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The Importance of a Social Science Research Agenda in the Management of Protected Natural Areas, with Selected Examples

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Abstract The advent of the modern protected area movement began in 1872 with the creation of Yellowstone National Park in the United States. For a century thereafter, as more nations began to set up protected area systems, the movement was largely western-dominated and adhered to 'fences and fines' forms of conservation. As many more developing nations gained independence in the latter half of the twentieth century, it was increasingly recognized that strict forms of conservation based on western ideals of nature could not be sustained in the long term. Specifically, many rural people in developing countries are dependent on local natural resources, and the conservation rules put into place in many protected areas frequently forbade all extraction and in many cases all entry except for tourism or research. This created a climate of increasing park-people conflicts that in many cases compromised conservation goals and led to a refocus in protected areas management and research in the social sciences worldwide. Here I describe survey and non-survey based protocols developed to study the effectiveness of protected areas in the societal realm. Policy gap analyses, rapid rural appraisals, key informant and focus group surveys and structured and semi-structured social surveys are described. Such studies can allow managers to plan for interventions where needed and can aid in designing appropriate local development projects in an effort to ameliorate park-people conflicts. I finish with a preliminary social research protocol, tested in May, 2009, for Yachang Orchid Reserve, Guangxi Province, the People's Republic of China.

Keywords Focus Group Surveys · Key Informant Interviews · Protected Areas Management · Rapid Rural Assessments · Policy Gap Analysis · Social Surveys

General Introduction

My field is integrated natural resources management and much of my work has focused on using household surveys and other social science techniques to study protected areas (PAs) policy and park-people relations in developing countries. I was thus quite pleased when Professor Hong Liu invited me to present a paper at the

Guangxi International Orchid Symposium, from which this special issue of the Botanical Review arose. As the only non-Botanist who presented at the meeting, I felt the need to inform colleagues of the importance of a social science research agenda in conservation in general, and in managing PAs in particular. While there has been quite a rift between the natural (especially ecology) and social sciences (especially anthropology) regarding studies on PAs and their roles in society (e.g. Redford & Sanderson, 2000; Schwartzman et al., 2000) no one approach has a monopoly on knowledge or know how. I assert that both are critically important for PAs management and those in my field integrate research across the natural and social sciences regularly.

Human societies have protected natural areas for various socio-cultural purposes for millennia. Examples include the sacred forests of South Asia and traditional royal hunting reserves in parts of Europe (e.g. Borgerhoff Mulder & Coppolillo, 2006). The modern concept of national ownership and protection for the benefit of society at large is a much more recent phenomenon; the United States became the first country to conserve nationally protected areas with the creation of Yellowstone National Park in 1872. Canada, Australia and New Zealand quickly followed suit. The largely Western ideal of protected areas as nature devoid of resident humans was never really true to begin with; most areas set aside in the West had been occupied by native peoples who had been removed. This concept was also largely out of synch with realities in developing nations. The International Union for the Conservation of Nature (now IUCN—The World Conservation Union) was begun in 1948 with a charter to develop global standards for conservation. Having been developed in the West, with most funding coming from West, meant that Western standards of nature conservation were becoming globalized. IUCN's World Commission on Protected Areas (WCPA) was organized in the 1950s, and developed categories of protected areas (PAs) by the 1970s that were modified in 1994.

Post-colonial developing nation governments began protecting areas by the 1960s, but the 'fences and fines' approach of the West had its limits. In 1962 and 1972, IUCN held its First and Second World Conferences on Protected Areas, respectively. Both were characterized by high representation from developed countries and little concern for conservation issues in newly independent developing countries. This began to change with the Third World Conference on Protected Areas held in 1982 in Bali, Indonesia: the theme was the role of protected areas in economic development and a majority of participants came from developing countries. The Fourth and Fifth World Conferences were held in Venezuela (1992) and South Africa (2002) respectively, and the global agenda for protected areas in each decade expanded from the one preceding it.

IUCN defines a PA as "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means." According to the World Database on Protected Areas compiled by the WCPA, there were over 7,000 separate units covering over 17 million sq. km. as of 2007. This includes nearly 10% of Earth's land surface, but less than 0.5% of its sea surface, although there has been recent growth in marine PAs. When one includes areas that are protected but are not categorized into one of IUCN's PA categories (see below), the

percentage of terrestrial area protected globally increases greatly (about 17%; Chape et al., 2008). The WCPA's mission is to "promote the establishment and effective management of a world-wide representative network of terrestrial and marine protected areas as an integral contribution to IUCN's mission". Although the growth of PAs has been rapid during the past several decades, some ecosystem types (e.g. deserts) are over-represented, while others, especially in productive low lying areas, are under-represented due to competing economic interests.

The WCPA uses a system in place since 1994 to define PAs (Table 1). Please note that many nations have PAs that do not fit within WCPA criteria and are thus not included on the United Nations List. Based on their criteria, PAs are those managed by the "highest competent authority" which, in most cases, is the national government. Yet many countries have State, County, or Provincial parks and private reserves (e.g. land trusts, etc.), or reserves managed by other entities (e.g. military) that are not included. National forests and rangelands are also generally not included because their permitted uses may exceed that considered appropriate by WCPA guidelines. With these caveats in mind, there is much more natural area set aside than is recognized internationally.

