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A CONSERVATION PROJECT MANAGEMENT PROCESS APPLIED TO MOUNTAIN PROTECTED AREA DESIGN AND MANAGEMENT IN YUNNAN, CHINA

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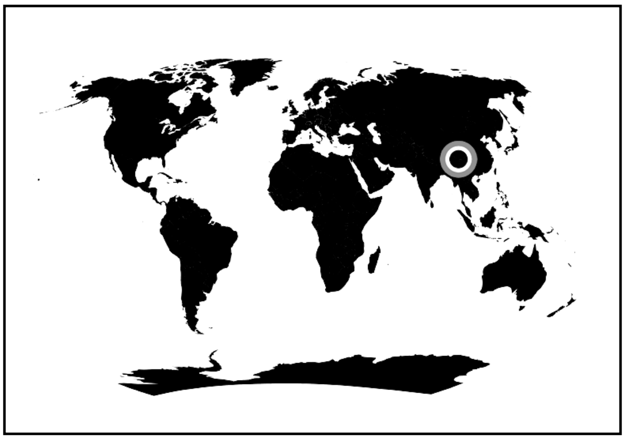

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Introduction

The race to preserve, maintain, and restore the biodiversity of the planet has never been faster paced—or more challenging. In the face of these challenges, conservationists need focused methods to determine implementation priorities and actions at protected areas. It is for this reason that The Nature Conservancy (TNC) uses a structured Conservation Project Management process that has evolved from 53 years of conservation experience at sites around the world. Increasingly, other non-governmental organisations (NGOs) and governments are employing this methodology because it provides a well-tested conceptual framework to develop effective biodiversity threat abatement strategies that achieve tangible conservation results (e.g., the papers by Cobb and Jefferies in this volume). The process enhances protected area and general conservation project planning in that it helps develop biodiversity conservation strategies based on: (1) a careful identification of focal biological elements and analyses of their viability, (2) a prioritised ranking of the threats that impair the health of these biological elements, and (3) the careful measurement of conservation impact that will ensure that conservation projects are adaptively managed.

In this paper we review generally the steps in the Conservation Project Management process and illustrate how it is being applied to the design and management of two mountain protected areas in north-western Yunnan Province, China.

Conservation by Design

TNC's Conservation Project Management process is best understood in the context of the organisation's

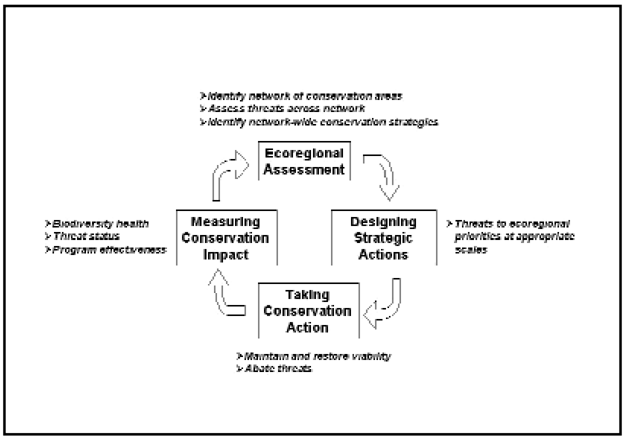

FIGURE 1. THE NATURE CONSERVANCY'S BIODIVERSITY CONSERVATION FRAMEWORK.

four-part conservation framework called Conservation by Design (TNC 2001). The framework was developed to systematically focus conservation action on priority biodiversity and critical threats in a dynamic, adaptive process involving setting geographic and threat priorities, developing strategies, taking action, and measuring conservation impact (Groves, Valutis et al. 2000; Groves, Jensen et al. 2002; Groves 2003; Poiani, Baumgartner et al. 1998; Salzer and Salafsky 2003; TNC 2000; Valutis and Mullen 2000). The framework is illustrated in Figure 1, although in reality it is less simplistically circular and much more dynamic. For instance, measures of conservation impact feed back to all steps in the process.

