Designing Systematic Conservation Assessments that Promote Effective Implementation: Best Practice from South Africa

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Abstract: *Systematic conservation assessment and conservation planning are two distinct fields of conservation science often confused as one and the same. Systematic conservation assessment is the technical, often computer-based, identification of priority areas for conservation. Conservation planning is composed of a systematic conservation assessment coupled with processes for development of an implementation strategy and stakeholder collaboration. The peer-reviewed conservation biology literature abounds with studies analyzing the performance of assessments (e.g., area-selection techniques). This information alone, however, can never deliver effective conservation action; it informs conservation planning. Examples of how to translate systematic assessment outputs into knowledge and then use them for "doing" conservation are rare. South Africa has received generous international and domestic funding for regional conservation planning since the mid-1990s. We reviewed eight South African conservation planning processes and identified key ingredients of best practice for undertaking systematic conservation assessments in a way that facilitates implementing conservation action. These key ingredients include the design of conservation planning processes, skills for conservation assessment teams, collaboration with stakeholders, and interpretation and mainstreaming of products (e.g., maps) for stakeholders. Social learning institutions are critical to the successful operationalization of assessments within broader conservation planning processes and should include not only conservation planners but also diverse interest groups, including rural landowners, politicians, and government employees.*

Keywords: adaptive improvement, conservation-area selection, conservation planning, operational model, social learning institutions

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Diseño de Evaluaciones Sistemáticas de la Conservación que Promueven la Implementación Efectiva: la Mejor Práctica en África del Sur

Resumen: *La evaluación sistemática de la conservación y la planificación de la conservación son dos campos distintos de la ciencia de la conservación que a menudo son confundidos como uno y lo mismo. La evaluación sistemática de la conservación es la identificación técnica, a menudo computarizada, de áreas de prioridad para la conservación. La planificación de la conservación esta compuesta por una evaluación sistemática de la conservación aunada a procesos para el desarrollo de una estrategia de implementación y colaboración de grupos de interés. En la literatura de biología de la conservación revisada por pares abundan los estudios que analizan el rendimiento de las evaluaciones (e. g., técnicas de selección de áreas). Sin embargo, esta información por si sola no puede derivar en acciones de conservación efectivas; informa a la planificación de la conservación. Son raros los ejemplos de cómo traducir los resultados de evaluaciones sistemáticas en conocimiento y luego utilizarlo para "hacer" conservación. África del Sur ha recibido generoso financiamiento internacional y doméstico para la planificación de la conservación regional desde mediados de la década de 1990. Revisamos ocho procesos de planificación sudafricana e identificamos los ingredientes clave de la mejor práctica para emprender evaluaciones sistemáticas de la conservación de manera que facilite la implementación de acciones de conservación. Estos ingredientes clave incluyen el diseño de procesos de planificación de la conservación, habilidades para los equipos de evaluación, colaboración con grupos de interés e interpretación e integración de productos (e. g., mapas) para grupos de interés. Las instituciones de aprendizaje social son críticas para la operatividad exitosa de las evaluaciones en el contexto de procesos de planificación más amplios y deben incluir no solo planificadores de la conservación sino a diversos grupos de interés, incluyendo a propietarios rurales, políticos y empleados gubernamentales.*

Palabras Clave: instituciones de aprendizaje social, mejoramiento adaptativo, modelo operacional, planificación de la conservación, selección de áreas de conservación

Introduction

Systematic conservation assessments are technical activities that identify the location and configuration of priority areas for conservation action. The techniques for conducting assessments have advanced rapidly since the 1980s. Major impetus has derived from concern about unprecedented environmental decline (Lawton & May 1995), development of iterative algorithms (Kirkpatrick 1983), and rapid advances in computer technology. Systematic conservation assessments (hereafter assessments) alone, however, do not deliver the actions necessary to conserve nature, they merely generate data to support the planning and implementation of conservation interventions (Cowling et al. 2004). Documented understanding of assessment techniques is comprehensive. Between 1980 and 2000 at least 245 published studies employed reserve selection algorithms (Pressey 2002). The fascination of many conservation planners with the incremental improvement of assessment techniques has drawn focus away from their real goal—directing conservation actions—because relatively few assessments published in the peer-reviewed literature actually lead to nature conservation (Prendergast et al. 1999; Knight et al. 2006).