Some Social Sciences Research Approaches: Policy Gap Analyses, Rapid Rural Appraisals, Key Informant and Focus Group Surveys

Given the large number of permitted human uses of various types of PAs (Table 1), it is not surprising that the social sciences play an important role in PAs research. What is perhaps surprising is that this took a while to recognize within WCPA (above). None-the-less it is now common in PAs literature to begin a research justification

Table 1 IUCN -The World Conservation Union Protected Area Management Categories (adapted from IUCN 1994)

	Management objectives								
	SR	WP	SD	ES	NF	TR	ED	SU	CA
Category and name									
1a: Strict nature reserve	a	b	a	b	–	–	–	–	–
1b: Wilderness area	c	a	b	a	–	b	–	–	–
II: National park	b	b	a	a	b	a	b	c	–
III: National natural monument	b	c	a	–	a	a	b	–	–
IV: Habitat or species management area	c	c	a	a	c	c	b	b	–
V.: Protected landscape Or seascape	b	–	b	b	a	a	b	b	a
VI: Managed resource or extractive reserve	c	b	a	a	c	c	c	a	b

Key to Management Objectives: *SR* scientific research; *WP* wilderness protection; *SD* species or genetic diversity conservation; *ES* environmental services; *NF* natural or cultural features; *TR* tourism and recreation; *ED* education; *SU* sustainable use; and *CA* cultural attributes

Key to importance of objectives by category: a designates a primary objective; b, a secondary objective; c, potentially not applicable; and -, not applicable

with the caveat that protection of biodiversity requires the awareness and tacit approval of local communities (in additional to national governments) if it is to be sustainable (e.g. Allendorf, 2007; Allendorf et al., 2006; Torn et al., 2008; Olupot et al., 2009). There are many veins of social sciences research relevant for biodiversity conservation. Within academic disciplines, political ecology, ecological economics, sociology, development studies and policy analyses all come into play and bring various research frameworks. Among the applied disciplines, these vary from natural resources management, which has used surveys for decades to study traditional extractive uses of renewable resources (e.g. sport hunters; Bookhout, 1994), to newer interdisciplinary studies that explore the socio-cultural and/or economic impacts of nature based tourism (e.g. Alexander, 2000; Lai & Nepal, 2006; He et al., 2008; Yuan et al., 2008; Bruyere et al., 2009).

In the context of modern PAs applications worldwide, several approaches from the social sciences have proven (in my estimation) most fruitful for the purpose of studying managerial issues in PAs. These are: policy analyses, rapid rural appraisal, key informant and focus group surveys, and house-to-house surveys. The first four are summed up quickly as they are relatively easy to describe and apply. The last is considered later. Note that these techniques are frequently used in combination and are not mutually exclusive. This is not an exhaustive list, but will allow the reader a broad look at social science approaches that have proven useful in PA research. I use a number of my own examples, and others where appropriate, from countries worldwide.

A number of treaties to which most nations are party govern, in part, the use and management of biological diversity. The most important of these are the 1971 Convention on Wetlands of International Importance (Ramsar), the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the 1976 World Heritage Convention (WHC) and the 1992 Convention on Biological Diversity (CBD). For background, all maintain websites (e.g. www.Ramsar.org, www.CBD.int). An important approach to studying their implementation and effectiveness is Policy Gap Analysis (PGA). It is similar conceptually to gap analysis in the context of using data bases as layers in a GIS system that may include ecosystem types, areas of high diversity and endemism and the location of existing PAs (e.g. Primack, 2006) to prioritize areas for conservation not now protected (i.e. "gaps" in the system).

PGAs take the form of exploring what international treaties and/or national laws state with regard to permitted resource uses or management standards, and assessing whether these standards have been implemented and enforced. For example, Ter-Ghazaryan and Heinen (2006) explored the history of Issyk-kul Nature Reserve (Kyrgystan) before, during and after transition of the Soviet Union using a PGA that reviewed current and historical documents and used key informant surveys with staff and other stakeholders. They showed that the Kyrgyz Republic was then unable to enforce its own laws (many of which were new) and hence grazing and fishing within the PA were common. The standards then in place also violated to varying degrees the Ramsar Convention, under which Issyk-kul is listed. The agency was under-staffed and a new project in the Oblast (province) with major international funding that created a much larger biosphere reserve gave little attention or funding to Issyk-Kul or other older reserves in the area at that time. The study highlighted the need for more cross-sectoral

integration and several weaknesses in national conservation law and the implementation of one international convention (i.e. Ramsar).

One frequently explores policy gaps at smaller scales as well. For example, Heinen (1993) showed that many complaints that local residents expressed on a social survey around Kosi Tappu Wildlife Reserve, Nepal were, on closer inspection, not valid. The most frequent complaints were that wild buffalo (*Bubalus arnee)* broke the fence to raid crops, and that crop damage was widespread year-around. The field work showed that most breaches of the fence were caused by humans allowing their livestock access to fodder inside the reserve, that most buffalo were unlikely to leave the reserve unless a flood was underway (i.e. a rare event) and only one village received significant crop damage year-around. The gaps here were multiple. Law enforcement was unable to stop incursions that permitted cattle to enter and there were obvious gaps in people's knowledge about the true costs of living nearby. The situation in Kosi Tappu has since improved (e.g. Heinen & Rayamajhi, 2001) but is still rather tense. Other studies have pointed out gaps in enforcement using social surveys with field observations (e.g. Ite, 1996; De Boer & Baquete, 1998; Holmes, 2003a, b; Lepp & Holland, 2006), and it is not uncommon to find that negative perceptions expressed on surveys are not consistent with realities on the ground (e.g. Gillingham & Lee, 2003).

Rapid rural appraisal (RRA) includes a variety of techniques designed to acquire knowledge of local living conditions at rather fine scales, and quickly. It is most frequently used by international development agencies and non-governmental organizations to assess the needs of communities and to explore what types of development alternatives may work in a given situation, and under various constraints (www.hd.gov). RRAs have the advantage of being relatively cheap to complete—they usually only take one to a few days per village—and they can generate a good deal of information. However, their credibility is frequently low with decision makers and results generally lack statistical validity due to non-random sampling and limited sample sizes. Still, they can be important in helping managers plan for local interventions around PAs (www.cs.noaa.gov) and their low costs are major pluses for many applications.