Within north-western Yunnan, we have used the priority-setting process to identify five sites for conservation actions (Yunnan Great Rivers Project Planning Team 2002). Two of these sites, so far, have been through rigorous planning using the Conservation Project Management process: the Meili Snow

Mountains and Laojun Mountain (Figure 2). These sites serve as illustrative examples of the benefits of systematic development and evaluation of conservation strategy implementation. The Meili Snow Mountains are a high range of peaks on the Yunnan–Tibet border in an area of extreme relief, ranging from 2,000 m in the arid valley of the Lancang River to 6,740 m on the highest peak. The area is ethnically Tibetan and has a relatively low population density. A protected area is currently being designed for these mountains as part of the larger Three Parallel Rivers World Heritage site, recently designated by UNESCO (the United Nations Educational, Scientific, and Cultural Organisation). Laojun Mountain, in contrast, is a relatively low-relief, forested massif surrounded by valleys with a high population density and high cultural diversity. Currently, a nature reserve is being designed for Laojun Mountain and management planning has been initiated.

Conservation Project Management

TNC's approach to biodiversity conservation has constantly evolved since we first began doing site conservation over 50 years ago. This evolved into what, until recently, was called the "Five-S" framework for conservation area planning (TNC 2000), but has expanded into a broader, "enhanced Five-S" Conservation Project Management process (TNC 2003). This framework was extensively tested and refined at many sites around the world ranging in size from small to very large, and even including systems of protected areas. This framework is designed to be a participatory planning framework involving partners and stakeholders at all stages of the process. The core elements of the Conservation Project Management process are explained in the following sections (Figure 3).

Project scope and goals. In beginning a conservation project, it is crucial to first set the project scope, which is informed by regional conservation priorities, as determined, for example, by an ecoregional conservation assessment (Groves 2003). It is important to include an initial goal statement that conveys the overall purpose of engaging in a particular conservation project. A conservation project is implemented by a team whose membership is often interdisciplinary and is drawn from the lead organisation, members of partner organisations, local stakeholders, and other key individuals knowledgeable about the site or biological elements. Each project also starts with some level of available or potential resources, including staff, money, and other inputs. These should be explicitly stated at the beginning of the project along with the roles and responsibilities of key project team members.