In attempting to address this "implementation crisis" (Knight & Cowling 2003), it is essential to distinguish between conservation assessment and conservation planning. Conservation assessment involves identifying spatial priorities for conservation action (i.e., area selection). When complemented with the development of an implementation strategy, in the context of stakeholder collaboration (i.e., the involvement of agencies that will take implementation of the plan forward), these activities constitute conservation planning (Fig. 1).

Assessment is often conflated with conservation planning, with no attention paid to implementation strategy development or stakeholder collaboration. In such cases it is no surprise that conservation activities at the priority areas identified by an assessment are not implemented. Compared with assessments, our documented understanding of how to effectively undertake planning processes is poor. Techniques for normative activities such as developing stakeholder collaboration, integrating expert and systematic approaches, designing and mainstreaming planning products, and collaboratively developing implementation strategies are rarely documented in the peer-reviewed conservation biology literature, yet are fundamental to effective planning processes. This lack of documented experience seriously hinders the advancement of conservation planning theory and practice. A culture of presenting case studies (a powerful tool in the social sciences) has yet to evolve in conservation biology but will be essential for distilling best practice. Documenting experiences and distilling key ingredients of best practice should help assessments focus on the development of implementation strategies and encourage academic involvement in planning processes. Case studies from planning processes (e.g., Pressey 1998; Davis et al. 1999; Clark & Slusher 2000) clearly demonstrate the value of documenting experiences of undertaking assessments.

*Figure 1. A systematic conservation assessment is only one component of a conservation planning process and should be complemented with a process for developing an implementation strategy in the context of stakeholder collaboration. The "knowing-doing gaps" (Pfeffer & Sutton 1999), composed of the assessment-planning gap and the planning-action gap, are real obstacles to the effective implementation of outputs from the assessment. Adapted from Driver et al. (2003*a*).*

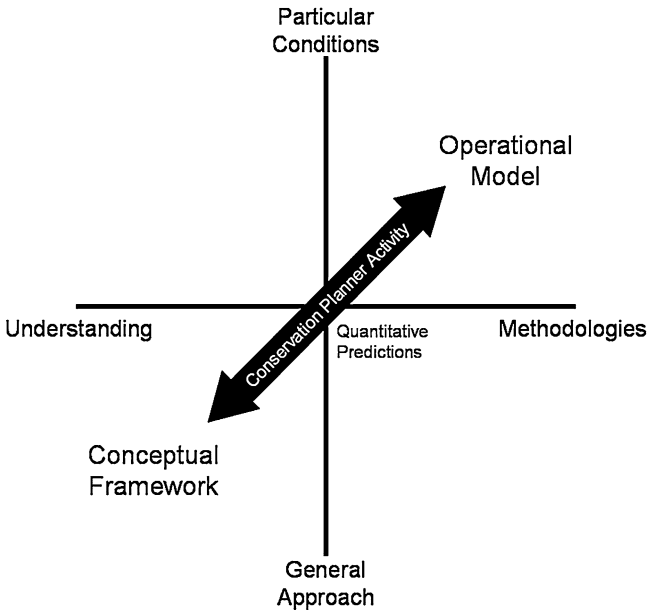

Figure 2. An effective conservation planner moves between a conceptual framework that aims to provide a general understanding of social-ecological systems and the role and approach of conservation planning processes and an operational model that aims to provide methodologies on how to "do" conservation assessments and planning processes for particular contexts at specific scales. This action research approach better ensures a conservation planner is effective at translating conservation assessments into conservation action because theory regularly informs practice and practice regularly informs theory. Adapted from Lawton (1996).

Conservation planners' focus on assessment has meant there are few well-established principles of planning practice. Although prescriptive approaches are best avoided in conservation biology because they stifle innovation (Meffe et al. 1997), generic elements of an idealized planning process are required for formulating operational models. An operational model is a simplified conceptualization of a process for implementing conservation action at priority conservation areas (e.g., Margules & Pressey 2000; Poiani et al. 2000; Groves et al. 2002; Knight et al. 2006). They guide and assist understanding of how these processes function (Knight et al. 2006), embody best practice, and provide an entity that can be adapted as techniques and approaches improve. The current absence of emphasis in the peer-reviewed literature on development of operational models is a concern.