Finally, key informant and focus group surveys have been used extensively in combination with PGAs (Ter-Ghazaryan & Heinen, 2006, above), RRAs (Dong et al., 2007; Bruyere et al., 2009) and in-depth social surveys (e.g. Debrot & Nagelkerken, 2000; Wang et al., 2006). Key informant surveys use open-ended questions concerning an issue to which key informants are asked to respond. Because they tend to be long and answers detailed, interviews are frequently tape-recorded with permission. Key informants are people 'in the know' about the topic of study; in the case of PAs, they can include reserve managers and staff, village leaders, the heads of resource management committees and/or the heads of local tourism associations, etc. Focus group interviews generally rely on the researcher observing, and asking some leading questions, to larger groups of people such as assemblies at village meetings, in an effort to gain insights about common complaints or issues. Like RRAs, both can be done quickly and cheaply, but they also generally lack statistical validity; analyses consist of finding related themes or topics that emerge from the dialogue with key informants or focus groups (e.g. Shrestha-Acharya & Heinen, 2009) and they are usually non-quantitative.

Social Survey Instruments

Structured and semi-structured questionnaire surveys have been used to answer a number of questions in PAs research and have become the method of choice for many. The main difference between structured versus semi-structured surveys is that, in the former, interviewees are constrained to an a priori list of answers to all questions (e.g. yes or no; agree, neutral or disagree, etc.), while, in the later, a combination of open-ended questions and questions with pre set answers are asked. Most researchers prefer semi-structured surveys as they allow interviewees to express opinions that may not be otherwise represented. In practice, most semi-structured surveys use pre-set answers for the majority of their questions as this allows for greater statistical power.

Issues such as conservation attitudes, awareness of conservation standards or restrictions, natural resource uses and needs, and various economic costs and benefits to local people living near PAs can all be addressed effectively with this approach, sometimes in combination with one or more method(s) above. Most surveys ask a variety of economic and demographic questions that can be cross-classified with questions concerning conservation attitudes, awareness, resource use, etc. (e.g. see Appendix 1, from Shrivastava & Heinen, 2007; Heinen & Shrivastava, 2009). Many are quite detailed and researchers frequently begin with one or more other techniques described above before implementing a major social survey. While using (generally shorter) phone poll, mail or email surveys is common in the West (e.g. Durrant & Shumway, 2004; McCleave et al., 2006; White et al., 2005; Weaver & Lawton, 2008), house-to house surveys (e.g. Maikhuri et al., 2000; Straede & Helles, 2000; Bandara & Tisdell, 2003) are the norm in developing countries because many people lack phone service, mail surveys are not reliable if illiteracy (and mail service) is an issue and, for those engaged in agriculture (the norm in rural areas of developing countries), there are gaps between planting and harvest in which people are home and have time to partake.

These considerations and more must be taken into account when planning such studies. It is typical for researchers to survey literature (including gray documents) extensively, conduct a number of key informant and focus group surveys, and conduct RRA-style site visits to assess conditions before beginning large house-to-house surveys. Survey instruments need to be pre-tested with a random sample of 15–25 households (sometimes more in cases in which large, ethnically mixed populations are involved) and survey instruments frequently need modification after pre-testing. One must also be sensitive to the fact that many people may be illiterate and few have gone as far as secondary school. Therefore, the language has to be simple and survey teams may need to include people who are fluent in English, at least one national language, and one or more local languages. Our Kaziranga study (Appendix 1), for example, included three team members: one fluent in English and Hindi, one fluent in Hindi and Assamese and one fluent in all three. Detailed surveys such as that in Appendix 1 generally take 45 min to an hour to complete per respondent and, given the size and population density of the area, and the desire to interview heads of at least 5% of households in the target area (a standard for such studies), the field work took over 3 months to complete nearly 600 usable surveys (Heinen & Shrivastava, 2009). Compared to other methods described above,

interview surveys are slow and expensive but they are valuable for their richness of information and provide robust, statistically valid results if properly done.

Another consideration is what ancillary questions are to be asked depending on the main research question. Many studies on PAs attitudes and awareness, for example, cross-classify these questions with questions that address more specific household level variables such as natural resource uses, crop damage or livestock loss incurred from wildlife, the location of the household with respect to the PA boundary, types of crops grown, education level, ethnic or religious group and measures of household wealth to determine which socio-demographic factors are most important in determining conservation attitudes and awareness (e.g. Fiallo & Jacobson, 1995; Fu et al., 2004; Xu et al., 2006; Durrant & Durrant, 2008). Numerous studies have shown that all these factors can be important, but the themes that have generally emerged are that education is frequently very important, as are direct and perceived economic costs or benefits to households. Several studies have shown that managerial engagement can help ameliorate negative attitudes (e.g. Heinen, 1993) but broad generalities are difficult because results can vary widely by ethnic and economic status, country, region and, in some cases, specific geographic areas around a single PA.

