. We propose that we can achieve our goal by meeting the following objectives:

- Minimizing the cost of the operations
- Reducing the effects of native herbivores on farmer's crops
- Minimizing the loss of farmer's livestock to tigers
- Increasing forest understory
- Reducing the number of tigers killed per year by farmers

We propose that these objectives can be met using three simple treatments:

- Fencing of livestock during night time hours
- Insurance schemes to help compensate those farmers that do lose livestock to tigers
- Increasing the number of park guards to prevent poaching and retaliatory killings

The first step in the SMART process is to fill out the objectives-treatments matrix; refer to the attached Excel slide. “Objectives” will be listed as row name, “Treatments” as column names. The matrix is filled with the measured values or effects the treatment will have on each objective. In this SMART example, the measured effects and values have all been estimated based on a general literature review of the issue. However in a real SMART process, these measured values will have to be carefully determined by the manager through research and discussion with stakeholders and the government.

Review the matrix and its contents. Take cost, for example: fencing will cost $30,000 to implement, insurance schemes $8,000 to fund, and the installment of new park guards will cost $6,000 in training and salaries. This value is measured in dollars. The “Effects on tigers” is less intuitive; this objective will be measured in the number of tigers killed in following the implementation of the treatment. If fencing is implemented, it is projected that only 4 tigers will be killed; if insurance schemes are implemented, 10; if park guards are hired, 2. For each objective, it is important to determine if the outcome should be maximized (such as the improvement of the understory), or minimized (such as costs, or the number of tigers killed).

Once the objective and treatments have been determined, the following steps are taken to determine which treatment option is the best for meeting those objectives:

1. Normalize all treatment methods to a 0-1 scale

2. Assign weights (“importance values”) to each objective

3. Calculate the weighted sum of scores for each treatment

4. Identify the treatment with the highest weighted score

5. Conduct a sensitivity analysis to determine how the weighted scores affect the outcome

Step one: Normalize all treatment methods to a 0-1 scale . Because each objective is measured differently (some in dollars, some in measurable values, others in a 1-10 ranking system), it is necessary to normalize them in such a way that they can be

compared against one another. This is done by comparing the highest and lowest treatment values of each objective against itself in a normalized scores matrix.

- To normalize a treatment which you wish to maximize the outcome, the equation is:

$$[(\text{value} - \min)/(\max - \min)]$$

- To normalize a treatment which you wish to minimize the outcome, the equation is:

$$1-[(\text{value} - \min)/(\max - \min)]$$

Refer to the Excel sheet. By selecting an individual cell it is possible to see the normalization equation in the function bar at the top of the spreadsheet. This normalization process puts the measurement of each objective (regardless of its original unit) on a 0-1 scale. The measured output of each objective can then be compared against the others.

Step two: Assign weights to each objective. Explained most simply, weights are the importance of each objective. How do you assign weights? Weights represent the relative values that stakeholders and managers place on different objectives. The weight must be elicited from stakeholders and decision-makers, which is why SMART is such an important tool for participatory management. The higher the weight, the more important the objective; in this example, I put the most weight on the potential effect on tiger and livestock populations. For the sake of ease and simplicity, it is often best for the sum of the weights to equal 1 (see example).

Step three: Calculate the weighted scores for each treatment. In the 'weighted scores' matrix, the weight of each objective is multiplied by the normalized score of each treatment. Refer to the excel sheet if this is unclear; by selecting each cell in the weighted scored matrix, it is possible to see which cells are multiplied together to the produce the value.

Step four: Identify the treatment with the highest weighted score. Once the weighted scores have been determined, the scores for all objectives for each

treatment are summed. The treatment option with the highest sum of weighted score is the management action that should be taken. In the provided example, given the provided costs, effects, and weights, it was determined that fencing is the best management action.

Step five: Sensitivity Analysis; this is one method for handling uncertainty in a complex, multiple-objective problem such as human-wildlife conflict. Because different stakeholders may rank values with different levels of importance, a sensitivity analysis allows managers to determine how the weighted scores given to each objective affect the outcome. Repeat the analysis, varying the weights over their ranges of uncertainty; by doing this, it is possible to determine the robustness of recommended treatment options. Refer to the excel sheet; it is possible to change the values of the different cells in the 'Weight" column. Change these values and see how it affects the final score.

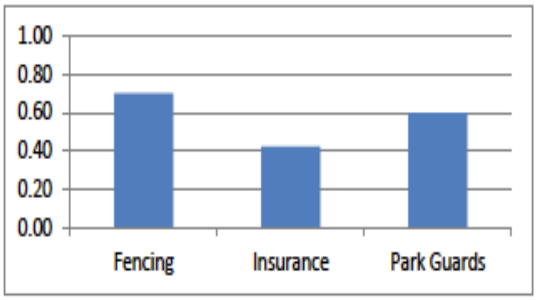
SMART is just one tool of Structured Decision Making that managers can use to involve local communities in the human-wildlife management process. Because the weights of each objective heavily influence the outcome of the analysis, stakeholder input and participation can actively influence decisions that managers and government officials make.