Operational models should be complemented with a conceptual framework to facilitate adaptive learning (Fig. 2). A conceptual framework is a cognitive tool that helps people conceptualize and think about planning phenomena by providing context for their actions and from which operational models can be developed and improved. Effective conservation planners move continuously between their conceptual framework and application of their operational model, constantly refining each from advances provided by the other (Fig. 2).

Documenting experiences and distilling lessons promote the development of best practice by maximizing the benefit of individuals' experiences of formulating and testing operational models (e.g., Driver et al. 2003*a*; Noss 2003; Knight et al. 2006) and by facilitating transdisciplinary knowledge sharing and critique. It also provides a process for building the strong partnerships required to foster social learning within and between groups of planners. These groups benefit from the development of a "safe-fail culture" (Redford & Taber 2000; Knight 2006), the strengths of collective decision making (Hill 1982), and enhanced intra- and interinstitutional social capital (Pretty & Ward 2001). In turn, the transaction costs of knowledge sharing are reduced (North 1990).

Recognizing the importance of knowledge exchange between the conceptual and operational aspects of planning processes, the Botanical Society of South Africa's Conservation Unit hosted a 3-day workshop to capture our experiences, focusing on assessment and bridging the gap between planning and implementation. The experiences of 16 conservation planners involved in eight South African planning processes (Table 1) were distilled as key

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Table 1. South African systematic conservation planning processes from which workers contributed experiences and lessons for the synthesis of the key ingredients* of effective systematic conservation assessments.

Process	*Planning region*	*Scale*	*Focus*	*Status*	*Conservation assessment references*
C.A.P.E. Cape Action Plan for the Environment	Cape Floristic Region	1:250,000	biome-wide priority setting	assessment and strategy completed 2000; formed basis for C.A.P.E. implementation program	Cowling et al. 1999*b*, 2003*b*
S.K.E.P. Succulent Karoo Ecosystem Plan	Succulent Karoo Biome	1:250,000	biome-wide priority setting	assessment and strategy completed 2002; formed basis for the SKEP	Cowling & Lombard 1998; Driver et al. 2003*b*
S.T.E.P. Subtropical Thicket Ecosystem Planning Project	Subtropical Thicket Biome	1:250,000	biome-wide priority setting	assessment and strategy completed 2003; sets direction for Fish River Biodiversity Initiative	Cowling et al. 2003*a*; Knight & Cowling 2003; Pierce 2003; Pierce et al. 2005; Rouget et al. 2006; Knight et al. 2006
KwaZulu-Natal provincial conservation plan	KwaZulu-Natal Province	1:50,000	province-wide priority setting	assessment and strategy completed 2002; adopted by provincial conservation agency	Goodman 2000
Cape Lowlands Renosterveld conservation plan	Cape Flats occupied by critically endangered renosterveld vegetation	1:50,000	fine-scale priority setting; priority subregion identified in C.A.P.E.	assessment and strategy completed 2003; adopted by provincial conservation agency	von Hase et al. 2003
Greater Addo Elephant National Park conservation plan	area surrounding and including the Greater Addo Elephant National Park	1:50,000	planning for protected area expansion	assessment and strategy completed 2002; adopted by South African National Parks	Nel et al. 2002
N.M.M.O.S.S. Nelson Mandela Metropolitan Open Space System	City of Port Elizabeth and surrounding area	1:10,000	fine-scale priority setting to inform development of an urban open space system	assessment and strategy completed 2002; adopted directly by Nelson Mandela Metropolitan Municipality	Stewart et al. 2003
Agulhas Plain conservation plan	Agulhas Plain	1:10 000	fine-scale priority setting; priority subregion identified in C.A.P.E.	initial assessment and strategy completed 2000, subsequently extended through the Agulhas Biodiversity Initiative	Cole et al. 2000

**Key ingredients: (1) a systematic assessment, (2) identification of stakeholders and goals of the process, (3) assessments conducted at different scales, (4) attention to assessment design, (5) assessment teams that include implementing organizations, (6) focused collaboration to address stakeholders' needs, and (7) interpretation of assessment outputs and mainstreaming products.*

ingredients of best practice for designing and implementing assessments. Greater detail is provided in Driver et al. (2003*a*) and was presented at the World Parks Congress in Durban in 2003 (by A.D.). We set our experience in a broader conservation planning context (e.g., Knight et al. 2006), highlighting the importance of social learning institutions for facilitating the rapid advancement of conservation planning theory and practice. Social learning institutions are the processes and structures used for facilitating a continuous dialog and deliberation among scientists, planners, managers, and natural resource users to explore problems and their solutions (Maarleveld & Dangbégnon 1999).