Some Important Themes in Social Science Research in Protected Areas

Here I consider more directly several recent important themes in the use of social science research in PAs management. Since the 1980s, various forms of community-based or participatory conservation programs (CBCs) have taken shape with varying degrees of success—especially within programs that develop buffer zone policies and those that allow some extractive uses within internationally designated PA categories (e.g. Heinen & Mehta, 1999, 2000)—and the social sciences have necessarily played a major role in both formulating and assessing them over time. There are now a number of studies that show the promise of CBC programs (e.g. Abbot et al., 2001; Mehta & Heinen, 2001, Lepp & Holland, 2006; Moorman, 2006) as well as various pitfalls (e.g. Straede & Helles, 2000; Campbell & Vainio-Mattila, 2003; Bajracharya et al., 2006; Straede & Treue, 2006). Several themes have emerged. One main issue from the societal standpoint is to what extent, and over what time periods, do CBCs actually improve local livelihoods and attitudes? Another main issue, from the ecological standpoint, is to what degree do CBCs actually improve conservation prospects (e.g. Spiteri & Nepal, 2006)? On the social front, economic equitability is a major issue and inequalities in benefit sharing can compromise both ecological and social goals (e.g. Jones, 2007; Groom & Harris, 2008). There is also frequently a mismatch between the perceptions of local people versus agencies about what is meant by conservation (McClanahan et al., 2005; Faasen & Watts, 2007).

Perspectives on CBC programs have evolved over time. Baral and Heinen (2007) showed that the amount of intervention and time since programs were implemented both affected attitudes and conservation outcomes and Baral et al. (2007) showed that community groups in one important CBC program in Nepal (Annapurna Conservation Area) themselves evolved over time. That is, based on

an exploration of themes addressed at community meetings over a 10-year period, by reading and translating their minutes, they found that local Management Committees early in their formation focused mostly on development projects (i.e. development over conservation). After several years, Committees shifted focus toward strengthening administrative capacity. Lastly, as programs matured, Committees tended to balance development with conservation decisions, but this took about 10 years in Annapurna. We concluded that many of the published studies on the topic, which have shown that development generally overshadows conservation in CBC programs, were premature. In any case, both socio-economic and ecological assessments are needed over project implementation, and for periods thereafter, to assess full impacts of CBCs. This has not been done in most cases.

Tourism is major topic of study in PAs research and, in many PAs worldwide (especially Category II, III and V reserves; Table 1) it is the major economic enterprise that can provide financing for CBC programs and for direct management (e.g. Sherman & Dixon, 1990). A full review of tourism research in PAs is beyond the scope of this work. Suffice it is to say that many studies have found both advantages and pitfalls of tourism in PAs for local communities and conservation using various interview techniques. Mehta and Kellert (1998) found strong support for tourism in Makalu-Barun Conservation Area, Nepal presumably because people thought they would benefit economically, but they also found little overall support for conservation upon which tourism depends. In contrast to this perception, Bookbinder et al. (1998) found little evidence that tourism benefitted the larger community around Chitwan National Park in lowland Nepal, where tourist markets had been large for a long time; similar results were found in Serengeti National Park, Kenya (Kaltenborn et al., 2008). Positive attitudes about the prospects for tourism have been found in many other studies (e.g. Walpole & Goodwin, 2001; Lepp, 2007), but negative impacts of tourism are many and varied; they range from major changes in local cultures to direct ecological impacts (e.g. Nyaupane & Thapa, 2006). None-the-less, tourism is increasing world wide and nature based tourism is an important component of this trend; research will continue in this important area and development and managerial funding in and around PAs in many countries will rely on tourism, at least in part. How this is done and how benefits are distributed will have major impacts on conservation programs into the future.

Tourists themselves offer abundant opportunity for research. Many studies have explored aspects of visitors' satisfaction within PAs, and/or the concept of a social carrying capacity, i.e. the extent to which greater numbers of tourists detract from visitor experiences. A number of studies have explored direct economic impacts of tourism using survey instruments that estimate money spent in travel to and in staying in PAs including estimated travel, lodging, entry and guide costs, etc. A major recent trend in economic research in PAs involves using non-market survey techniques to explore issues such as willingness-to-pay for entry. A number of studies have found that tourists (especially international visitors) frequently express a willingness to pay much more than current admission fees into PAs (e.g. Baral et al., 2008; Bhat, 2003). This is a fruitful area of research because it indicates that PA authorities could garner more funding

for direct conservation and local development than is currently the case in many places.

Lastly, many PAs in developing countries, and especially those in which CBCs and tourism operations have been implemented, act as employment draws for people from other areas (Wittemyer et al., 2008). This struck me directly nearly 20 years ago when I visited the tour guide association in Chitwan National Park, Nepal, where I had worked as a Peace Corps Volunteer several years previously. I met a new tour guide and instinctively began speaking to him in Nepali. After a few sentences, he then told me (in fluent English) that he had recently moved there from South India to work, and that he had no idea what I had said because he knew no Nepali. Needless to say, and much to my amazement, Chitwan's employment was internationalizing. Other studies have found that disparities in resource use, perceptions, knowledge about and willingness to follow local conservation norms, and conservation attitudes, can all vary greatly between long-term and more recent residents around PAs worldwide (e.g. Sah & Heinen, 2001; Nyhus et al., 2003). This must be accounted for when considering the nature and fabric of CBCs, tourism operations, and myriad other issues of concern; generally, programs becomes more difficult to implement as populations increase and diversify (e.g. Heinen, 1996) and, in this context too, the need for and role of the social sciences in PAs research and management becomes increasingly apparent.

A Social Science Research Protocol for Yachang Orchid Reserve

For 1 week after the Guangxi International Orchid Symposium had finished, I had the opportunity to explore villages around Yachang with Ms. Wuying Lin, a recent University graduate who served as my translator and interpreter. The purpose was to get preliminary information about societal conditions of villagers living in the area including demographic makeup, uses of and needs for various natural resources and perceived costs and benefits of living near Yachang. We were also able to do a number of key informant surveys with the Director and various staff and several other local officials. We visited seven villages where we completed RRAs and semi-structured interviews with 15 households as a pre-test for future studies (Appendix 2). Here I highlight important findings and discuss the potential for more social science research around Yachang.