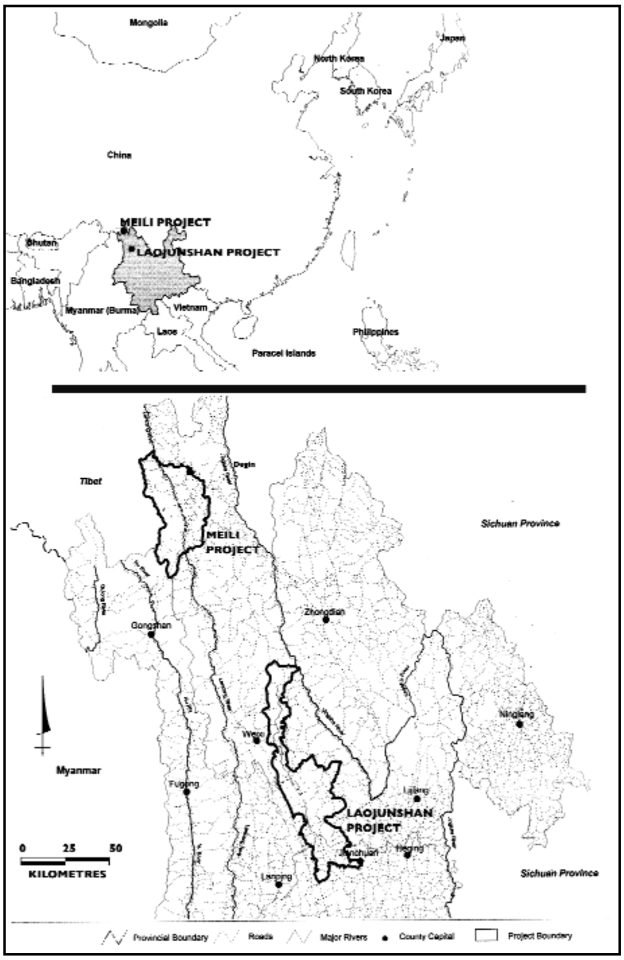

FIGURE 2. LOCATION OF THE MEILI SNOW MOUNTAINS AND LAOJUN MOUNTAIN CONSERVATION AREAS IN NORTH-WESTERN YUNNAN.

For example, both the Meili Snow Mountains and Laojun Mountain were identified as high-priority conservation areas through the Yunnan Great Rivers Project ecoregional assessment (Yunnan Great Rivers Project Planning Team 2002). To begin the Conservation Project Management process, resources were allocated and an initial project team was selected, led by TNC, but including government and other partners. It is acknowledged that the composition of the project team, as well as the resources needed, will change as the process moves from planning to implementation and monitoring. The goal statements for these two projects appear below. Be aware that specific and measurable objectives are developed to support these general goals.

- *Meili Snow Mountains:* "Conserve the gene resources and species composition in the Meili project area by ensuring conservation of the full environmental and ecological gradient—the whole landscape—from warm-valley scrub along the

	Meili Snow Mountains	*Laojun Mountain*
Ecological System[1]	Mid-Montane Mixed Forest Evergreen Oak Forest Spruce–Fir Forest Alpine Mosaic Mountain Stream Corridor	Mid-Montane Mixed Forest Alpine Mosaic Ravine Forest Red Sandstone Ecosystem Spruce–Fir Forest
Ecological Community[2]	none	Alpine Lake
Species[3]	Ungulates Big Cats	Golden Monkey

1. Broad-scale groups of communities that occur together in the landscape, are linked by the same ecological processes, environmental regimes, and ecological gradients, and form distinct and robust units on the ground.
2. Groups of co-occurring species, including vegetation communities and aquatic macro-habitats.
3. Threatened and endangered, wide-ranging, indicator, keystone, and umbrella species; species groups and species aggregations of global importance.

TABLE 1. FOCAL BIODIVERSITY ELEMENTS FOR THE MEILI SNOW MOUNTAINS AND LAOJUN MOUNTAIN CONSERVATION AREAS IN NORTH-WESTERN YUNNAN, CHINA.

Lancang River and mountain tributaries, up to the highest glacial peaks, through full participation of local communities and government stakeholders."

- *Laojun Mountain:* "Long-term survival of all the native species and natural communities in Laojunshan has been ensured by successful management of the sole authorised agency that has balanced the requirement of natural heritage conservation, interests of different governmental stakeholders, local communities' subsistence and livelihood improvement, and local economic development."

Focal elements of biodiversity. Conservation areas can include occurrences of dozens or hundreds or even thousands of important biological elements (species, ecological communities, or broad-scale ecological systems) identified through regional conservation planning efforts. The sheer number of individual elements prohibits planning for each one individually. To overcome this challenge, TNC uses "focal elements" as surrogates or coarse filters to represent the biodiversity of the conservation area. In order to represent the biodiversity of an area, these elements encompass a range of spatial and biological scales and major habitat types (Poiani, Richter et al. 2000). The selection process typically starts with ecological systems and communities, then adds species that have a particular value in representing biodiversity or sensitivity to threats at the project, such as wide-ranging, indicator, keystone, or umbrella species.

Lists of focal elements chosen to represent the range of biodiversity at the Meili Snow Mountains and Laojun Mountain conservation areas appear in Table 1. For efficiency, we prioritise conservation effort on the broader-scale ecological systems (Poiani et al. 2000). Nested within these systems are many species whose conservation will most likely be encompassed in the protection of the ecological system. For instance, the Alpine Mosaic element in the Meili Snow Mountains is habitat for many rare and narrowly endemic plant species and commercially exploited medicines, too many to plan for individually.

