Conservation Biology

Essay

Putting People on the Map through an Approach That Integrates Social Data in Conservation Planning

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Abstract: *Conservation planning is integral to strategic and effective operations of conservation organizations. Drawing upon biological sciences, conservation planning has historically made limited use of social data. We offer an approach for integrating data on social well-being into conservation planning that captures and places into context the spatial patterns and trends in human needs and capacities. This hierarchical approach provides a nested framework for characterizing and mapping data on social well-being in 5 domains: economic well-being, health, political empowerment, education, and culture. These 5 domains each have multiple attributes; each attribute may be characterized by one or more indicators. Through existing or novel data that display spatial and temporal heterogeneity in social well-being, conservation scientists, planners, and decision makers may measure, benchmark, map, and integrate these data within conservation planning processes. Selecting indicators and integrating these data into conservation planning is an iterative, participatory process tailored to the local context and planning goals. Social well-being data complement biophysical and threat-oriented social data within conservation planning processes to inform decisions regarding where and how to conserve biodiversity, provide a structure for exploring socioecological relationships, and to foster adaptive management. Building upon existing conservation planning methods and insights from multiple disciplines, this approach to putting people on the map can readily merge with current planning practices to facilitate more rigorous decision making.*

Keywords: conservation planning, ecoregion conservation, political empowerment, social indicators, social well-being

Poner a la Gente en el Mapa por Medio de una Estrategia que Integra Información Social en la Planeación de la Conservación

Resumen: *La planeación de la conservación es integral para la operación estratégica y efectiva de las organizaciones conservadoras. Al partir de las ciencias biológicas, la planeación de la conservación históricamente ha utilizado de manera limitada la información social. Ofrecemos una estrategia para integrar información sobre el bienestar social en la planeación de la conservación. Esta estrategia captura y ubica en contexto los patrones espaciales y las tendencias en las necesidades y las capacidades humanas. Esta estrategia jerárquica proporciona un marco de trabajo nidificado para caracterizar y mapear datos sobre el bienestar social en cinco dominios: bienestar económico, salud, fortalecimiento político, educación y cultura. Cada uno de estos cinco dominios tiene múltiples atributos; cada atributo puede ser caracterizado por uno o más indicadores. A través de datos existentes o nuevos que muestran heterogeneidad espacial y temporal en el bienestar social, los científicos conservadores, los planificadores y quienes toman las decisiones pueden medir, comparar, mapear e integrar esta información dentro de procesos de planeación de la conservación. Seleccionar indicadores e integrar esta información en la planeación de la conservación es un proceso participativo e iterativo hecho para el contexto local y las metas de la planeación. La información sobre el bienestar social complementa los datos sociales biofísicos y orientados hacia las amenazas dentro de los procesos de planeación conservadora para así poder informar a las decisiones con respecto a dónde y cómo conservar la biodiversidad, proporcionar una estructura para explorar las relaciones socio-ecológicas y fomentar el manejo adaptativo. Al construir sobre métodos de existentes de planeación de la conservación y conocimientos de disciplinas múltiples, esta*

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Paper submitted April 26, 2013; revised manuscript accepted November 12, 2013.

Conservation Biology, Volume 28, No. 5, 1236–1248

DOI: 10.1111/cobi.12357

estrategia para poner a la gente en el mapa puede incorporarse pronto con las prácticas de planeación actuales para así facilitar una toma de decisiones más rigurosa.

Palabras Clave: bienestar social, conservación por eco-región, fortalecimiento político, indicadores sociales, planeación de la conservación

Introduction

Conservation planning is integral to strategic and effective operations of governmental and nongovernmental conservation organizations. Spatial and strategic conservation planning provide direction regarding which elements of biodiversity to protect and how to do so, allowing conservation organizations to set priorities and allocate scarce resources more efficiently (O'Connor et al. 2003; Pressey & Bottrill 2008). (We use the term *conservation planning* broadly, referring to discrete decision making processes designed to identify options and to set priorities among them in pursuit of specific conservation objectives.) The goals of conservation planning are to protect the most important areas of biodiversity (Margules & Pressey 2000), maximize returns on conservation investments (Brooks et al. 2006), and promote effective conservation interventions (Knight et al. 2006).

The field of conservation planning draws heavily upon biological sciences. Researchers and practitioners have developed sophisticated methods to identify global and regional conservation priorities (Brooks et al. 2006; Moilanen et al. 2009; Pressey & Bottrill 2009). Once these priorities have been delineated, methods to select biodiversity targets (i.e., focal species, habitats, ecological processes), assess their viability (i.e., likelihood of persistence), and identify threats further narrow the geographic and thematic focus of future conservation interventions (Salafsky et al. 2002; Parrish et al. 2003). Finally, operational planning guidelines (e.g., Knight et al. 2006; CMP 2007) and standard conservation strategies (Salafsky et al. 2008) provide guidance for protection of prioritized biodiversity targets.

Less attention in conservation planning has been paid to the social factors that influence (and are influenced by) an organization's choice of strategic action (O'Connor et al. 2003; Cowling & Wilhelm-Rechmann 2007), though the need to incorporate sophisticated and diverse social data into conservation planning is increasingly recognized (Knight & Cowling 2007; Polasky 2008; Pressey & Bottrill 2008). Given that social variables (e.g., values, norms, institutions, human well-being) underpin most opportunities and constraints for effective conservation action (Cowling & Wilhelm-Rechmann 2007), understanding social phenomena that affect conservation action and biodiversity targets is fundamental to conservation success (Cowling et al. 2004; Sheil et al. 2006; Polasky 2008).