The first key informant surveys were done with the Director of the Reserve and his Deputy. They provided us with detailed information about staffing, budget issues, annual report and management plan requirements, how meetings with villagers are conducted, educational outreach, particular law enforcement problems (there are relatively few around Yachang; see below) and the situation with the ten guard stations located at various points around the Reserve. Much of the information was rather standard for any bureaucracy in such a context, but the Director did indicate particular interest in educational outreach with local schools and this piqued my curiosity.

We then did an unplanned key informant survey with the Principal of a elementary school who indicated that in fact, his students regularly took part in

cleanups around one tourist spot in the Reserve (Huangjingdong, a large natural limestone pit; see below). The Guangxi Forestry Bureau, according to the Principal, provided a great deal of educational outreach to the school (e.g. videos and pamphlets); activities and meetings regarding the Reserve were arranged twice per month during the school year and conservation, although it is not formally in the curriculum, is included as an outside activity. The level of integration of the Reserve with the local educational establishment thus seemed strong and this can be used advantageously in the future as Yanchang begins to attract more tourism (see below), one goal of current management.

In visiting several of the guard posts maintained around Yanchang, and in talking with lower level staff (mostly Rangers), several things were apparent. The law enforcement situation around Yanchang is not urgent at this time. Most Rangers indicated that they patrolled daily and meet with villagers on a regular basis, and only one or two serious infractions per year required police intervention. Most of those were relatively minor (e.g. cutting one tree or grazing a few livestock in non-facility zones) and most infractions required only warnings. Poaching is virtually non-existent, although it should be pointed out that mammal and bird populations are quite low throughout the area. The main complaints of the Rangers were that the pay is low and they see their families rarely due to strict leave policies. But most expressed job satisfaction and seemed to enjoy their work. Several had worked for a Guangxi Forestry Bureau sawmill that had since closed and those individuals expressed that their current jobs were preferable. Several stated that they hoped the pay would improve once the Reserve became national in designation, which has since happened.

For someone (such as myself) who has worked in some of the poorest rural areas of South Asia, the situation in the villages around Yachang, as evinced from rapid rural appraisal, was eye-opening to say the least. Households were generally clean and well kept and livestock (including dogs which, in China, are livestock) and children were comparatively rare and well tended. Everyone who maintained pigs and poultry had well-built sties and coops for them. Most people did not keep draft animals (e.g. buffalo or bullocks) but rented or borrowed those from neighbors when they needed to plow. In addition, each village we visited had a biogas facility that was fed with both human and animal wastes and many households had biogas lines for cooking. The biogas production was impressive in that concrete ditches extended from the backs of many pigsties directly into biogas chambers, which were also adjacent to human outhouses. Little was wasted.

Results from the pre-test of the social survey instrument designed for the area (Appendix 2) were also quite telling. Most people were of Han Chinese ethnic origin, but two recognized minorities also live in the area: Zhuang and Yao. We were able to visit and talk to people of all three ethnic groups, and, unlike the situation in highly socially-stratified Nepal (e.g. Heinen, 1993) there were few discernable ethnic differences in needs, economic strata, or opinions about the reserve. No one expressed that there was significant crop or livestock lost to wildlife, but several did indicate that poultry were occasionally preyed upon by hawks and wild cats. Based on the descriptions given of the latter, they were most likely both leopard and marbled cats (*Prionailurus bengalensis* and *Pardofelis*

marmorata), two species with large geographic ranges in tropical Asia. Several people in one village indicated that wild pigs (*Sus scrofa*) were occasional crop pests. There are no large cats left in Yachang and the only ungulates besides pigs found in the Reserve are one species each of barking deer and serow (a goat antelope), but both are rare. Thus conflicts with wildlife are negligible. Most people also expressed that the resources they needed from the Reserve were provided by legal facility zones around its periphery and thus there were few other conflicts between Yachang and local villagers. Many families lived in traditional wooden houses, but these tended to be large, durable structures that needed little yearly maintenance; others had converted to cement and stone houses. Stone was collected locally, but this is also legal in facility zones.

The only major conflict that we witnessed directly was with a Zhuang family who planted corn on a hillside located outside the Reserve proper, but on Guangxi Forestry Bureau land that contained an important population of *Geodorum eulophioides*, a highly endangered orchid thought to have been extinct (Hong Liu, personal communication). The family claimed the land because their ancestors were buried nearby. We interviewed them and Professor Liu organized a meeting with the family and County officials. A resolution was agreed to such that the family would be allowed to keep the current corn crop as long as they did not use pesticides or disturb the orchids. The Guangxi Forestry Bureau was supposed to compensate them for abandoning farming in future years but, at the time of this writing, it had not done so. Thus this conflict is ongoing and we plan to follow the situation given the importance of that orchid population.

We also were able to visit several important sites for tourism around the Reserve, and the greenhouse facility in which wild orchid species are under experimentation for domestication. These sites are quite spectacular (particularly Huangjingdong and Yachang Orchid Garden) and tourism in the area could increase greatly. Huangjingdong is a large, natural limestone pit with high plant species diversity throughout; a trail surrounds the entire area with an overlook that extends high above the floor of the pit. The Yachang Orchid Garden is a very moving spectacle. The walk takes about 45 min and the trail winds along a slope in which each bend gives new, up-close and amazing views of blooming orchids. Since we were there in May, and many other species are summer or fall bloomers, each season brings new colors and sights.

As tourist markets expand, especially now that Yachang is being elevated to a national level Reserve, there is abundant opportunity to train local graduates to be guides. For guides of foreign tourists, English proficiency would be required, but there are many qualified applicants from universities across China, including several in Guangxi Province. It would, in my opinion, be imperative to require that visitors go in small groups (6–8 people) with one guide per group through the Orchid Garden, and no more than three groups per hour. A number of those species are rare and that site is too important to allow large numbers of unaccompanied visitors. Guided tours should also be offered around Huangjingdong as visitors could learn a great deal about the geology and ecology of the region with qualified guides; guides, in turn, could keep noise, garbage, plant poaching, etc. to a minimum. As markets increase, more social science research will be needed to assure quality experiences and adequately trained guides.