Example of SMART Construction

SIMPLIFIED MATRIX		Treatment (Alternatives)			
Objectives	Goal	Fencing	Insurance	Park Guards	Units
Cost	Min	30,000	8,000	6,000	$dollars
Effects on Crops	Min	8	2	2	Yield per year, 1-10 scale
Effects on Understory	Max	8	2	2	Stem density (m^2)
Effects on Tigers	Min	4	10	2	Number of tigers killed per year
Effects on Livestock	Min	2	5	15	Number of livestock killed per year

NORMALIZED SCORES		Treatment (Alternatives)			Convert performance measures to normalized (0-1) ranks	
Objectives	Goal	Fencing	Insurance	Park Guards		
Cost	Min	0.000	0.917	1.000	To normalize (max):	[(value – min)/(max-min)]
Effects on Crops	Min	0.000	1.000	1.000	To normalize (min):	1-[(value – min)/(max-min)]
Effects on Understory	Max	1.000	0.000	0.000		by row (objective)
Effects on Tigers	Min	0.750	0.000	1.000		
Effects on Livestock	Min	1.000	0.769	0.000		

WEIGHTED SCORES			Treatment (Alternatives)			Add objective weights; sum wt'd scores; avg
Objectives	Goal	Weight	Fencing	Insurance	Park Guards	
Cost	Min	0.1	0	0.091666667	0.1	
Effects on Crops	Min	0.1	0	0.1	0.1	
Effects on Understory	Max	0.1	0.1	0	0	
Effects on Tigers	Min	0.4	0.3	0	0.4	
Effects on Livestock	Min	0.3	0.3	0.230769231	0	
Sum of Weights (for all objectives)		1				
Sum of weighted scores (for each alternative)			0.70	0.42	0.60	
Final Score (sum of weighted scores/sum of weights)			**0.70**	**0.42**	**0.60**	



For a complete working example with equations, please see the attached Excel document.

Payment for Ecosystem Services and its Potential for Implementation in Bhutan

Overview

Since the national government published the *Bhutan National Human-Wildlife Conflicts Management Strategy* in 2008, an innovative model called payment for environmental services (PES) has emerged that holds potential for addressing human-wildlife conflicts. Given the recent democratic transition in Bhutan, PES may prove the most economically efficient mechanism within the structured decision-making model to address both poverty alleviation and ecosystem objectives through market-based incentives.

PES are incentivizing, market-oriented policies that compensate individuals or community members for undertaking actions that achieve the desired objective of the ecosystem as a whole. In Bhutan's case, the desired objective is to address human-wildlife conflict in an effort to increase biodiversity and protect rural livelihoods. We intend to delineate holistic options that can be used when developing a PES strategy. With this delineation, we aim to supplement the PES strategy with a review of contemporary literature from 2008 until 2012. We also provide instructive materials that can be used by the government of Bhutan to educate community members on how to construct a PES model appropriate for their culture and transforming political and economic structures.

The Problem

Diligence to the environment accumulates social benefits for the entire ecosystem, but often does not directly benefit the individual financially. Individuals who interact and directly contribute within the private marketplace exchange are

often directly rewarded and compensated. However, a market failure arises when the person taking action does not directly receive the private monetary benefits, but instead receives the social benefits that are generated to the entirety of the ecosystem. The indirect social benefit received by the individual is an externality that does not incentivize individuals to diligently tend to ecosystem services. PES is a market-oriented solution for market-failures arising from caring for the ecosystem and seeks to directly reward individuals by realigning incentives.

The Solution

PES is an emerging policy solution designed to realign direct private benefits with the social benefits that result from decisions related to ecosystem services, or in Bhutan's case, specifically human-wildlife management. Sven Wunder (2007) defines PES as a "voluntary, conditional agreement between at least one 'seller' and one 'buyer' over a well-defined environmental service or a land use presumed to produce that service." Working off this definition, we seek to educate the Bhutan community on how they can create a holistic voluntary agreement that correctly identifies effective sellers and buyers to carry out the two-pronged objective within human-wildlife management: to protect rural livelihoods and increase biodiversity.

Building a PES Strategy: Three Key Aspects

Defining Ecosystem Services

Ecosystem services are whatever nature provides that is valuable to mankind. However, when contriving a PES system, there is a distinction between ecosystem services innately provided by nature and those deriving from human husbandry. While it is important to properly classify the environmental service or good used within the PES model to avoid double counting or over-assessing, it is also important to keep an open mind about how these classifications can be uniquely combined to develop a new product or service for a PES scheme. UNEP (2008) has identified four main types of ecosystem services:

1. Cultural services or non-material benefits (e.g. ecotourism)

2. Provisioning services or products obtained from ecosystems (e.g. fresh water)
3. Regulating services (e.g. climate regulation)
4. Supporting services (e.g. nutrient cycling and soil formation)

Payment Arrangements:

After identifying the ecosystem service, a proper payment arrangement must be established. There are four types of payment arrangements that are applicable to Bhutan:

1. Pay-outs
2. Insurance
3. Credits
4. Conditional compensation/monetary reward

Identifying the Buyers and Sellers of the PES scheme

PES involves a myriad of stakeholders at the local, regional, national and international level. It is a policy that is easily adaptable and flexible for varying practices. When identifying the buyers and sellers of a PES scheme, it is important to keep in mind which stakeholders are enduring the market failure and are in need of the direct institutional incentive (sellers), and which stakeholders are viable to hold accountable and responsible to participate in the giving of market/monetary rewards (buyers). As seen in Figure 1.1: Examples of PES Market segments, the buyers and sellers of a PES system can range from the domestic private sector, international institutions and governmental agencies to households, cooperatives, and farmers.

Figure 1.1: Examples of PES Market Segments

Ecosystem Service	----------Buyer----------				
	Public sector	Private, under regulatory requirement	Private, voluntary (business case)	Philanthropic (non-use values)	Consumers of eco-certified products
Carbon sequest-ration	World Bank BioCarbon Fund	Kyoto protocol, CDM	Carbon offset projects by US corporations	Offsets of personal C emissions	--
Water Quantity	Water payments in South Africa	Salinity trading in Australia	Irrigators pay upstream land owners	--	--
Flood Control	Sloping land program in China	Wetland mitigation banking in US	--	--	--
Water Quality	Watershed protection in Catskills, US	Nutrient trading for farm runoff in US	Water bottling companies, dam operators	TNC: farmer conservation easements	Organic certified products
Biodiversity	Europe agri-environment schemes for biodiversity	Habitat banking for endangered species in US	Farmers protect land to maintain pollination services	Conservation concessions	Bird-friendly coffee; Rainforest Alliance products
Landscape beauty & recreation	Europe agri-environment schemes	--	Ecotourism	Conservation easements in US	--

How to Approach Designing a PES System for Bhutan

As seen above, there are numerous market segments, each with their unique objectives and approaches. According to research conducted by the World Wildlife Fund (2006), there are often four distinct approaches to the development of PES market segments:

1) Social Developers Approach
2) Pro-market's Approach
3) Conservation Approach
4) Governmental Approach

We determined that the integrated outcomes we wish to achieve in Bhutan—protection of rural livelihoods, conservation of wildlife populations, and increase in biodiversity– demands an interdisciplinary approach that combines these four outlined approaches. By elucidating opportunities for a Bhutanese PES system through each approach described in Figure 1.2, we hope to demonstrate PES's multi-faceted potential within a given structured decision-making model.

From a social development perspective, PES can be used to improve Bhutanese livelihoods by focusing objectives on the protection of social capital and income. Such social capital gains are achieved through the pro-market approach,

which illustrates how the integration of market-efficiency tools, like the valuation of ecosystem services and an appropriate pricing strategy, can tap market-oriented gains. Lastly, there is a strong objective in Bhutan to not only improve rural livelihoods, but also promote overall conservation gains. From a conservation standpoint, the pro-market and social developers solutions are better constructed within an environmentally ethical framework. A governmental perspective supplements the former three approaches by providing the flexibility to strategically target specific market-oriented, social development, and conservation stakeholders to work together on all sides of the PES system to redistribute rewards.

Figure 1.2: Four Main Approaches to PES

In conclusion, PES is intended as an economic incentive to help attain governmental conservation goals and global social benefits. Through a development of social, environmental, economical, and governmental approaches, PES can promote better livestock management practices by farmers and work to link conservation with poverty alleviation for mutual buyer/seller benefits.

Enabling Conditions for Equitable PES System

While there has yet to be a PES system developed specifically for human-wildlife management, the World Wildlife Fund (WWF) has worked closely with a variety of PES projects that have uniquely achieved integrated social development and conservation outcomes, similar to our intentions for Bhutan. We summarized WWF's research (2006) in conjunction with recent literature in 2011 to define six general enabling conditions for an equitable PES system:

1) Willingness to buy
2) Willingness to sell
3) Identifying ecosystem services and understanding of environmental linkages
4) Legal framework
5) Voluntary nature of the transaction: minimal transactions costs and appropriate dialogue among stakeholders
6) Mechanisms for conditionality of payments

Through a case study we will support how these enabling conditions are not strict criteria, but options that provide a flexible opportunity to develop a unique PES system.

Case-Study: Namibia's Community-based Natural Resource Management Program

In 2011, WWF submitted recent literature review on Namibia's community-based natural resources and management (CBNRM) program, which is the world's longest-standing effective large-scale PES scheme. In this review, WWF acknowledges that no PES scheme should be subjected to Wunder's 2007 strict definition of PES or WWF's identified general requirements for a PES program. Rather, there are other unintended benefits and unexpected net-outcomes that derive from PES schemes, such as CBNRM's increase in wildlife populations, that were not originally outlined in the intended objectives but still function appropriately within a PES scheme.