Traditionally, social data in conservation planning have focused upon direct and indirect threats to biodiversity. These direct and indirect threats are represented by direct measures of human resource use, proxies for human behavior (e.g., population density), and by indicators of human impacts (e.g., tons of fish harvested) (Gorenflo & Brandon 2006; CMP 2007; Salafsky et al. 2008). Novel approaches that rely on a wider range of social data and analyses include incorporating spatially explicit information about the equity (Halpern et al. 2013) and economic costs of conservation (Naidoo et al. 2006; Wilson et al. 2007); mapping social assets (del Campo & Wali 2007) and local concerns and preferences (Sheil et al. 2006; Knight et al. 2010) as foundations for conservation action; predicting conservation return on investment based on social and ecological factors (O'Connor et al. 2003; Wilson et al. 2007); and integrating data on social institutions and governance structures in conservation planning (Pressey & Bottrill 2008).

We extended this recent work by devising a framework and process for integrating data on social well-being into conservation planning. This approach, which we termed Putting People on the Map (P-MAP), captures and places into context the patterns and trends in human needs and capacities and, thus, complements other biophysical and social data used in conservation planning. The P-MAP approach builds upon in-country collaboration with conservation practitioners at 7 landscape conservation programs in 8 countries (2006–2009) (Morrison et al. 2009). We introduce the P-MAP approach and highlight 4 key questions that can be addressed by integrating data on social well-being into conservation planning processes. (For detailed technical guidance, see Stephanson & Mascia 2009*a*, 2009*b*.) Though we draw upon existing social monitoring frameworks and conservation planning approaches, P-MAP is a novel and robust approach intended for use in any conservation planning process that would benefit from a richer understanding of social well-being as 1 component of social context.

Measuring Social Well-Being

The P-MAP approach enhances decision makers' understandings of the social dimensions of conservation planning, action, and impacts. To develop P-MAP, we drew upon conservation practice and best practices in other sectors. We defined social well-being and its constituent

components by comparing and identifying emergent concepts from approaches developed by Sen (1999), the Millennium Ecosystem Assessment (MEA) (2005), and a review of social indicators used to monitor protected areas (A. Khurshid & M.B.M., unpublished data). Sen's capabilities approach, which defines well-being based on human capabilities "to lead the kinds of lives that they have reason to value . . . " (1999), was the first to extend the definition of poverty beyond simplistic measures of gross domestic product or per capita income (Sen 1999), a perspective now institutionalized in the UN Human Development Index (UNDP 2007) and Millennium Development Goals (MDGs) (UN Millennium Project 2005). The MDGs and associated indicators provide a commonly accepted framework for measuring human development. The MEA (2005) explored the relationships between ecosystem services, direct and indirect drivers of change, and human well-being. The comprehensive review of social indicators used to monitor protected area impacts provided a snapshot of conservation monitoring practices (A. Khurshid & M.B.M., unpublished data).

Despite their disparate origins, Sen, MEA, and the social indicators review coalesce around a similar definition of social well-being as *the human capabilities and conditions associated with a productive, fulfilling life* (MEA 2005; CMEPSP 2009). Given that social well-being inherently comprises multiple components (Table 1), we derived a hierarchical framework for P-MAP with 5 primary domains: economic well-being, health, political empowerment, education, and culture. Economic well-being represents the resources people use to meet basic needs and access other sources of well-being (Sen 1999). Health is a state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity (WHO 1946). Political empowerment refers to people's ability to participate in and influence decision making processes that affect their lives (UNDP et al. 2005). Education refers to formal and informal structures, systems, and practices used to transfer knowledge and skills in a society. Culture refers to the "distinctive spiritual, material, intellectual and emotional features of society or a social group, . . . encompass[ing] . . . lifestyles, ways of living together, value systems, traditions and beliefs" (UNESCO 2002).

Framework for Measuring Social Well-Being

To operationalize this framework within P-MAP, we looked to conservation practice for inspiration—particularly the flexible approach developed by the Conservation Measures Partnership (CMP). The *Open Standards for the Practice of Conservation* (CMP 2007, 2013), an operational model of conservation planning, outlines a participatory process for identifying conceptual relationships among elements relevant for place-based or thematically oriented conservation activities. Two key components of the Open Standards guided our work: processes used to define biodiversity targets and assess the viability of targets in a given conservation area (Table 2) (Parrish et al. 2003; CMP 2007, 2013). We developed loosely analogous systems in P-MAP for measuring elements of social well-being most relevant for conservation planning. Our goal was to establish a rigorous, replicable, and robust approach (i.e., framework and process) that could be adopted by users of diverse strategic (e.g., Open Standards, Miradi), systematic (e.g., Marxan, Zonation), and asset-based conservation planning tools (e.g., social-asset mapping).

Similar to the Open Standards and UN Human Development Index (UNDP 2007), we used a hierarchical structure to categorize and quantify social well-being in P-MAP. In this structure, the *domain* represents a broad component of social well-being. Each domain contains numerous social *attributes*. Each attribute can be measured with 1 or more social *indicators* (Table 3). For example, to incorporate health (social domain) into conservation planning, one might use data regarding nutrition (health attribute), such as prevalence of underweight children (indicator).

Through P-MAP, we examined indicators that represent the well-being of local residents (i.e., construct validity), which is a fundamental component of the social context of conservation. Social well-being is tightly linked to biodiversity conservation through complex and reciprocal relationships, both as variables that influence human interactions with the environment and as a manifestation of conservation interventions. Contextual variables such as degree of water security (health attribute) and strength of resource tenure (political empowerment attribute), for example, may influence resource use patterns (e.g., harvest rates, locations). A village without secure access to water might dam a river, whereas residents with secure hunting rights might guard wildlife against poaching. Conversely, conservation interventions may (a) directly impact social well-being; (b) directly impact the flow of ecosystem services, with indirect effects on social well-being; or, (c) by affecting one component of social well-being, induce secondary impacts on other attributes. For example, establishment of a marine protected area (conservation intervention) might directly reshape local residents' resource rights (political empowerment attribute); indirectly influence food security (health attribute) by directly protecting fish populations for harvest (ecosystem services); and indirectly enhance educational attainment (education attribute) by enhancing food security and, thus, allowing children to attend school more regularly (secondary impact). Moreover, the social equity of conservation plans may influence the likelihood of plan implementation and success (Halpern et al. 2013).