Lastly, I should point out that what we were able to see in the villages around Yachang, and whom we were able to meet, was determined largely by the Guangxi Forestry Bureau. They were our hosts and provided us with transportation. The next step in research should be a large-scale house-to-house survey, using Appendix 2 as the preliminary instrument, to assure a large random sample encompassing much more scope. For that reason, my goal is to recruit a qualified Chinese graduate student (or students) to complete a much greater social sciences research effort in the area. The karst topography in which Yachang is located is simply beautiful. There are large caverns with enormous stalactites, vast natural limestone pits, fast flowing rivers above and below ground, elevations ranging from sub-tropical to cool temperate zones and highly nutrient-depleted soils that have all in turn created the selective pressures for the speciation of myriad orchids and their pollinators. As both tourism and the aspirations of local inhabitants grow, so will the need for an expanded (and ongoing) social sciences research agenda to assure sustainability in this complex and rapidly-changing social landscape.

Synthesis and Conclusions

As human populations and living standards, and natural resource management issues, all increase in a rapidly industrializing world, the role of the social sciences in PAs research and management has necessarily increased in importance globally. That this was largely neglected early in the modern PAs movement was unfortunate, but the past three decades have seen a great shift in emphasis and this has, in many ways, improved the prospects for long-term conservation in many parts of the world.

But we still have a long way to go. For example, many PAs are still set aside in developing countries without a priori knowledge or input from local communities and, in too many places, local communities are marginalized. Numerous studies have shown that there is growing support for national conservation programs, but this is generally true for more educated urban populations (e.g. Bandara & Tisdell, 2003). In too many places, rural people who must deal directly with conservation decisions, and suffer costs, are less in favor of conservation programs and are less empowered to address their grievances. Ideally, local-level social and economic feasibility studies would be completed prior to the establishment of protected areas, but this is not required by any national PAs enabling legislation to my knowledge. Yet myriad studies of wildlife, plant diversity, geology, etc., are carried out to determine where PAs should be located. So the natural sciences are still dominant in the establishment of PAs and, partly because of that, the social sciences become important after the fact, i.e. when socio-economic conflicts emerge.

It is my contention that this needs to change. The social sciences have an equal role with the natural sciences to play in all stages of protected areas establishment and management. When conflict becomes apparent due to any number of factors (e.g. too much tourism, poaching, grievances due to restrictions, etc.), one could argue that the role of the social sciences is, in fact, greater than that of the natural sciences.

If left to its own devices, nature can take care of itself. It's the inclusion of people in the equation where things get interesting. I believe that managerial conflicts could be lessened to a great degree, and perhaps even avoided in many cases, if the social sciences played a more prominent role in PAs research and establishment. Some of the programs set up a priori on a community-based conservation model (e.g. Annapurna, Nepal; above) have shown this to be the case, but there are still too few of these compared to the large and growing list of more traditional PAs (i.e. Categories I through IV; Table 1).

Humans and nature can coexist. We can establish zoning criteria such that the most important natural areas (as determined by the natural sciences) are largely off limits while outlying facility areas can provide some extractive uses, and in many cases sustainable human enterprises such as well regulated nature-based (i.e. eco-) tourism can be used to the betterment of conservation through new funding mechanisms. The trick is to get the balance correct early in the establishment of PAs. I have also found a frequent lack of appreciation or understanding on the part of many of my colleagues in the natural sciences—as well as many natural resource agency personnel who are trained mostly in the natural sciences—about the large role that the social sciences could and should play in PAs research and management, and about the plights of marginalized rural residents.

The case of the endangered *Geodorum* population just outside Yachang Orchid Reserve (above) is rather telling. After the agreement was formulated, a local bureaucrat declined payment to the Zhuang family (that was part of the agreement) because, in his view, they did not hold legal land title. While this is true (i.e. rural lands have belonged to the Chinese Government since the 1950s), it misses the point. Without compensation for their lost labor and corn, that family will continue to farm in an area with an endangered orchid population. If forced by the Government to stop farming, the family could simply destroy the orchids out of spite. I am not stating that they will, but it is within their power because the Forestry Bureau cannot place armed guards on that hillside 24/7. This has happened too often in the annals of endangered species conservation and it need not be the case (e.g. the "shoot, shovel and shut up" phenomenon; Heinen, 1995). So both the family's interests and the interests of the conservation of a globally-important orchid population are now in peril, all due to the actions of one local official. Conflict resolution through arbitration and (where appropriate) direct compensation, already standard in many countries, should be universal in PAs management, and it is the social sciences that inform such efforts.

From the largest scale (i.e. implementation of international conservation treaties and national conservation law) to the smallest scale conservation issues (i.e. local conflicts such as that described above), the social sciences have a very important role to play in all stages of PAs research and management. They also have a much richer literature than could possibly be described fully here. While this review was necessarily short due to space constraints, I hope that I have convinced readers of this fact, and I also hope to continue and expand research in Yachang Orchid Reserve. There are myriad opportunities for social science research projects in and around Yachang that address local concerns and opinions, the potential for and pitfalls of growing tourism opportunities, potentially new funding mechanisms, national and local-level policy

implementation, the adequacy of current facility zones, etc. And then there are orchids, all 140 plus species (and counting). What a wonderful place.