We intend to summarize the CBNRM literature published in September 2011, to offer a specific example of how Bhutan can utilize the general criteria of PES

discussed above to construct a PES system that combines differing PES scheme approaches, multiple environmental services/ products, integrative payment plans, and new regulatory frameworks. By doing so, we aim to provide an open-ended, structured guide for constructing a PES scheme for human-wildlife management in Bhutan.

Sellers: Identifying through legal framework

The sellers in the Namibia are unique from other PES schemes in that they are community members and not private landholders. The local community members are those who have registered with their conservancy and collectively hold rights to customary landholders. A new legislation in 1996 was implemented to devolve user rights to wildlife and tourism from the government to local communities. With such legislation, a legal framework was developed to provide buyers with reassurance that the sellers have continuous ability to manage the environmental service being sold without interference of outside parties. Bhutan can similarly implement an innovative legal framework to provide more structure and reassurance among the voluntary transactions between buyers and sellers.

Buyers

Though most national-level schemes are sold to the government, CBNRM elucidates how private sector actors are equally viable buyers. CBNRM's buyers included private companies like licensed hunting operators and tourism that often compete for rights to ecosystem services on communal lands. However, government and NGO bodies act as intermediaries and facilitators by helping with training and capacity-building activities. The Bhutan government could similarly work with farmer cooperatives, not as a buyer, but as an intermediary between the local level and private sector. Given their recent shift to democracy, and slight turn towards liberalism, it may be more appropriate to limit the government's role in the PES system and allow the integration of private markets to sustain the voluntary transactions.

Identifying Ecosystem Service

In Namibia's case, there were 'cultural services' being sold, including trophy hunting (high value species including elephant) and photographic safaris (eco-tourism) as well as 'provisioning services' plant-based products (baskets). In effect, Namibia was able to combine both ecosystem goods and services into one system, blurring the lines between the four distinctive classifications noted above and confronting the conventional knowledge that each PES system must only deal with one type of ecosystem service/goods. There are a multitude of opportunities for Bhutan to become equally creative in identifying types of ecosystem services, and a combination of the classifications listed above could further revert the need to refer to the conventional separate classifications of ecosystem services/goods.

Voluntary Transactions

The legislation enacted in Namibia in 1996 did not obligate the transaction for the cultural and provisioning ecosystem services, but enabled a profitable environment where sellers (local community members) had the autonomous control to profit from the natural resources on their communal lands. With government and NGO help, these transactions were voluntarily carried out with the high-demanding buyers (private companies). Nevertheless, the legislation decision to zone lands for PES does not mean that each zoned-conservancy is a homogenous entity. In fact, the distribution of benefits and costs among the households vary and the zoning implements a mandatory participation of the households to abide by a communal land use. Though such mandates do not force a PES transaction, if individuals were to voluntary enter a PES transaction, these underling mandates may warrant a strong negative disconnect between individual household and community benefits. Therefore, sufficient evaluation studies should be regularly conducted on both the household and community level to ensure positive voluntary transactions.

Conditionality of Payments

Most payments by buyers should be conditional on the provision of the good or service that is voluntarily agreed upon during the PES transaction. These conditions are easily enforced through carefully constructed contracts. Within these contracts, there should be stipulations for maintaining and managing the environment so that the service is available, specifically in the Namibia case of eco-tourism services. Adherence to these stipulations can be determined based on careful monitoring and evaluation of the system. If these provisions are not adequately maintained, then the contracts are nullified and the PES transaction is voided.

Opportunities for Bhutan

The CBNRM case evidence shows that perverse incentives were not an issue throughout the program. In fact, CBNRM activities outlined above proved a major attitudinal shift in community members towards natural resources. Prior to CBNRM's PES system in Namibia, wildlife had been perceived as a detriment to livelihoods, but now they are viewed as an asset to community livelihoods. Namibia's PES system was intended to generate sustainable financial benefits in order to ensure long-term natural resource management. However, the 2011 case study finally concluded that the ultimate sustaining driver was not the monetary rewards circulated through the PES system, but the great sense of pride and ownership that was developed among the communities towards the preservation of wildlife populations. Therefore, the long-term desire to sustain these wildlife populations is not attributed to monetary rewards, but to the desire among the community for their children to continue living alongside the wildlife. The outcome of this case study demonstrates the potential for PES to be used as an educational tool to initiate long-term environmentally friendly habits, even in the absence or failure of market-incentives.

Applications in Bhutan

Based on the potential gains for government conservation efforts, farmer livelihoods, and the environment, we suggest that PES would be a viable scheme for implementation in Bhutan. However, we also recognize that PES is merely one

possible tool within a larger set of strategies that can be assessed through decision-making schemes such as SMART. If the national government were to implement a PES strategy, it could establish a system where the government, possibly supported by interested NGO's, would be the buyer and farmers would be the sellers of ecosystem services. As an alternative to Bhutan's current system of payouts for instances of wildlife killing livestock, which creates perverse incentives for poor management practices, we suggest conditional PES strategies. A PES scheme could include payouts or tax incentives to farmers who adhere to a determined set of proper management criteria, insurance payouts for damages to livestock or crops, or a combination of both. However, it is essential that these payments include terms of conditionality, where payouts are only given when farmers have adopted the necessary management practices determined by the seller and outlined explicitly in the PES contract.