Table 1. Social domains characteristic of the Putting People on the Map (P-MAP) approach and the established frameworks for characterizing social well-being upon which it is based.[a]

P-MAP	*Social impacts of protected areas*	*Capabilities approach*	*Millennium Ecosystem Assessment*
Economic well-being	well-being	economic facilities	basic material for a good life
Health[b]	health	good health	health
Political empowerment[c]	governance & social capital	political freedoms	freedom of choice and action
Education	education	access to education	
Culture	culture		
		basic human rights	good social relations
			security

[a]*Sources: Sen (1999); MEA (2005); A. Khurshid & M.B.M., unpublished data.*
[b]*May include rate or risk of injury or death from natural disasters, human-wildlife conflict, and other forms of interaction with the natural world, which are defined as a subset of security by the Millennium Ecosystem Assessment.*
[c]*While these concepts all relate to the political sphere, each conveys a slightly different meaning about how the political sphere manifests in individual lives and within society.*

Table 2. Hierarchical nested frameworks of Open Standards used to measure biological status and P-MAP[a] used to measure social well-being.[b]

		Open Standards	
Target	Features of a place that are chosen to represent and encompass the biodiversity found in a conservation area. Targets can be focal species, habitats, or ecological systems and processes.		
	Key ecological attributes	An aspect of a target's biology or ecology that, if present, defines a healthy target and, if missing or altered, would lead to the loss or extreme degradation of that target over time.	
		Indicator	A specific, measurable characteristic of the attribute or a collection of such characteristics combined into an index.
		Viability assessment	Rating to classify the state of the target (based on indicator measurements) as Poor, Fair, Good, Very good.
		P-MAP	
Domain	The specifiable components of social well-being: economic well-being, health, political empowerment, education, and culture.		
	Attributes	Characteristics or qualities that describe each domain (e.g., Health = Food security + access to medical care + access to clean water)	
		Indicator	A specific, measurable representation of the attribute (e.g., Food security is measured by: Proportion of population below minimum level of dietary energy consumption).
		Benchmarking	Rating to compare the value of an indicator against national or global average (where possible).

[a]*Putting People on the Map.*
[b]*Sources: CMP (2007); authors.*

Where appropriate, for efficiency and comparability, we look to globally accepted indicators to measure social well-being. For example, MDGs (UN DESA 2008) provide numerous conservation-relevant indicators of social well-being that are measured by governments globally.

Social Well-Being Data

The P-MAP approach explicitly recognizes that social well-being is heterogeneous in space and time. To inform conservation planning, social data must reflect this spatial and temporal heterogeneity at the finest practicable resolution. Commonly available social data sets (e.g., government censuses, demographic and health surveys, and MDG indicator data), which tend to track social well-being at district-level spatial scales or larger, are a default source of social well-being data for P-MAP. Though secondary source data may not always provide sufficient spatial and temporal resolution to inform conservation planning at extremely local levels or in particularly dynamic social settings, existing data can inform

Table 3. Sample attributes and indicators of social well-being.

Domain	*Attribute*	*Indicator*
Economic well-being	income	proportion of people living on <$1/day*
	material assets	telephone lines or cellular phone subscribers/100 population*
	natural assets	% households with access to sustainable source of fuel wood
Health	food security	proportion of population below minimum level of dietary energy consumption*
	water security	proportion of population using an improved drinking water source*
	mortality	infant mortality rate*
Political empowerment	resource rights	% population whose land tenure is recognized by the government
	political engagement	% population participating in local, regional, national elections
	women's empowerment	proportion of seats held by women in national parliament*
Education	enrolment	% of school age children enrolled in primary school*
	achievement	proportion of pupils starting grade 1 who reach last grade of primary*
	literacy	literacy rate of 15- to 24-year-olds, women and men*
Culture	heritage	% important cultural sites preserved
	heritage	% population speaking traditional language
	knowledge	incidence of traditional ecological knowledge in land management

**Indicator used to measure progress against the Millennium Development Goals.*

conservation planning without the costs or complexities associated with primary data collection. For example, data on economic activity collected at the scale of village development committees (VDCs, each roughly analogous to a municipality) in Nepal's Terai region provides information that is useful for planning village-level interventions (Fig. 1a). Spatial heterogeneity apparent at the VDC level is masked by aggregated district statistics, which may be appropriate for ecoregional planning (Fig. 1b) but not more localized planning. These VDC data highlight, for example, opportunities for partners to expand localized alternative livelihood programs into additional geographies of high conservation importance and social concern, in order to reduce long-term threats to livelihoods and biodiversity (B. Gurung and T.P. Gnyawali, personal communication).

Similarly, trends in the incidence of acute respiratory infection in Nepal illustrate the spatial and temporal heterogeneity of social well-being (Fig. 2). Induced by burning wood for fuel, respiratory infections are a health indicator tightly linked to human patterns of natural resource use. From 2001 to 2007, acute respiratory infection rates in Bardiya district were nearly twice as high as in 3 neighboring districts. However, over the 6 years, infection rates in Banke, Kailali, and Kanchanpur districts rose by an average of 300%, relative to an 18% increase in nearby Bardiya. These infection rates highlight the dynamic nature of social well-being across space and time as well as the links between natural resource use and human well-being. An organization seeking positive synergies among social and ecological outcomes might focus its conservation investments in districts of highest or most rapidly increasing infection rates, whereas an organization seeking the most conducive social contexts for conservation might view high infection rates as a hindrance to environmental stewardship and choose to work in districts with low infection rates instead.