South Africa is a conservation planning hotspot. The combination of a strong research sector, capable implementing institutions, major development needs, and globally significant nature have secured generous international funding, with more than 30 conservation planning processes undertaken since the 1970s (Rouget & Egoh 2003). This abundance of planning processes, their sequential timing that promoted the "rollover" of staff so later processes benefited from the experiences of earlier ones, and the injection of international expertise have stimulated the development of an "invisible college" of conservation planners. Strong relationships have been forged between conservation planners from diverse organizations, promoting the rapid advancement of conservation planning theory and practice in South Africa since the mid-1990s.

Toward Best Practice: Key Ingredients of an Operational Model

An assessment is worth little if it fails to deliver local-scale conservation action. We recommend that assessments be embedded within a broader operational model (Fig. 1) that is focused on and lays the basis for implementing planning outcomes. This is achieved, in large part, by involving implementing organizations and stakeholders in the process, thereby offering an explicit pathway for bridging the assessment-planning gap and the planning-action gap, forms of the "knowing-doing gap" (Pfeffer & Sutton 1999) that are very real obstacles to translating information (e.g., a map of priority areas) into conservation action on the ground (e.g., private land conservation agreements). There is no recipe for establishing an operational model, but there are some key ingredients. We have identified seven that underpin an approach we call *planning for implementation* (Knight et al. 2006): (1) a systematic assessment, (2) identification of stakeholders and goals of the process, (3) assessments conducted at different scales, (4) attention to assessment design, (5) assessment teams that include implementing organizations, (6) focused collaboration to address stakeholders' needs, and (7) interpretation of assessment outputs and mainstreaming products.

Systematic Assessment

CONDUCT A SIMPLE ASSESSMENT EVEN IF DATA ARE LIMITED

An assessment is a potentially powerful tool for conservation action and provides a scientifically sound, and therefore defensible, basis for land-use decision making. In regions with high conservation values and extensive, rapidly encroaching land-use pressures, however, spending years generating vast data sets for sophisticated assessments does little to further conservation efforts. Rapid assessments based on key data layers are more effective strategically at preserving landscapes and allow timely motivations of decision makers for the retention of priority areas. A simple assessment is better than none. Assessments can, and should, be revised as new data or implementation occurs. Scientists, who often chase quantifiable certainty, struggle to accept this lesson, especially when the questions are complex and the answers uncertain. Rapid assessments require team members with experience from previous processes, which allows teams to work within tighter timeframes and to simplify the assessment without making it simplistic.

PURSUE GOALS OF REPRESENTATION AND PERSISTENCE

The effectiveness of any assessment depends on the principles on which it is based (Noss 2003). Two principles are of particular importance: representation and persistence (Cowling et al. 1999*a*). Representation is, perhaps, the most widely advocated principle and ensures that typical examples of the full spectrum of environmental pattern are sampled comprehensively. Protected-area networks, however, should not simply be stamp collections. Ensuring the persistence of environmental pattern requires maintenance of environmental processes, inclusive of ecological, evolutionary, geomorphological, and hydrological processes (Cowling et al. 1999*a*) for the entire landscape inside and outside protected-area networks. Representation and persistence avoid ad hoc protected-area establishment, which produced the highly biased and fragmented protected-area networks currently in many countries (Pressey 1994).

INTEGRATE EXPERT INPUT AND SYSTEMATIC TECHNIQUES

Assessments can be expert driven (e.g., Mittermeier et al. 1995) or systematic (Margules & Pressey 2000). Consensus has emerged that expert knowledge is crucial for planning but is best applied within systematic conservation assessments (Pressey & Cowling 2001) because of their methodological rigor and scientific defensibility (Noss 2003), which we have found better received by

stakeholders than purely expert-driven approaches. An assessment provides a basis for constructive interaction between land-use sectors because it focuses on priority areas, recognizes competing land uses, and sets defensible and transparent targets. Ecological knowledge of local experts, however, is crucial for mapping land classes, environmental processes, habitat transformation, and future land-use pressures. Experts are also essential for developing rules for decision-support analysis and identifying other experts and key stakeholders.