The implementation of a PES scheme in Bhutan faces several short- and long-term challenges. Primarily, putting this system into effect will require initial investments in educating farmers, hiring workers, conducting ecosystem research, and designing contracts. However, based on the Bhutanese government's recent focus on conservationism, this scheme would be crucial for protecting governmental investments in the long run. Furthermore, it is essential that the design of a PES program also include long-term monitoring and evaluation systems to determine project efficacy. The program should also include a system of outreach to rural areas so that farmers maintain ongoing access to government networks and educational resources. With proper monitoring systems and management strategies, such a PES scheme could provide the necessary incentives for both farmers and the government to benefit from conservation efforts.

For the educational tool designed for buyers and sellers of PES, please see the attached PowerPoint presentation.

Annotated Bibliography

The *Bhutan National Human-Wildlife Conflicts Management Strategy* describes the integrative, participatory, and adaptive approach needed of development programs to address wildlife-human conflicts in Bhutan. Beginning in 1993, the government of Bhutan implemented a modern conservation scheme increasing the protection of wildlife through bans on cultivation and hunting, increasing restrictions on traditional resources and enhancing environmental standards (*Strategy* 2008). The shift in Bhutan's conservation strategy led to an increase in wildlife populations threatening both human and livestock populations. The current challenges facing Bhutan are understanding the food-web dynamics that involve farmers, livestock, wildlife, crops, and other socio-economic as well as cultural variables to ensure a long-term successful conservation strategy.

Since the *Strategy* was published in 2008, an innovative model called payment for environmental services (PES) has emerged to address human-wildlife conflict. Given the recent democratic push in Bhutan, PES may prove the most economically efficient mechanism in addressing both poverty alleviation and ecosystem objectives through a combination of market and institutional incentives. PES could shift cultural attitudes of managing ecosystems by using markets and institutions to create a voluntary transaction between beneficiaries willing to pay for environmental services to maintain and sustain their natural resources. Efficient environmental outcomes are then achieved through the payment incentives. Our objective is to derive a PES model to supplement the *Strategy* proposal and address human-wildlife conflict in Bhutan through a comprehensive review and synthesis of the following literature:

Payment for Ecosystem Services

Understanding PES Models in the Role of Conservation

Clements, T., J. A. Nielsen, and L. Tan, et al. 2010. Payments for biodiversity conservation in the context of weak institutions: Comparison of three programs from Cambodia. *Ecological Economics,* Vol. 69(6): 1283-1291.

- This paper aims to explore the role of PES programs in Cambodian forest landscapes where there are a high number of threats to dwindling natural resources and specie populations. The PES programs were measured by their conservation results, institutional arrangements, and cost/benefit analyses. The paper contends that PES programs are more successful when created with the intention to empower local institutions.

Dickman, A.J., E.A. Macdonald, D.W. Macdonald. 2011. Paying for predators: A review of financial instruments to encourage human-carnivore coexistence. *Proceedings of the National Academy of Sciences*. In press.

- An analysis on how financial instruments may be used to encourage individuals to coexist with species while also alleviating poverty. The paper terms such financial instruments as "payments to encourage coexistence," and includes a review of insurance, compensation, revenue-sharing, and conservation payments.

Lipper, L., & Food and Agriculture Organization of the United Nations. 2009. Payment for environmental services in agricultural landscapes: Economic policies and poverty reduction in developing countries. Rome, Italy: Food and Agriculture Organization of the United Nations.

- An comprehensive insight into PES from a multi-lateral perspective, and in a broader development situation

Sommerville M., E. J. Milner-Gulland, J. P. G. Jones, and M. Rahajaharison. 2010. The role of fairness and benefit distribution in community-based Payment for Environmental Services interventions: A case study from Menabe, Madagascar. *Ecological Economics,* Vol.69 (6): 1262-1271.

- This is a case study highlighting the importance of local acceptance of PES in communities through the analyses of the opportunities and challenges in distributing PES benefits fairly among communities.

Focused Reviews on how PES impacts poverty alleviation and conservation dynamics

Asquith N.M., M.T. Vargas, and S. Wunder. 2008. Selling two environmental services: In-kind payments for bird habitat and watershed protection in Los Negros, Bolivia. *Ecological Economics.* Vol. 65 (4): 675-684.

- Describes a multi-faceted PES model that both protects migratory birds and increases biodiversity. This multi-tiered PES model may be important to reconcile the larger socio-economic and environmental conditions in Bhutan

Wunder S., S. Engel, and S. Pagiola. 2008. Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries. *Ecological Economics.* Vol. 65 (4): 834-852.