The disconnect between ecological boundaries (e.g., ecoregions, landscapes) and political boundaries commonly associated with social data (e.g., districts, provinces) presents a challenge to integration of social and ecological data in conservation planning (Rindfuss et al. 2004). Ecological and social boundaries often differ (e.g., Terai Arc Landscape, southern Nepal; Fig. 1). These discrepancies complicate and potentially distort analyses of socioecological relationships. Given spatial heterogeneity of social and ecological data, simply cropping disjunct polygons to align with predetermined conservation planning boundaries may result in substantial inaccuracies. Disaggregation of existing data sets, targeted data collection (Knight et al. 2010), and spatially explicit modeling (e.g., Ramankutty & Foley 1999) represent more rigorous methods for aligning social and ecological boundaries for conservation planning.

The spatial and temporal scale of conservation planning and management decisions influence the extent and resolution at which data on social well-being are collected and analyzed. If one is setting priorities among countries, national-level data on social well-being may be sufficient; if allocating resources among districts within a country, then data at the district scale (or finer) are required. In practice, as a rule of thumb, conservation planning at the ecoregion scale necessitates social data at district or subdistrict levels; landscape-level planning requires subdistrict or community-level data; and community-scale planning requires social data at the household level. Similarly, iterative conservation planning processes would benefit from data on social well-being that correspond to planning timescales (e.g., a 3-year management plan benefits from new data every 3 years). Government agencies

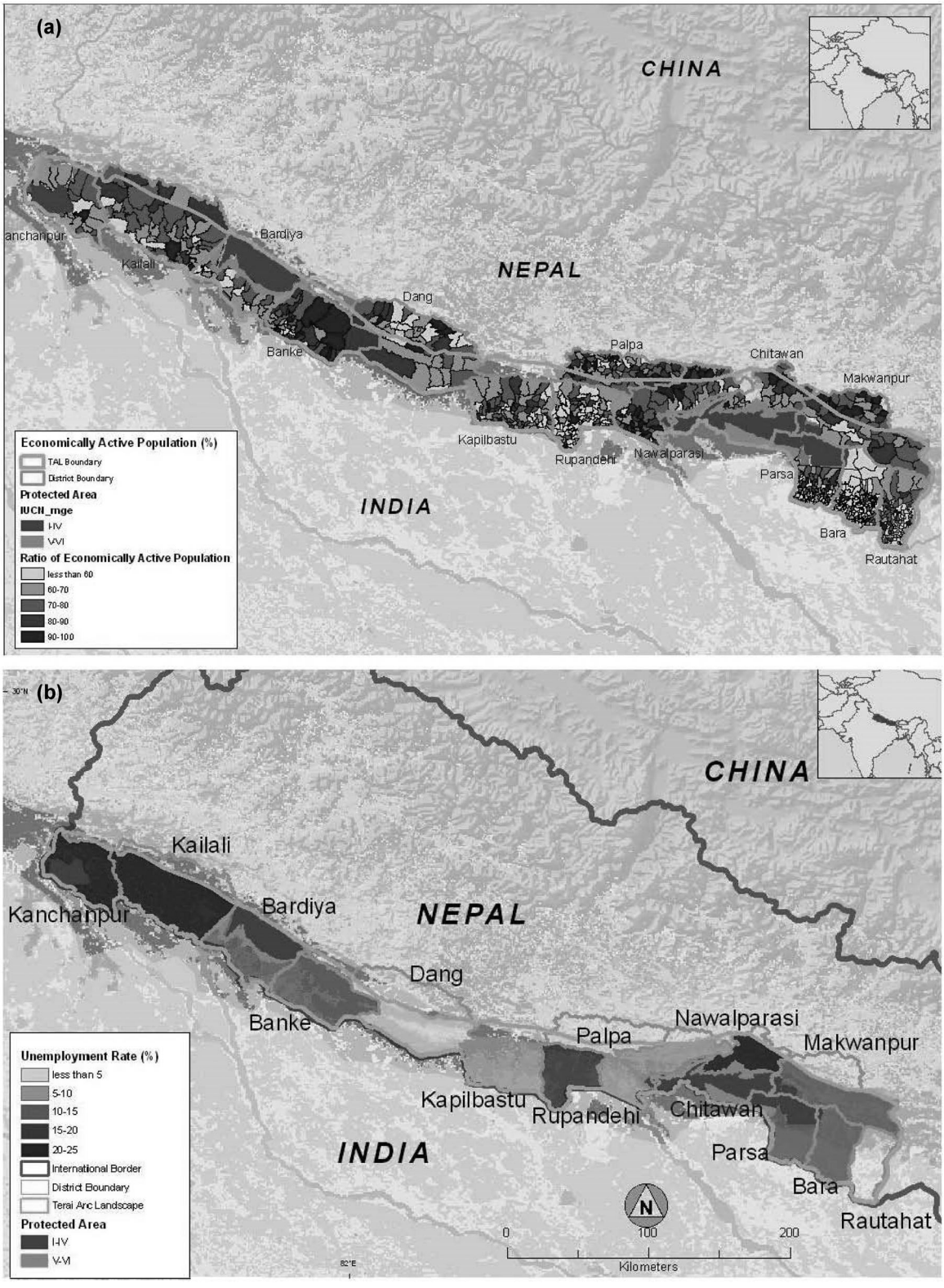

Figure 1. Spatial heterogeneity of (a) economic activity and (b) unemployment across the Terai Arc Landscape (TAL), Nepal, at the scale of (a) village development committees and (b) districts. Each village development committee comprises 9 villages. Data calculated and mapped from (a) Tibetan and Himalyan Digital Library (www.thdl.org/collections/cultgeo/nepal/census/index.php?selection=20, accessed June 2008; based on Nepal Central Bureau of Statistics, 2001 Census) and (b) Nepal Central Bureau of Statistics, 2001 Census. Figures also show protected areas: IUCN I-IV, strict protected areas; IUCN V-VI, sustainable use protected areas.