GATHER AND APPLY DATA USEFUL TO ACHIEVING YOUR GOALS

Gathering all available spatial data should be avoided. Not all spatial data are useful, so the utility of data should be carefully considered before investing time and resources acquiring or developing them. Basing your assessment on five spatial data sets (minimum)—environmental pattern, environmental processes, habitat transformation, future land-use pressures, and planning units—will better ensure the assessment is implemented effectively. Environmental pattern data, where resources are limiting, are most effectively represented as land classes. A continuous land-class layer for the entire planning region, ideally mapped by experts with local ecological and biological knowledge, is essential. Species data can supplement land class data where survey bias and scale are not limiting (Cowling et al. 2004) and may be useful for fine-scale planning or identifying priority subregions. Limited resources for species data collection should be focused on rare, endemic, vulnerable, and economically useful species. Locations are best given as coordinates, not grid squares. Plot-scale inventory data are also useful for target setting (Desmet & Cowling 2004). Environmental processes (e.g., speciation, migration) are essential for ensuring the persistence of living landscapes and are usually represented by spatial surrogates (Cowling et al. 1999*a*). Expert knowledge is essential to map them.

Ideally three categories of habitat transformation need to be identified: (1) irreversibly transformed areas, (2) potentially restorable areas, and (3) intact areas. Mapping potentially restorable areas is difficult and requires careful conceptual planning and verification. Mapping future land-use pressures allows avoidance of areas likely to be compromised in the future and is a conceptually and technically complex task (Hulse et al. 2004). Keeping time frames short (5 to 10 years), avoiding complex statistical models, and drawing on expert knowledge make the task manageable and produces more realistic and defensible predictions.

Planning units are the building blocks of protected-area networks and allow the value or priority of different areas to be compared. Their size and shape affect efficiency (Pressey & Logan 1998). Other useful data include keystone species (Noss et al. 2002), critical natural capital (Lombard et al. 2004), and contextual data (e.g., roads, rivers).

Some authors believe environmental pattern data (e.g., land classes, species localities) are usually inadequate to conduct conservation assessments (e.g., Prendergast et al. 1999; Dinerstein et al. 2000). In our experience, the lack of spatially explicit data on environmental processes is a far greater hindrance. Spatial layers showing transformation and predicted future pressures are usually relatively expensive and complex to develop. If limited resources are available for developing additional data sets, these resources should be invested in mapping land classes, ecological processes, and transformation (including restorable habitat) rather than in collecting species distribution data. Cost-effective ways of mapping partially transformed restorable habitat need to be explored (e.g., grazing impacts, invasive alien plants).

SET QUANTIFIED TARGETS

Assessments founded on explicitly stated quantitative and qualitative targets facilitate the implementation of outputs because they provide a clear purpose for conservation decisions, lending them accountability and defensibility (Pressey et al. 2003). We use *target* differently from other authors for whom targets are the features sampled in protected areas (e.g., Noss 2003). Quantitative targets describe the amount of each feature to be conserved and should be set for individual features (e.g., land classes) based on scientific methods if data are available. We found the use of biological heterogeneity and species-area relationships within land classes effective (Desmet & Cowling 2004). Our experience confirms others' opinion that the widely adopted 10 or 12% targets are inadequate because they lead to underrepresentation of most features and fail to account for biological heterogeneity (Soulé & Sanjayan 1998; Pressey et al. 2003; Desmet & Cowling 2004). Qualitative targets can apply to decision protocols for protected area design criteria, for example, prioritizing planning units adjoining existing protected areas. Explicit quantitative and qualitative targets should form the basis for monitoring implementation.

Our recent experience suggests that incorporating future land-use pressures into target-setting procedures (e.g., Pressey et al. 2003) should be avoided. Spatial predictions of land-use pressures are extremely difficult to derive in a defensible manner. Combining biological heterogeneity with a measure of land-use pressure (e.g., vulnerability) masks the criteria driving the target value. This lacks transparency, and we have found it conceptually confusing for stakeholders. Moreover, representation targets are "artificially" increased for highly transformed land classes irrespective of their biological diversity. Vulnerability data are best used to prioritize sites and schedule conservation action.