- An article looking into different models of PES and how they may be applied in different socio-economic conditions

Zilberman D., L. Lipper, and N. Mccarthy. 2008. When could payments for environmental services benefit the poor? *Environment and Development Economics.* Vol. 13 (3): 255-278.

- Explores the relationship between PES, land-ownership, and agricultural productivity, which are three aspects that must be taken into account when addressing the complex and multi-faceted human-wildlife conflict in Bhutan

Developing a PES Model for Wildlife-Human Conflict

Hemson G, S. Maclennan, G. Mills, P. Johnson, and D. Macdonald. 2009. Community,

lions, livestock and money: A spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human-carnivore conflict in Botswana. *Biological Conservation*, Vol. 142: 2718–2725.

Maclennan, S.D., R. J. Groom, D.W. Macdonald, and L.G. Frank. 2009. Evaluating a compensation scheme to bring about pastoralist tolerance of lions. *Biological Conservation*, Vol. 142: 2419–2427.

- A review of a recent PES policy to help mitigate hunting of lions for protection of livestock. A good paper to analyze when analyzing long-term impacts of PES models in Bhutan

Zabel A, S. Engel. 2010. Performance Payments: A New Strategy to Conserve Large Carnivores in the Tropics. Institute for Environmental Decisions, Zurich.

- Examines a PES model aimed to increase biodiversity, including wildlife, with a focus in South Asia. The paper explicates how to design such a PES scheme and the appropriate performance measurements. The assessment will be helpful for us to leverage while designing a PES model for Bhutan.

Zabel, A. and K. Holm-Muller. 2008. Conservation Performance Payments for Carnivore Conservation in Sweden. *Conservation Biology*, Vol. 22: 247–251.

- This paper discusses the issues that cause human-wildlife conflicts, such as land pressure caused by agricultural cultivation and population increase. It highlights the issues of economic losses and human retaliations that result from these conflicts, and brings up the need for viable solutions. It discusses the use of a "performance payment" scheme to alleviate carnivore-livestock conflicts. This method could be a good alternative to compensation schemes, which function "after-the-fact" and do not promote actual changes in husbandry practices. Performance payments are paid based on some

conservation outcome, which in the case of carnivore conservation can be defined as the number of new carnivore offspring in a given area.

Zabel A, K. Pittel, G. Bostedt, and S. Engel. 2009. Comparing Conventional and New Policy Approaches for Carnivore Conservation – Theoretical Results and Application to Tiger Conservation. International Institute for Environment and Development, London.

- This paper is a case-study of tiger-livestock conflicts in India and discusses how PES, and especially performance payments, are an alternative policy model for livestock protection and hunting of predators.

Participatory Management

Now a democratic nation, "the Bhutan Government now has the opportunity to incorporate the democratic process into its nine model sites (*Strategy*, Ch. 8) to garner local support for conservation" (Lassoie 2012). One such strategy is participatory co-management. Participatory co-management has many advantages that are absent from top-down approaches to conservation; it enhances the sense of ownership and encourages responsible use of resources, and allows for a more accurate inclusion of local socio-economic restraints in the planning process. Many studies have shown that there is a greater compliance with the regulations eventually decided upon when the community is involved in the decision-making process. However there are many challenges facing the effective use of participatory management. Minority groups can be underrepresented through the interactions of community officials, experts, and politicians, resulting in a façade of representation. This can be a potential opportunity for industries or governments to take advantage of natural resources with the perceived approval of local communities. However

Bhutan is a unique situation; with its nation-wide, deeply engrained Buddhist values, the opportunity exists for this process to be particularly successful.

Armitage, D. R., R. Plummer, F. Berkes, R.I. Arthur, A.T. Charles, I J. Davidson-Hunt, A.P. Diduck, N.C. Doubleday, D.S. Johnson, M. Marschke, P. McConney, E.W. Pinkerton, and E.K. Wollenberg. 2009. Adaptive Co-Management for Social-Ecological Complexity. *Frontiers in Ecology and the Environment*, Vol. 7(2): 95-102.

- Describes the core features of adaptive co-management, including: innovative institutional arrangements and incentives, monitoring and assessment of interventions, power roles, and how to link science with policy. Promotes the idea of using adaptive co-management to resolve sociopolitical and environmental issues through the collaboration between institutions and communities.

Bohlen, P. J., S. Lynch, L. Shabman, M. Clark, S. Shukla, and H. Swain. 2009. Paying for Environmental Services from Agricultural Lands: An Example from the Northern Everglades. *Frontiers in Ecology and the Environment*, Vol. 7(1): 46-55.

- Describes a program in Florida's northern Everglades that has been developing a "Pay-for-Environmental Services" program since 2005. The program pays cattle ranchers to provide water storage and nutrient retention on private lands. Outlines the key challenges to implementing this type of plan.

Jones, J. P. G., M.M. Andriamarovololona, and N. Hockley. 2008. The Importance of Taboos and Social Norms to Conservation in Madagascar. *Conservation Biology,* Vol. 22(4): 976-986.