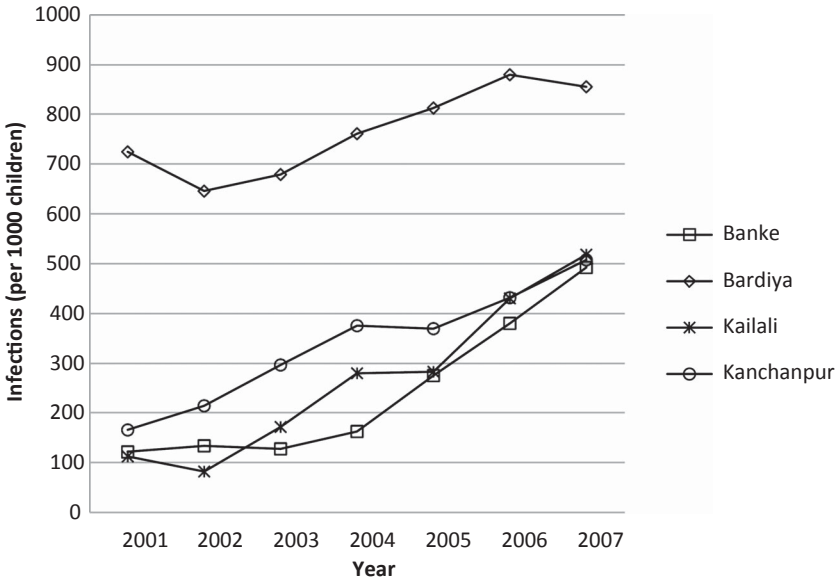

Figure 2. Rates of acute respiratory infection among children <5 years of age in 4 districts of western Nepal. Calculated from Nepal Department of Health Services (www.dohs.gov.np).

and other actors may not collect data on social well-being on a cycle that corresponds to conservation planning, however, complicating decision makers' attempts to use existing data on social well-being. Social well-being data with high spatial and temporal resolution (e.g., household, village; annual, seasonal) are more powerful and scalable than low-resolution data, but present trade-offs in terms of cost and complexity. Weighing these trade-offs requires site-specific consideration of management needs, financial and human capacity constraints, and data costs by decision makers responsible for planning (Morrison et al. 2009).

Social Data in Context

In conservation practice, biological data are sometimes rated according to viability criteria that put numbers into context and provide insights for interpretation (Table 4) (Parrish et al. 2003; CMP 2007, 2013). To put social well-being data into context, we developed a benchmarking protocol for P-MAP that draws upon the CMP approach to viability assessment (CMP 2007, 2013) and the UN Human Development Index, the standard system for assessing, classifying, and comparing social well-being among nations (Table 4) (UNDP 2007).

We benchmark social data in 4 categories along a continuum ranging from low to high levels of human development: low human development (LHD), medium-low human development (MLHD), medium-high human development (MHHD), or high human development (HHD). United Nations' databases house data on numerous national-level social indicators. These databases can be used to produce global averages against which one can benchmark specific social indicators. For example, applying the benchmarking system to infant mortality data in 14 Nepali districts (Fig. 3) showed where infant mortality is relatively high (e.g., Dang, LHD), low (e.g., Rupandehi, MHHD), and intermediate (e.g., remaining 12 districts, MLHD) relative to other countries. Similarly, for country-specific indicators, one may benchmark local data on social well-being against national or subnational averages. While commonly collected social indicators can be benchmarked against national or international levels, highly localized or infrequently collected social indicators cannot be benchmarked and must be assessed independently via expert judgment.

Process as Key

A framework helps organize data into conceptually distinct categories, but cannot replace processes for selecting representative and locally relevant indicators; determining scales at which to measure indicators; or for applying data in a conservation planning system. Selecting indicators generally benefits from a participatory process, in which diverse stakeholders with regional expertise (e.g., knowledgeable social scientists, government officials, local residents, conservation and development practitioners) determine indicators to describe social well-being within the conservation planning unit. The process to define indicators represents an opportunity to explore relationships between conservation priorities and social well-being and to begin identifying appropriate conservation interventions. A portfolio of strategically chosen indicators can represent the multiple dimensions of social well-being. In some cases, it may be possible to measure a portfolio of such indicators by drawing upon consistently available, accessible data (e.g., government statistics, UN statistics). Drawing upon secondary sources is particularly important for conservation planning at large spatial scales, where primary data collection is often impractical or impossible for conservation organizations (Morrison

Table 4. Approaches to benchmarking indicators of biodiversity and social well-being.

Viability assessment for biodiversity indicators[a]					
Chinook salmon		*Rating*			
Key ecological attribute	*Indicator*	*Poor*	*Fair*	*Good*	*Very good*
Habitat size	area of floodplain habitat (ha)	0	0–40	41–404	>404
Recruitment: juvenile abundance	abundance of juveniles (catch/hour in rotary screw cap)	0–0.10	0.11–0.25	0.26–1	>1
Benchmarks for social well-being indicators[b]					
Health		*Human development category*[c]			
Attribute	*indicator*	*low*	*medium-low*	*medium-high*	*high*
Water access	population using an improved water source (%)	<58[d]	59–79	80–96	>97
Nutrition	children <5 years under weight for age (%)	>29	18–28	8–17	<7
Mortality	infant mortality rate per 1000 live births	>109	47–108	10–46	<9