The last stage is to objectively assess the viability of focal biodiversity elements. This stage is integral to measuring the effectiveness of conservation programs for conserving biodiversity (Parrish et al. 2003). The viability assessment begins with identifying key ecological attributes for each element, that is, the critical component of its life history, physical or biological processes, composition, structure, or the spatial and temporal scales of distribution. Next, viability indicators are selected; these are measurable entities used to assess the status of key ecological attributes. Finally, indicator rating categories are developed. These are criteria that objectively define an indicator as one of four categories corresponding to *poor, fair, good,* and *very good* viability status. Table 2 illustrates a viability assessment from Laojun Mountain for one key ecological attribute each for two focal biodiversity elements.

Threats to biodiversity. The Conservation Project Management process divides the threats analysis into two components: (1) the stresses that reduce viability of the focal biological elements, and (2) the proximate extraneous sources, human or biological, that are generating the stresses. The most critical threats are identi-

Focal Biodiversity Element	Viability Category	Key Ecological Attribute	Viability Indicator	Indicator Rating Categories			
				Poor	Fair	Good	Very Good
Yunnan Golden Monkey	Condition[1]	Age structure of monkey troop	Percentage of infants in each monkey troop	Infants account for <5%	Infants account for 5–10%	Infants account for 10–15%	Infants account for >15%
Mid-Montane Mixed Forest	Landscape Context[2]	Fragmentation	Percentage of the total area linked with functional corridors (>10 m wide)	<40% of the total area functionally linked	40–60% of the total area functionally linked	60–80% of the total area functionally linked	>80% of the total area functionally linked

1. An integrated measure of the composition, structure, and biotic interactions that characterise the occurrence.
2. An integrated measure of two factors: the dominant environmental regimes and processes that establish and maintain the target occurrence, and connectivity.

TABLE 2. VIABILITY ASSESSMENT FROM LAOJUN MOUNTAIN CONSERVATION AREA, YUNNAN, CHINA. THIS EXAMPLE CONTAINS ONLY ONE KEY ECOLOGICAL ATTRIBUTE EACH FOR TWO FOCAL BIODIVERSITY ELEMENTS.

fied through a process of identifying and ranking the extent and severity of the stresses and the sources of stress. In using this method to identify and rank critical threats, we can both determine the highest-ranked threats to a particular focal biodiversity element and identify the highest-ranked threats at a conservation area across all elements. Relying solely on the method described above to identify critical threats oversimplifies the situation. It only identifies the direct threats to biodiversity and does not get at the underlying causes. For this, we link targets, through highly ranked sources of stress, to the underlying or indirect threats often associated with the human context. We call this process the *situation analysis* and use conceptual modelling to help convey these linkages. The combination of identifying the proximate critical threats and the indirect threats through situation analyses forms the basis for developing threat abatement strategies; in other words, the suite of conservation actions needed to reduce or eliminate sources of stress to the conservation targets.

At Laojun Mountain, the narrowly endemic Yunnan golden monkey is threatened by very low population sizes. Direct mortality from illegal hunting by local villagers is one proximate source of that stress. Through a situation analysis, we found that the illegal hunting is being driven by two underlying causes: cultural traditions of some local ethnic groups requiring bush meat in their diet, and poverty that is alleviated though the sale of monkey parts. Table 3 contains other examples from Laojun Mountain and the Meili Snow Mountains of direct critical threats and the indirect drivers of those threats derived from situation analyses.

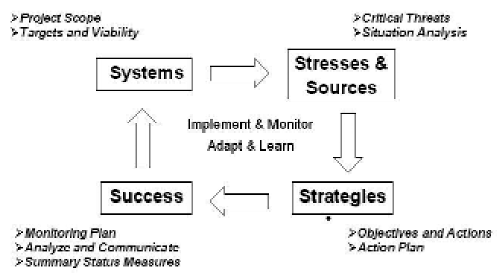

FIGURE 3. CONSERVATION PROJECT MANAGEMENT PROCESS.