- Describes how a traditional Malagasy system called *fady* plays a role in the use of natural resources within Madagascar. Cultural taboos under this system protect wildlife and reduce pressure on economically important species. The authors found that these traditions were being ignored in the area surrounding Ranomafana National Park. They suggest that the externally mandated conservation rules are weakening the traditional systems for managing wildlife.

Loring, P. A., F. S. Chapin, and S.C. Gerlach, S. C. 2008. The Services-Oriented Architecture: Ecosystem Services as a Framework for Diagnosing Change in Social Ecological Systems. *Ecosystems,* Vol. 11(3): 478-489.

- Describes the role of computational thinking (a way of thinking and solving issues that draws on concepts from computer science) in sustainability science using a model that businesses apply to describe the services they offer. This model (SOA) can capture the important relationships between ecosystems, ecosystem service consumers, providers of ecosystem services, and the effects of their interactions on ecosystem health.

Reed, M. S., A.J. Dougill, and T.R. Baker. 2008. Participatory Indicator Development: What Can Ecologists and Local Communities Learn from Each Other. *Ecological Applications,* Vol. 18(5): 1253-1269.

- Describes a case study from the Kalahari, Botswana to show how participatory planning can be combined with traditional ecological science to develop indicators that are accessible to both scientists and community members. The article cautions acceptance of locally developed indicators unquestioningly because they are not always accurate or reliable. It is important to combine expert knowledge and local knowledge with co-management.

Shackleton, C. M., G. Cundill, and A. T. Knight. 2009. Beyond Just Research:

Experiences from Southern Africa in Developing Social Learning Partnerships for Resource Conservation Initiatives. *Biotropica*, Vol. 41(5): 563-570.

- Describes four case studies from South Africa and uses them to demonstrate important lessons in developing social learning processes relating to natural resource management. The importance of these lessons lies in the fact that scientists must engage with local subsistence resource users who are often *de-facto* decision-makers when it comes to natural resources management in their areas.

Sletto, B. I. 2009. We Drew What We Imagined: Participatory Mapping, Performance, and the Arts of Landscape Making. *Current Anthropology,* Vol. 50(4): 443-476.

- Investigates participatory-mapping workshops in Trinidad and Venezuela and suggests revisions in the application of participatory-mapping approaches.

Wilson, R. S. 2008. Balancing Emotion and Cognition: a Case for Decision Aiding in Conservation Efforts. *Conservation Biology,* Vol. 22(6): 1452-1460.

- The author examines results from 3 experiments that demonstrate how shortcuts in complex decision-making situations influence judgments. He describes why individuals tend to resort to shortcuts and also prescribes methods to encourage a balance between the emotional and cognitive aspects of decision-making.

Human Wildlife Conflict

In addition to the PES and participatory management strategies, there has been a wealth of other new human-wildlife conflict research published subsequent to the 2008 release of the *Strategy* . The topics of these studies range widely, including: conservation investment plans, the role of social factors and attitudes in human-wildlife conflict, new methods for conflict mitigation, and new ways of merging biological and social sciences to achieve conservation. Many of these studies have direct applicability to the issues faced by the people of Bhutan.

Dickman, A. J. 2010. Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation*, Vol. 13: 458–466

- This article looks at the social factors that contribute to human wildlife conflicts, studying how aspects like cultural backgrounds, human interactions, religious differences, and human conflicts can be even more detrimental to wildlife outcomes than environmental damage.

Elliot, W., R. Kube, and D. Montanye. 2008. Common Ground: Solutions for reducing the human, economic and conservation costs of human wildlife conflict. Species Programme, WWF International, Switzerland.

- This 66-page reading outlines the issues influencing HWC, stressing the importance of the topic in relation to people affected by poverty and climate change. The text focuses on the conflicts surrounding African and Asian elephants at the international and national policy level, at the meso-institutional level, and at the community level. It uses case studies in highly populated regions in south-western and south-eastern Nepal as examples.

Gordon, I. J. 2009. What is the Future for Wild, Large Herbivores in Human-Modified Agricultural Landscapes? *Wildlife Biology*, Vol.15(1):1-9.

- This article focuses on wild herbivores that compete with livestock for pasture, stating that the wild animals can often harbor and spread diseases to the domesticated animals. Humans have reacted by separating their populations, violently retaliating, or changing their management practices in other ways. The author reviews attempts to turn this relationship into a positive one, though she states that in the future, the attitude towards wildlife will most likely be a negative one.

Gore, M. L., B.A. Knuth, C. W. Scherer, and P.D. Curtis. 2008. Evaluating a conservation investment designed to reduce human–wildlife conflict. *Conservation Letters*, Vol. 1: 136–145.

- The authors examine evaluation of HWC using the case study of human-black bear conflict in New York City. After the program intervention, there were no changes found in environmentally conscious behavior. Based on the findings, the authors stress the need for evaluation as a part of program implementation.