Identification of Stakeholders and Goals

The clarity of the reasons for undertaking an assessment affects the success of implementation. Processes with a poorly defined problem are less likely to result in effective conservation action. Solutions must include goals clearly articulated by the staff of implementing organizations and formulated cognizant of those affected by the outputs, who will inherit and implement the assessment outcomes and products, existing organizational capacity for implementation; instruments to operationalize the plan, and implementation opportunities and constraints. Assessments should be demand led, not supply driven, and should meet real needs of implementing organizations. In some instances, unsolicited assessments can offer significant contributions to an organization's strategic direction, but planners must demonstrate the potential of assessments to contribute to corporate goals. This requires sensitivity to the implementation challenges and capacity constraints faced by organizations.

Assessments should inform two distinct sets of activities: (1) land-use planning, including environmental assessment, to slow habitat loss in priority areas, and (2) proactive implementation actions by conservation organizations to achieve targets in protected areas. It is important to be clear whether an assessment is aimed at one or both of these applications.

Assessments at Different Scales

Assessments at different scales meet different aims and should be applied in different ways. When designing the planning process, determine the appropriate scale given the goals of the assessment. Spatial error of data inputs and intended assessment outputs and their interpretation and application on the ground are critical considerations affecting implementation. Broad-scale assessments (e.g., 1:250,000) best identify broad priority areas for entire regions. Fine-scale assessments (e.g., 1:50,000) are usefully undertaken within priority subregions and can be used to design protected-area networks and inform land-use planning outside protected areas. Fine-scale assessments may be necessary in regions that are highly fragmented and have heterogeneous land use or high biological or landscape diversity. Fine-scale assessments complement broad-scale assessments (Rouget 2003).

Attention to Assessment Design

There is no single best recipe for a planning process, so prescriptive approaches are best avoided. Significant investment of time and resources should be dedicated to involving key stakeholders (e.g., influential staff in implementing organizations) in the design of the planning process. Process design should vary according to the aims and spatial scale of the assessment, institutional and sociopolitical context, timeframe, and budget. Major design tasks include (1) designing linked components (e.g., conservation assessment, socioeconomic analysis), (2) establishing teams for different components, (3) establishing an advisory group, (4) designing processes for stakeholder collaboration, and (5) establishing timeframes and management systems.

Assessment Teams That Include Implementing Organizations

CAREFULLY RECRUIT ASSESSMENT TEAMS

An assessment is a transdisciplinary activity that requires coordination skills, specialist skills, and a group of advisors. Specialist skills include high-level analytical GIS skills, assessment expertise, and regional natural-history and biogeographical knowledge. A specialist's most basic combination of required skills is highly specialized GIS and assessment skills and an intimate understanding of regional ecology. Intimate expert knowledge of regional land uses, people, and organizations greatly facilitates integrating implementation issues into assessments.

Investment in project coordination is crucial, especially in rapid, low-budget processes. A dedicated coordinator is more effective than combining coordination and specialist functions in one person. The coordinator must be an effective manager and should understand the basics of assessment and, more broadly, conservation planning. An advisory group of experienced, respected people can provide guidance, credibility, and a forum for reporting on progress.

INVOLVE IMPLEMENTING ORGANIZATIONS

Implementing organizations are key stakeholders, and their staff should be intimately involved in the assessment. Ideally the implementing agency should lead the planning process and be involved in the day-to-day work of the assessment team. This greatly enhances the probability of successful mainstreaming (Pierce et al. 2002) by ensuring that assessments meet the needs of implementing organizations and so inform their ongoing work without a complex and time-consuming handover from the assessment team to the implementing organization. Involvement also provides on-the-job training to build capacity. If implementing organization involvement in the assessment team is not possible, then key staff should be involved in other aspects of the planning process (e.g., developing the implementation strategy) or, at the least, be kept fully informed of the process through regular update sessions.

INVOLVE THE TEAM IN PLANNING-PROCESS DESIGN

The assessment team should be involved in initial process planning to ensure clear understanding of goals and

approaches and to avoid poor integration with teams working on other process components. Ideally, all team members should be located together within the planning region (Dick 2000) to facilitate communication within and beyond the team. Regular meetings, plus liaison with other participants, is essential for ensuring effective integration. Team members can be employed full time or part time and are ideally based in an implementing organization.

Focused Collaboration to Address Stakeholders' Needs

A great deal of time and resources can be wasted on poorly conceived, unfocused stakeholder collaboration. It is clearly important to collaborate with a broad range of stakeholders from different sectors, but this should be done in a focused way.