[a] *Rating derived from scientific evidence and expert opinion about the conditions necessary for a biodiversity target to persist over time. There are 4 classes of indicator values, representing a continuum from low to high likelihood of persistence (adapted from Parrish et al. 2003).*
[b] *Categorization based on comparison of site-specific value to global mean in each of 4 country categories.*
[c] *The United Nations divide human development into 3 categories: low, medium, and high. We split the medium category for greater resolution. Ranges in reference values reflect range between mean values for each category. For example, mean infant mortality rates for UN categories are 109/1000 (low development), 47 (medium development), and 9 (high development); thus, the P-MAP benchmark value for infant mortality at low-medium levels of development is 47–108/1000 live births. Values calculated from UNDP Statistics (http://hdr.undp.org/en/statistics/data; accessed September 2008).*

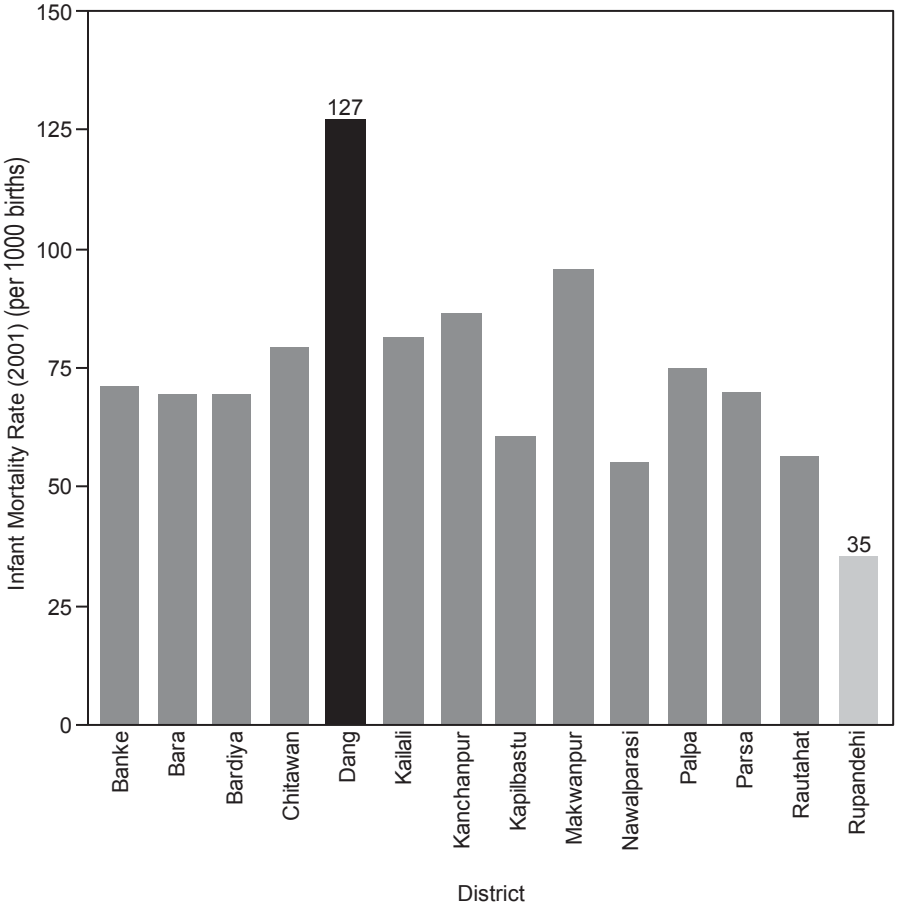

Figure 3. Infant mortality in 14 Nepali districts (2001) benchmarked against UN global averages. Black bar = low human development; dark gray = low to medium human development; and light gray = medium to high human development (Sources: calculated from UNDP and UN Statistics).

et al. 2009). Indicator selection is as an iterative process that evolves throughout data collection and analysis; some initially proposed indicators may prove infeasible or inappropriate.

The specific steps required to structure and integrate data on social well-being into a conservation planning tool or process depend upon the planning system itself. In spatially explicit optimization tools such as Marxan (www.uq.edu.au/marxan/), for example, social well-being data must be transformed into one or more cost layers that shape the relative importance (i.e., priority) of a given location for conservation investment. In strategic conservation planning tools such as the Open Standards, by contrast, indicators characterizing raw or benchmarked data on social well-being may be considered targets (i.e., what conservation interventions seek to achieve), threats or opportunities, enabling conditions (i.e., macroscale social variables that foster or hinder intervention effectiveness), or exogenous variables that simply enrich understanding of the context within which conservation planning and action occur (CMP 2007, 2013). In asset-based planning (del Campo & Wali 2007), certain aspects of social well-being may be considered a type of social asset that is the basis for spatial and temporal priority setting. In each of these planning systems, participants must decide for themselves how to analyze the data, weight them relative to other variables, assign causal relationships, and make decisions based on the resultant outputs (e.g., based on strict quantitative criteria or "informed opportunism" [Knight & Cowling 2007; Pressey & Bottrill 2008]). Methodological challenges and corresponding scientific uncertainty about these relationships and their implications suggest the necessity of participatory processes, formal or informal sensitivity analyses, and scenario planning when using data on social well-being (Peterson et al. 2003; Rindfuss et al. 2004; Knight et al. 2006). The robustness and flexibility of P-MAP foster its use in diverse planning systems but limit the potential for highly prescriptive guidance (Stephanson & Mascia 2009*a*).