Gubbi, S., M. Linkie, and N. Leader-Williams. 2008. Evaluating the legacy of an integrated conservation and development project around a tiger reserve in India. *Environmental Conservation*, Vol. 35: 331-339.

This paper describes an independent evaluation of a donor-funded conservation project in southern India. Two years after the project had been completed, the researchers distributed a survey to determine the legacy and long-term effects of the intervention. The results demonstrated that attitudes towards human-wildlife conflicts were not influenced by the project, but by past experiences, age, and participation in ecotourism activities.

Hemson, G., S. Maclennan, G. Mills, P. Johnson, and D. Macdonald. 2009. Community,

lions, livestock and money: A spatial and social analysis of attitudes to wildlife and the conservation value of tourism in a human–carnivore conflict in Botswana. *Biological Conservation*, Vol. 142(11):2718-2725.

- This study quantifies both livestock losses to lions and attitudes towards wildlife conflicts by locals in Botswana. The authors conclude that losses increase with herd size. They also find that attitudes towards wildlife, conservation, and lions varied across different groups of society (tourism workers, villagers, and cattle herders).

McCleery, R. A. 2009. Improving Attitudinal Frameworks to Predict Behaviors in Human–Wildlife Conflicts. *Society & Natural Resources: An International Journal*, Vol. 22(4): 353-368.

- This study aims to understand the attitude-behaviors that shape human-wildlife contexts, specifically in urban environments. A survey on a university campus was used to analyze the behavior response to a proposal to manage the campus squirrel population. Based on the data, the authors suggest that attitudes correspond to behavioral intentions rather than attitudes and beliefs. The authors propose that a theoretical framework is needed to better analyze behavior and attitude data.

Ogra, M., and R. Badola. 2008. Compensating Human–Wildlife Conflict in Protected Area Communities: Ground-Level Perspectives from Uttarakhand, India. *Human Ecology*, Vol. 36(5): 717-729.

- This paper examines a compensation program for HWC in Uttarakhand India, using a case study approach to determine the socioeconomic characteristics of applicant households, understand why certain households applied while others did not, and gather information on perceived program effectiveness. Participation rate in the program was only 37%, which was found to be

mainly due to program inadequacy, corruption, and late or infrequent repayments.

Smith, M.E., J.D.C. Linnell, J. Odden, and J.E. Swenson. 2010. Review of Methods to Reduce Livestock Depradation: I. Guardian Animals. Agriculturae Scandinavica, Section A – *Animal Science,* Vol. 50(4)

- This paper reviews the efficacy of different management tools such as aversive conditioning, repellents, and deterrents in mediating predator – livestock conflicts.

Tamang, B., and N. Baral. 2008. Livestock depredation by large cats in Bardia National Park,
Nepal: Implications for improving park–people relations. International Journal of Biodiversity Science & Management, Vol.4 (1): 44-53

- This paper focuses on the conflict between local peoples and the conservation objectives of parks and protected areas in developing countries. It examines spatio-temporal variations in livestock loss, severity and magnitude of the problem, and the predators involved in the southwestern section of the Bardia National Park, Nepal. Rather than enforcing stringent rules, it suggests involving local residents in conflict management, providing incentives to maintain and relocate corrals, and introducing grass and fodder species to help mitigate the problem.

Treves. 2008. The Human Dimensions of Conflicts with Wildlife around Protected Areas. http://www.nelson.wisc.edu/people/treves/Pubs/Treves_2008_HDFW.pdf

- This book chapter focuses on the human side of HWC, especially with regard to wildlife managers and individuals living and working near protected areas.

It discusses the clashes between global biodiversity concerns and economic gains for poverty in terms of political motivations.

Treves, A., R.B. Wallace, and S. White. 2009. Participatory Planning of Interventions to Mitigate Human–Wildlife Conflicts. *Conservation Biology*, Vol. 23: 1577–1587.

- This paper offers 13 distinct interventions to mitigate human retaliations to wildlife damages incurred by humans. Eight of these interventions are classified as direct, and are designed to reduce the number of animal encounters, while five are indirect and are designed to raise human tolerance to wildlife interactions. The authors characterize the recommendations for their social acceptability, cost, and wildlife specificity, and include support tools for workshops.

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Mabee, Holly, and George Hoberg. "Equal Partners? Assessing Comanagement of Forest Resources in Clayoquot Sound." *Society & Natural Resources* 19.10 (2006): 875-888.

Naidoo, R., Weaver, C., De Longcamp, M., Du Plessis, P. (September 2011) "Namibia's community-based natural resource management programme: an unrecognized payments for ecosystem services scheme" Environmental Conservation 38 (4): 445–453 World Wildlife Fund. Retrieved online May 9, 2012: http://www.worldwildlife.org/what/howwedoit/conservationfinance/WWFBinaryitem26759.pdf

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Wunder S (2007) "The Efficiency of Payments for Environmental Services in tropical Conservation" Conservation Biology 21:48 –58 Retrieved online 24 April 2012