IDENTIFY KEY STAKEHOLDERS FIRST

Identifying and understanding the needs of key stakeholders sets the foundation for implementation. A stakeholder analysis should be conducted in the context of the specific aims of the process and should include identifying stakeholders' needs and interests, their geographic influence, and constraints to their participation (e.g., transport, time). Key stakeholders should be relevant, important, or influential, and include local-level stakeholders such as local communities and high-level stakeholders such as politicians. Different stakeholders possess distinct mental models, which necessitates managing multiple realities (Sayer & Campbell 2004).

DESIGN A COLLABORATION PROGRAM WITH CLEAR OBJECTIVES

It is important to clearly communicate the objectives of the assessment and of stakeholder collaboration to avoid unrealistic expectations (e.g., local officials expecting a broad-scale assessment to provide all the environmental information needed for local-scale decision making). Objectives of stakeholder collaboration can include building awareness, gathering information, building consensus on a regional vision or priority actions, securing commitment from stakeholders for implementation, and building capacity for implementation.

Different stakeholders should be involved in different aspects of the process, and each requires different levels of information on the assessment. Detailed technical information is often not necessary or constructive for most stakeholders. Although everyone involved should understand the basics of the approach, the precise methodological details of an assessment are less relevant for most stakeholders.

Key high-level stakeholders, implementing organizations, and key experts with specialized ecological or socioeconomic knowledge of the planning region, may be valuable contributors to the design of the process because of their political or institutional knowledge or influence. The scientific community and expert stakeholders need to be involved in the assessment, perhaps through an initial workshop to get input on the approach and possible data sources. Reporting results of draft assessments for comment to a forum of scientists with regional expertise may also be useful. Stakeholders from a range of social and economic sectors, notably local government, agriculture, tourism, and community groups, are critical for development of an implementation strategy and local-scale action plans (e.g., Knight et al. 2003). It is important to be conscious of language when engaging with stakeholders. For example, describing production activities as "threats" to nature alienates stakeholders with legitimate land-use interests.

AVOID BROAD, UNFOCUSED STAKEHOLDER WORKSHOPS

A centralized process with little collaboration is generally inappropriate. Large numbers of stakeholder workshops, however, are not necessarily the solution. Although broad workshops may efficiently achieve some objectives, such as raising awareness, reporting results, and building consensus on priority actions, many broad workshops can simply produce workshop fatigue, frustration, and resentment. Focused, one-on-one meetings or small-group sessions with key stakeholders addressing their needs or specific issues often are more effective. Geographically decentralized workshops may be useful for a broad-scale assessment covering a large area. If large workshops are held, impeccable workshop planning and facilitation are crucial; professional facilitation is often warranted. Caution is required when planning with local stakeholders—they often deal with practicalities of land use and are understandably frustrated when planning occupies significant time and resources with no perceived link to action.

MAKE THE CASE FOR NATURE

Specialists often fail to explain why nature matters and how it contributes or could contribute to livelihoods. Making the case for nature, and hence the need for assessment, should be an integral part of stakeholder collaboration. Promoting conservation as a valid land use that contributes to development, rather than preventing development, is useful. Compelling local or regional examples of nature's central role in maintaining flows of ecosystem goods and services can be powerful. Focus on aspects not perceived as detrimental by stakeholders. As a case in point, farmers often believe large predatory mammals kill stock, making these animals a poor choice for promoting the importance of nature (Davie 1997).

Interpretation of Assessment Outputs and Mainstreaming of Products

A GIS linked to planning software (e.g., C-Plan; Ferrier et al. 2000) can apply targets to feature data and develop spatially explicit assessment outputs (i.e., expert maps) and planning products (i.e., maps for implementers). Minimum-set analyses (e.g., Kirkpatrick 1983) are often impractical because they select a dispersed arrangement of areas, with little consideration to reserve design. They also represent only one of many possible solutions, offering no information on options outside the minimum set (Ferrier et al. 2000). A map of conservation options (e.g., irreplaceability; Ferrier et al. 2000) is often better for planning protected areas expansion. Alternatively, land-use planners prefer the certainty of a minimum set of areas meeting quantitative and qualitative targets, coupled with information on options for land use outside candidate protected areas (e.g., Pierce 2003).