Developing strategies. Strategies are the types of conservation activities deployed to abate on-going sources of stress (threat abatement) and persistent historical stresses (restoration). The way a site practitioner responds—or fails to respond—to critical threats will be the single most important factor affecting the long-term viability of the focal systems. This step involves setting objectives, selecting strategic actions, and implementing an action plan for the conservation project. It is rooted in a set of measurable, outcome-oriented objectives and an action plan that conveys the intended approach to abate threats and restore or maintain biodiversity health. First, the overall conservation goal developed in the first step of the process is revisited and refined. Then, a set of outcome-based objectives focused on viability enhancement and / or threat abatement is developed. Next, a set of strategic

Focal Biodiversity Element	Stress	Highly Ranked Source of Stress (Critical Threat)	Indirect Driver	Threat Abatement Strategy
Meili Snow Mountains				
Evergreen Oak Forest	Simplification of forest stand structure	Collection of fuelwood	Poverty (lack of low-cost alternatives to fuelwood)	Alternative energy: Support adoption of appropriate alternative energy sources such as biogas, solar, and micro-hydropower that reduce use of wood gathered from priority forest habitats.
Alpine Mosaic	Altered species composition	Unsustainable harvest of commercially exploited non-timber prod-	Poverty (cash income); Market forces (determines which species become commercially exploited)	Non-timber products: (1) through research program develop models of sustainable harvest for 5 most critical species; (2) implement threat abatement strategy through existing village regulatory structures.
Laojun Mountain				
Mid-Montane Mixed Forest	Simplification of forest stand structure	Collection of fuelwood	Poverty (lack of low-cost alternatives to fuelwood)	Alternative energy: in cooperation with local county government, deploy biogas and solar energy units as alternative energy sources for residents in low-elevation valleys.
				Fuel efficiency: promote energy-efficient stoves in ethnic Yi villages and other mountain households at mid- to high elevations.
Yunnan Golden Monkey	Very low population size	Illegal hunting	Cultural traditions of ethnic groups (bush meat as food); poverty (cash from sale of animal parts)	Support local forestry bureaus to establish Yunnan golden monkey protection patrolling program, whose long-term existence is assured through appropriate financial and institutional mechanisms.

TABLE 3. EXAMPLES OF STRESSES, SOURCES OF STRESS, AND THREAT ABATEMENT STRATEGIES FOR SELECTED TARGETS FROM LAOJUN MOUNTAIN AND THE MEILI SNOW MOUNTAINS, YUNNAN, CHINA.

actions are identified and prioritised. These actions must be ranked as to their strengths and weaknesses (benefits, feasibility, cost, etc.) before selecting a set as the basis of an action plan, with clear responsibilities. Finally a work plan with action steps is compiled, and a budget and time line developed.

In addition to listing stresses and critical threats, Table 3 also links these to strategies being deployed at Meili and Laojun to abate these threats. One of these strategies from Meili, alternative energy, is used here to illustrate objective-setting, identifying strategic actions, and selecting work plan action steps:

- *Objective:* To abate the fuelwood collection threat to Evergreen Oak Forest by reducing fuelwood use within the Meili Snow Mountains conservation area by 75% by 2013, including elimination of use of primary forests.
- *Strategic action:* Support adoption of appropriate alternative energy sources, such as biogas, solar, and micro-hydropower, that reduce use of wood gathered from priority forest habitats.
- *Action steps:* (1) Implement solar technology demonstration project for cooking livestock food in 2004, and (2) expand program to 450 households by 2013.