Improved Conservation Planning

The P-MAP approach can inform conservation decisions by providing a rigorous yet flexible method for integrating the multiple dimensions of social well-being into conservation planning. Characterizing social context provides conservation planners with a starting point for addressing 4 sets of key questions:

1. Defining and prioritizing targets (ecological or social)
   (a) To what extent is social well-being a concern within the conservation geography?
   (b) Considering the social context, are there particular places or issues (ecological or social) that conservation strategies should avoid or focus upon?
   (c) Are social targets necessary, for either conservation organizations or their partners? If so, what aspects of social well-being should be targeted? Where should interventions be targeted?
2. Designing strategies
   Given local human capacities and needs, what conservation investments—targeting whom, employed where—are most likely to deliver results?
3. Exploring socioecological relationships
   Are there synergies between biodiversity conservation and human development? Do trade-offs exist between these 2 outcomes?
4. Managing adaptively
   As social context shifts, what changes to conservation strategy are required?

Defining Targets (Social or Ecological)

Conservationists debate the appropriateness of social targets as legitimate goals for conservation planning and action (Adams et al. 2004). Some see social targets as distracting from the ecological objectives of conservation interventions (Terborgh 1999; Salafsky 2011), while others see social targets as a necessary means to achieving biodiversity conservation ends (Adams et al. 2004; Berkes 2004). Still others see biodiversity conservation as a vehicle for advancing human development through ecosystem services, ecotourism, political empowerment, and other means (Adams et al. 2004; Sachs et al. 2009). A trend toward recognizing human societies as an integral part of complex, adaptive ecosystems (Berkes 2004) and efforts to incorporate broad swaths of human-dominated landscapes into targeted conservation areas (Brooks et al. 2006) highlight the need to explicitly consider the utility of including social targets in operational conservation plans. The social and ecological implications of narrowly focusing interventions on biodiversity targets versus a mix of social and ecological ends are widely debated among conservation scholars and practitioners (e.g., Terborgh 1999; Adams et al. 2004).

Regardless of one's perspective on this debate, integration of social well-being data into conservation planning provides a richer understanding of conservation context. Examining patterns and trends in social well-being allows decision makers to determine if social issues are cause for concern, where problems are acute, and how social dynamics are changing over time. This knowledge permits conservation organizations to make informed choices about the social contexts in which they wish to operate, and the ecological (and possibly social) targets upon which they wish to focus. All else being equal, some organizations may be drawn to areas where social well-being is a particularly acute concern, while others may

choose to avoid places characterized by, for example, extreme poverty, poor human health, or widespread political disenfranchisement. Conservation plans that assess and address social equity when siting conservation interventions may increase the likelihood of plan implementation (Halpern et al. 2013). Spatially explicit data on social well-being do not necessitate action by conservation organizations to enhance human welfare, though some may choose to do so directly, in partnership, or by sharing data with organizations better equipped to address social well-being concerns. These strategic decisions depend upon, for example, organizational mission, values, and capacities.

Designing Strategies

Incorporating data on social well-being into conservation planning can facilitate selection of conservation strategies that respond to local human capacities and needs, resulting in more sustainable and effective conservation action (Sheil et al. 2006; Cowling & Wilhelm-Rechmann 2007; del Campo & Wali 2007). Understanding spatial patterns and temporal trends in educational attainment (e.g., literacy rates) or material well-being (e.g., percent households owning radios), for example, provides simple yet powerful insights required for design of environmental education and communication strategies. Similarly, examining patterns and trends in food security can yield valuable information on the risks associated with crop-raiding wildlife and other forms of human-wildlife conflict and suggest conservation strategies local residents are likely to support. Patterns and trends of land tenure (political empowerment indicator) may reveal that tenure insecurity is an issue that undermines both conservation and social well-being, highlighting the potential for mutually beneficial and reinforcing policy reforms. Analyzing spatial and temporal trends of social well-being can empower conservation planners to develop strategies that address the most pivotal issues, take action in the most strategic locations, and elicit the most effective partnerships.

Socioecological Relationships

Integrating social and biological data through conservation planning can facilitate novel analyses that advance conservation science. Global analyses examining spatial patterns of linguistic diversity and biological diversity, for example, reveal sites of high biocultural diversity and highlight common threats facing endangered species and indigenous peoples (Stepp et al. 2004; Gorenflo et al. 2012). Similarly, comparing national indicators of taxonomic endangerment and economic prosperity suggests a complex and multifaceted relationship between social well-being and biodiversity conservation (Naidoo & Adamowicz 2001). Though socioecological analyses like these may be conducted independent of formal conservation planning processes, the problem-oriented and spatially explicit analytic framework of conservation planning can productively structure policy-relevant analyses of spatial and temporal socioecological relationships. Spatially explicit data on social well-being also permit rigorous analyses of trade-offs or synergies between the ecological coverage and social equity of conservation plans (Halpern et al. 2013). Scientific understanding of relationships between social well-being and ecological integrity is limited and fraught with challenges, simultaneously highlighting the need for further inquiry and for caution when exploring data and interpreting results (Radeloff et al. 2000; Rindfuss et al. 2004; Grove et al. 2006).

Adaptive Management

Incorporating social well-being data in conservation planning provides a foundation for adaptive management in the face of shifting social contexts. (We use *adaptive management* broadly, to mean learning from management experiences and—based on these experiences and shifting contexts—modifying management activities to deliver desired outcomes more effectively.) Declining food security, for example, may increase pressure on natural resources, requiring shifts in conservation strategies and new partnerships to address local livelihood concerns. Similarly, spatial and temporal data on land tenure may highlight areas vulnerable to appropriation and exploitation by extractive industries (von Braun & Meinzen-Dick 2009), suggesting the need for conservation strategies that strengthen local land rights and, thus, prevent industrial exploitation of priority conservation areas. Equipped with such information, managers can creatively adapt conservation strategies to respond to shifting challenges (Cowling & Wilhelm-Rechmann 2007).