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Appendix 1. An example questionnaire survey administered to residents living in villages near proposed extension areas around Kaziranga National Park and World Heritage Site, Assam, India. See text for explanation

KAZIRANGA BUFFER ZONE MANAGEMENT PROJECT
EXTENSION AREA INTERVIEW QUESTIONNAIRE

No:____

Extension Area:_____

Village:_____

Ward/Block No:_____

District:_____

Distance to KNP Core:_____km

Distance to KNP Buffer:_____km

Distance to KNP Extn. Area:_____km

Distance to Highway: _____km

Name of Respondent:_____

Date of interview:_____

Time of interview:_____am pm

Location of interview:_____

1. Respondent's Ideographic Data

1.1 Sex:_____Male _____ Female 1.2 Age:_____
1.3 Caste:_____ 1.4 Education:_____
1.5 Occupation:_____ 1.6 Marital Status:_____

2. Household Member Information

No.	Relation to Respondent	Age	Education	Occupation	Months in[@]	Days in[#]
1.						
2.						
3.						
4.						
5.						

[@]Village [#]Forest

IL - Illiterate L - Literate(read/write) HS - High Secondary(8-10)
P - Primary(1-5) LS - Lower Secondary(6-7) I - Intermediate(11-12)
B - Bachelors M - Masters
AG - Agriculture AGS - Agri. + Service B - Private Business
T - Teaching FI - Fishing KNP - Work for KNP
FO - Forest Dept. Staff GS - Govt. Service PS - Private Sector

3. Immigration

3.1 Have you immigrated from elsewhere? Yes_____ No_____
3.2 Migrated from:

No.	Migrated From	Put a Check Mark
1	Inside KNP	
2	A Village in same District	
3	Another District	
4	Another State	
5	Bangladesh	

3.2.1 Date of Migration_____
3.2.2 Reason for Migration_____

3.3 Emigration

3.3.1 Has any family member emigrated ? Yes_____ No _____

No.	Age	Gender	Education	Profession
1.				
2.				
3.				

4. Land Holdings 4.1 Do you own agricultural land? Yes_____ No_____

No.	Land Type	Land Area
1.	Productive	
2.	Unproductive	
3.	Productive/Irrigated	
4.	Vegetable Garden	
5.	Fodder	

4.2 Land Tenure

No.	Land tenure	Area
1.	Freehold	
2.	Leasehold	
3.	Appropriated w/o title	
4.	Rented In	
5.	Rented Out	
6.	Share cropping In	
7.	Share cropping Out	

.2.1 Area of house plot_____.

5. Livestock Holdings 5.1 Do you own any livestock? Yes____ No___(if No, go to question # 7
Immunized: Y____No_____. Year:_____. Number of Cattle Immunized:_____.
Benefits: Y____No_____. If No, Why?_____.

5.2 Livestock Holdings:

No.	Livestock	Local Breed	Improved Breed	Yield/month	Income (Rs.)
1.	Cows				
2.	Buffalo				
3.	Bulls				
4.	Goat / Sheep				
5.	Pig				
6.	Poultry				
7.	Other				
Total Income:					

5.3 Problems in Raising Livestock

No.	Problem	Rank
1.	Decreasing natural grasslands	
2.	Restrictions on grazing in KNP	
3.	Restrictions on grazing in Reserved Forests	
4.	Insufficient farm fodder	
5.	Lack of drinking water	
6.	Shortage of labor to graze cattle	
7.	Lack of market to sell dairy products	
8.	Cattle rearing is no longer profitable	
9.	Lack of veterinary services	

6. Fodder

6.1 Forest Fodder Species Lopped

No.	Species	Proportion only forest fodder					
		1/4	1/3	1/2	2/3	3/4	All
1.							
2.							

6.2 Forest Areas used for Fodder Extraction

No.	Location of fodder extraction	Distance from home	Proportion					
			1/4	1/3	1/2	2/3	3/4	All
1.								
2.								

6.3 Total Proportional Fodder Supply

Season	Farm	Village Commons	Forest	Market
Summer				
Monsoon				
Winter				

6.4 Market Price of Fodder

Season	Quantity purchased	Price Paid (Rs.)
Summer		
Monsoon		
Winter		

6.5 Stall Feeding

Livestock	Summer / days	Monsoon / days	Winter / days	All
Cattle				
Buffalo				
Goat/Sheep				

6.6 Forest Grazing - Duration

Livestock	Summer Days / Week	Monsoon Days / Week	Winter Days / Week
Cattle			
Buffalo			
Sheep / Goat			

6.7 Forest Grazing - Specific Location

Livestock	Summer	Monsoon	Winter
Cattle			
Buffalo			
Sheep / Goat			

6.8 Reason for Forest Grazing

No.	Reason	Checkmark
1.	Farm fodder is not enough	
2.	Lack manpower to collect farm fodder	
3.	Lack manpower to collect forest fodder	
4.	Abundant free forest fodder	
5.	Tried stall feeding unsuccessfully	
6.	Can't supply drinking water when stall feeding	
7.	It keeps livestock healthy	
8.	Other..	

6.9 Reason for not grazing in Forest

No.	Reason	Rank
1.	Restriction by wildlife authorities	
2.	Restriction by forest authorities	
3.	Restriction by village community	
4.	Enough farm fodder	
5.	Purchase all fodder from market	
6.	Not enough forest grazing available	
7.	To minimize forest damage	
8.	Other..	