Measuring conservation impact. TNC has defined "conservation success" as making substantial progress towards (1) the long-term abatement of critical threats, and (2) the sustained maintenance or enhancement of the viability of focal biological elements in a conservation area or across conservation areas. Yet how much progress is being made by conservation practitioners given the current suite of implemented strategies? This key question can be answered at two levels: for individual threats and targets at any scale, and for a single conservation area. Tracking changes in the status of threats and focal biological elements through careful measurements of conservation progress allows the effectiveness of individual conservation strategies to be assessed, and maintains the adaptive management of our conservation actions (TNC 2000; Parrish et al. 2003).

An increasing number of resources are being developed to aid conservation managers in developing a monitoring and evaluation plans and choosing the right indicators to monitor (Hockings 2003). There are some real challenges, however, in allocating monitoring resources for a conservation project, including (1) allocating limited resources between measuring the *effectiveness* of conservation actions versus tracking the *status* of biodiversity and threats that are not currently the subject of actions, and (2) deciding whether to focus monitoring efforts on threat-based indicators versus biodiversity element-based indicators. Status monitoring focuses purely on answering the questions: "How is the biodiversity we care about doing?" and "How are threats to biodiversity changing?" Effectiveness monitoring focuses on answering the question: "Are our conservation actions having their intended impact?" There is no simple formula to factor in these considerations. We believe that most conservation projects will have to collect data on some combination of target and threat-based indicators to both assess status and measure effectiveness (Salzer and Salafsky 2003).

The Meili Snow Mountains and Laojun Mountain projects began in 2001 and are now establishing the metrics of conservation impact using the viability analysis described above (Parrish et al. 2003). We have set quantitative viability goals for the focal biological elements and will monitor achievement towards them (Table 2).

Multiple scales

The Conservation Project Management process has been primarily applied at the conservation area level. However, because it is biodiversity- and threat-driven, and is defined by ecological not administrative boundaries, it is independent of scale and can be used for conservation planning across conservation areas and at multiple scales.

For example, the Yunnan Great Rivers Project ecoregional conservation assessment identified fuelwood collection as a critical threat to two focal biological elements across the ecoregions of north-western Yunnan, Evergreen Broadleaf Forest and Mid-Montane Mixed Forest (Yunnan Great Rivers Project Planning Team 2002). TNC China Program decided to pursue a strategy of alternative energy to abate this threat and hired a director for its alternative energy program. The program then began to implement conservation actions at three conservation areas, including the Meili Snow Mountains and Laojun Mountain. But the threat is so pervasive across the ecoregions that the alternative energy program evolved organically from a conservation area-level strategy into a multi-area strategy. In retrospect, it would have been more efficient and powerful to have designed a multi-area strategy from the beginning, instead of at three individual sites. An interdisciplinary team of scientists and alternative energy experts are now redesigning the alternative energy as a multi-area strategy using the Conservation Project Management process outlined in this paper.

Conclusion

Conservation Project Management is an effective tool for systematically assessing priority actions to conserve biodiversity at a conservation area or at multiple areas across an ecoregion. It is being employed around the world in a variety of contexts and at a variety of scales, where it is continually being refined and improved. Many resources and examples for the Conservation Project Management process (mostly under its former names of Five-S Framework, Site Conservation Planning, or Conservation Area Planning) are available for downloading at www.conserveonline.org, especially the handbook *The Five-S Framework for Site Conservation* and the Microsoft Excel tool *Conservation Project Management Workbook.*

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Dan Salzer, Jeff Baumgartner, and Doria Gordon presented the new concepts and enhancements to the Conservation Project Management process during a seminar in June 2003, prior to the Society for Conservation Biology annual meeting in Duluth, Minnesota, USA (their Microsoft PowerPoint presentation *Measuring Conservation Effectiveness: New Tools Workshop Held at TNC's All Science Meeting, June* 2003 can be downloaded from www.conserveonline.org). Much of the general information on this process we present here is drawn from their seminar and from Dan Salzer's and Nick Salafsky's manuscript on allocating conservation resources (Salzer and Salafsky 2003).

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