Relation of P-MAP to Conservation Practice

The P-MAP approach builds upon conservation practice, complementing other protocols for assessing biological and social context. Similar to the Open Standards approach (CMP 2007, 2013), P-MAP uses a hierarchical framework and participatory process to nest contextually appropriate indicators within broader conservation-relevant domains. The Open Standards (CMP 2007) traditionally included social variables only to the extent that these variables directly or indirectly represented a threat to biodiversity or (less frequently) an opportunity for conservation. More recent efforts create conceptual space for human well-being targets (i.e., goals and objectives) affected by conservation interventions through changes in ecosystem services (CMP 2013). Thus, P-MAP complements the Open Standards by focusing upon social well-being—1 portion of the broader social context within which threats,

opportunities, and biodiversity are embedded—to build a more rigorous foundation for priority setting, strategy design, program evaluation, and adaptive management. The P-MAP approach provides a systematic way to characterize social well-being that can be operationalized within the Open Standards as targets, enabling conditions, or contextual information (CMP 2013).

Despite sharing analogous participatory processes and hierarchical approaches for conceptualizing data in conservation planning, P-MAP and the Open Standards (CMP 2013) differ in their overall intent, their conceptualization of social well-being, and use of social data. First, the Open Standards are a conservation planning tool (CMP 2013), whereas P-MAP is an approach to characterizing social well-being and embedding it within diverse conservation planning tools (including the Open Standards but not limited to them). Second, while the Open Standards are explicitly designed to address planning after geographic priority setting has occurred (CMP 2013), P-MAP is designed to inform both spatial priority setting among geographies and strategic planning within priority geographies. Third, the Open Standards use the MEA framework for categorizing attributes of human well-being (CMP 2013), whereas P-MAP draws upon MEA (2005), Sen (1999), and conservation practice (A. Khurshid and M.B.M., unpublished data). Fourth, the Open Standards principally consider human well-being a target (i.e., desired conservation end) and secondarily as a factor (i.e., means to a desired conservation end) (CMP 2013:16–18, 22, 24). The P-MAP approach recognizes these 2 conceptual framings for human well-being and creates space for other conceptualizations (e.g., unintended consequences of conservation, contextual variable that may influence site selection or strategy selection, etc.) within conservation planning processes. Fifth, the Open Standards describe changes in human well-being targets as wholly dependent upon changes in ecosystem services associated with conservation (CMP 2013:16–18). P-MAP recognizes that diverse mechanisms may influence human well-being, both as a result of conservation interventions and independent of such interventions. These mechanisms include broad-scale political, social, or ecological contextual changes; reallocation of property rights associated with conservation interventions; conservation-associated infrastructure, information, and ideas; and shifts in ecosystem services (L. Glew, M.B.M., and D.C. Miller, unpublished data). Sixth, the Open Standards do not explicitly highlight spatial and temporal variation (CMP 2013); P-MAP is designed to capture spatial and temporal variation. Last, as a planning tool, the Open Standards adopt an explicitly normative approach (e.g., targets, factors for conservation) that seeks specific positive changes within a specified, targeted subset of indicators (CMP 2013). As a framework for characterizing and operationalizing data, by contrast, P-MAP seeks to characterize social well-being patterns and trends—even for social indicators not targeted by a conservation intervention. Thus, P-MAP is designed to capture unintended consequences and relationships beyond the program logic, whereas the Open Standards are not.

Consistent with Sen (1999), UN Human Development Report (UNDP 2007), and MEA (2005), P-MAP focuses on the state of social well-being, rather than the means by which well-being might be attained or the outcomes of particular interventions. As a result, P-MAP deviates slightly from more process-oriented methods for characterizing the social context of conservation, which examine the means by which well-being might be attained or the outcomes of particular interventions. The sustainable livelihoods framework, for example, examines 5 types of livelihood assets (human capital, natural capital, social capital, financial capital, and physical capital) as the foundation for livelihood strategies and outcomes (DfID 1999). Similarly, the conservation-oriented Landscape Outcomes Assessment Methodology borrows from the DfID framework but focuses on livelihood outcomes, measuring social variables in these 5 categories to assess the performance of conservation interventions at landscape scales (Sayer et al. 2007). These differences are modest, however, because P-MAP and the sustainable livelihoods approaches measure components of social context within which priorities are identified, strategies chosen, and outcomes assessed.

Though scientists and practitioners increasingly recognize that every conservation plan and every conservation action occur within a social context, social data and social considerations represent a frontier in conservation planning. With its focus on social well-being, P-MAP complements other recent innovations in the use of social data for conservation planning, but many important aspects of social context remain poorly developed or unexplored. Arenas ripe for further exploration and operationalizing within conservation planning include equity; laws and policies; environmental beliefs, values, and place attachment; social networks; and more systematic, evidence-based approaches to operationalizing threats (e.g., direct measures of discrete human behaviors). At a more fundamental level, the potential of appreciative inquiry (Cooperrider et al. 2003) and asset-based approaches (del Campo & Wali 2007) within conservation planning processes remains unexplored. Given the tremendous challenges facing biodiversity and the resource-dependent peoples who rely upon it for their survival, scientists and practitioners must explore diverse approaches for integrating social data within conservation planning and, thus, lay the foundation for more ecologically and socially sustainable conservation outcomes.

Acknowledgments

We thank WWF staff and partners in Coastal East Africa, Coral Triangle, Heart of Borneo, Kamchatka-Bering Sea, Namibia, and Nepal. We also thank J. Morrison,

B. Llewellyn, A. Shapiro (WWF-US), B. Gurung, T. P. Gnyawali, R. Shrestha, G. J. Thapa, and colleagues (WWF-Nepal). M. Bottrill, H.E. Fox, M. Mills, and S. Pailler provided valuable feedback. K. Haisfield helped prepare the manuscript for submission. The Sall Family Foundation and the John D. and Catherine T. MacArthur Foundation provided funding. A version of this manuscript previously appeared as working paper 2009–01 of the Society for Conservation Biology's Social Science Working Group.

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