7. Income: Crops cultivated Year 1999

No.	Crop	Qty. Used	Qty. Sold	Qty. Stored	Income (Rs)
1.	Rice				
2.	Wheat				
3.	Maize				
4.	Jowar/Bajra				
5.	Potato				
6.	Legume				
7.	Jute				
8.	Vegetables				
9.	Fruits				
Total					

7.1 Income expected from total crops harvested in 2000_____Rs.

7.2 Income from total crops harvested in 1998_____Rs.

7.3 Sum Total of Household Income Sources:

No.	Source of Income	Amount (Rs.)
Farm Income:		
1.	Crops	
2.	Vegetables	
3.	Fruits	
4.	Milk	
5.	Eggs/cheese	
6.	Poultry	
7.	Cattle/Buffalo sale	
8.	Fish farming	
Non-Farm Income:		
10.	Business/Shopkeeping	
11.	Industry/Manufacturing	
12.	Service: Govt./Private	
13.	Remittance/Pension	
14.	Labor	
Forest Income		
15.	Fodder grass	
16.	Thatch	
17.	Fuelwood	
18.	Fruits/Seeds/Tubers	
Total Income:		

8. Natural Resource Use

No.	Resource	Kg	Freq./ week	Proportion KNP KNP Buf . Other specify RF/PF Community			
1.	Fuelwood						
2.	Fodder						
3.	Thatch						
4.	Timber Logs/Poles						
5.	Timber Fencing						
6.	Fruits						
7a.	Seeds (planting)						
7b.	Seeds (sowing)						
7c.	Seeds (consumed)						
7d.	Seeds (sold)						
8.	Tubers						
9.	Medicinal Plants						
10.	Fish						

8.1 Natural Resource (Species)

No.	Plant Species
1.	Fuelwood:
2.	Fodder:
3.	Thatch:
4.	Pole/Logs for construction:
5.	Fruits:
6.	Seeds:
7.	Medicinal Plants:

9. Household Fuel

No.	Type of Fuel Used	Quantity Used/ Cost in Rs.
1.	Fuelwood	
2.	Kerosene	
3.	Cow-dung Cakes	
4.	Electric Stove/Heater	
5.	Gobar-Gas	
6.	LPG	

9.1 Do you propose to change type of fuel used? 9.2 New fuel____- proposed time for change_____.
9.3 Will you continue to use both existing fuel and new fuel? 9.4 Proportion of each to be used:_____.

10. Wildlife Damage

10.1 Do you experience wildlife damage of any kind? Yes_____ No_____. (if No go to #11)

10.2 Seasonality of Overall Damage

No.	Season	Frequency of Damage Increase/decrease/NC	Occurrence		
			Yearly	Some Years	Never
1.	Summer				
2.	Monsoon				
3.	Winter				

NC=no change

10.3 Type of Damage & Compensation 3 yr Period:

No.	Crop/Property	1998 Loss	Comp.	1999 Loss	Comp.	2000 Loss	Comp.
1.	Rice						
2.	House						
3.	Cow						
4.	Bull						
5.	Buffalo						
6.	All Calf						
7.	Sheep/Goat						
8.	Pig						
13.	Human Life						
14.	" Injury						
Total							

10.4 Source of Compensation:

Year	Source of Compensation	Satisfied? Yes/no
1998		
1999		
2000		

10.5 Utilization of Compensation by household

No.	Year	Utilization Details
1.	1998	
2.	1999	
3.	2000	

10.6 Fine and Penalty Payments:

No.	Year	Infringement type	Amount (Rs.)
1.	1998		
2.	1999		
3.	2000		

10.4 Seasonality of large mammal movement. Enter sighting periodicity in months.

No.	Species	Fields	Pastures	Extn. area	Buffer zone	Other
1.	Elephant					
2.	Rhino					
3.	W Buffalo					
4.	Wild Boar					
5.	Sambar					
6.	Chital					

11. Awareness of Prohibitions

No.	Management Practice for KNP	Yes	No
1.	Fuelwood collection		
2.	Grass harvest		
3.	Tree branch lopping		
4.	Tree felling		
5.	Pole cutting		
6.	Thatch for housing		
7.	Forest Produce, fruits nuts seeds tubers		
8.	Medicinal Plants		
9.	Grazing		

12. Attitude

No.	Issue	Y/N/Don't know
1.	Do you support KNP	
2.	Has KNP succeeded in improving the local environment	
3.	Have any of KNP mgmt activities damaged the local environment	
4.	Is there a need to enlarge the area managed under KNP	
5.	Do you support the proposed area extensions to KNP	
6.	Do large mammals need more area under protection	
7.	Do you think that these area extensions will help large mammals	
8.	Will these extensions help better manage KNP	

Appendix 2. Preliminary Draft Survey Instrument for Yachang Orchid Reserve, Guangxi Province, China (May, 2009)

1. Village_____Ethic Group_____ Distance of House from Reserve_____

2. Number of People in your Household_____

3. Number of livestock owned and tended by the household:

Cattle_____ Goats_____ Sheep_____ Buffalo_____ Pigs_____ Poultry/ducks_____

Other (specify):_____

4. Are you aware of the rules of Yachang Orchid Reserve: Y N
   Restrictions against: Timber Harvest Y N Fuelwood Collection Y N
   Fodder Collection Y N Grazing Livestock Y N
   Other (specify) Medicinal Plants

5. How do you meet your household needs for: Timber Fuelwood
   Fodder Medicinal plants
   Other (specify)

6. Have you lost any livestock to wild animals in the past 5 years: Yes No
   If so, what species of livestock?
   Specify type and number_____
   What species of wildlife caused the loss (list all)?

7. How much land does your Household farm?_____
   What crops do you grow (specify type and area)_____

8. Have you lost any crop production from wild animals in the past 5 years: Y N
   If so, what types of crops (List all)
   What types of wildlife caused the loss (List all)?

9. What are the advantages of living near Yachang Orchid Reserve? (open)

10. What are the disadvantages of living near Yachang Orchid Reserve? (open)

11. How do you think the Reserve could be managed to address the disadvantages?

12. Overall, are you in favor of the creation of the Reserve? Y N

    Why or why not? (open-ended)