DELIVER ASSESSMENT OUTPUTS AS USEFUL PLANNING PRODUCTS

Assessment outputs are usually technical, complex, and often meaningless to implementers. Although a potentially powerful tool, they present information in formats not equally useful for all implementers; they often need to be interpreted and redesigned as planning products to facilitate decision making (e.g., Pierce 2003) by distinct implementer groups. Time and resources should be allocated by the assessment team to developing these products, tailoring them specifically to implementer needs and capacity. Staff from implementing organizations, who have local knowledge of implementation opportunities and constraints, are in the best position to advise on the effects of individual land-use decisions, with the assistance of meaningful planning products.

Planning products should display the results of the assessment with features (e.g., land classes), not planning units, whose values are misleading when calculated from "underlying" features. For example, stakeholders unfamiliar with assessment techniques may assume their entire property is a priority, when the priority area is only a small section. In our experience, land-use planners find artificial planning units (i.e., grids, hexagons) impractical. Cadastral boundaries often make a useful overlay on a map of features but, depending on the specific purpose of the assessment, are sometimes best not used as planning units. Although irreplaceability maps have been well received by high-level managers within land management organizations (Ferrier et al. 2000), our experience suggests they are both confusing and difficult to apply for land-use planners and rural landowners. They are, however, a useful input layer into more complex analyses (Rouget et al. 2006). Use of red as a color for priority properties should usually be avoided because it may signal danger to stakeholders.

Interpretive land management guidelines (e.g., Pierce 2003) should accompany planning products, especially for land-use planners wanting to know what particular activities are appropriate for an area. Other supporting products (e.g., explanatory posters) may also be useful. Further experience and testing into how to redesign conservation options maps into planning products are required. Valuable lessons are emerging from two projects under way in the Cape Floristic Region and the Subtropical Thicket Biome of South Africa.

MAINSTREAM PLANNING PRODUCTS INTO ACTION

Planning products, complemented with an implementation strategy, must be actively mainstreamed—incorporated into the policies, decisions, and day-to-day actions of the diverse range of people and organizations whose activities affect natural resource management (Pierce et al. 2002). Mainstreaming planning products is not a once-off activity; rather, it requires continuous input and involvement. It cannot be led effectively from outside the region, and employing outsiders to conduct an assessment and develop an implementation strategy almost guarantees mainstreaming failure.

Successful mainstreaming depends on continuity between those leading the planning process and those leading subsequent implementation. Several people centrally involved in the planning process, who understand and believe in the vision and are committed to its success, should champion mainstreaming and implementation at the policy level and at the level of day-to-day action. Champions must exhibit tenacity, leadership, empathy, and an ability to build capacity in a broad range of individuals and organizations.

Committed individuals and organizations, flexible funders willing to take calculated risks with new approaches, effective cross-sectoral partnerships, and approaches that actively seek and highlight opportunities to link nature to socioeconomic gains (e.g., job creation) are essential for mainstreaming. Mainstreaming should be driven through projects rather than organizational structures.

Conclusions

Conservation assessment is the technical task of identifying priority areas for conservation. When coupled with implementation strategy development, in the context of stakeholder collaboration, these activities constitute a conservation planning process (Fig. 1). Knowing-doing gaps are real phenomena in planning processes (Knight et al. 2006) that lead to failure in the implementation of effective conservation action. Bridging the gaps between assessment and implementation strategy development—the assessment-planning gap—and between conservation

planning and implementing conservation action—the planning-action gap—requires specific, explicit techniques. Assessments published in the peer-reviewed literature overwhelmingly focus on development of area-selection techniques, with little attention to how assessment outputs can be translated into effective conservation actions.

Our experiences in South Africa (Table 1) suggest that the approach and structure of an assessment determine, in part, the effectiveness of a planning process. Given the current lack of consideration of how assessments will be implemented in the face of ongoing environmental decline, an urgent need exists to document best practice for conservation assessments. Our seven key ingredients underpin an approach we call planning for implementation: (1) a systematic assessment, (2) identification of stakeholders and goals of the process, (3) assessments conducted at different scales, (4) attention to assessment design, (5) assessment teams that include implementing organizations, (6) focused collaboration to address stakeholders' needs, and (7) interpretation of assessment outputs and mainstreaming products (see also Driver et al. 2003*a*; Knight et al. 2006). These key ingredients represent a South African consensus on current best practice for undertaking assessments and situate them within broader planning processes (e.g., Knight et al. 2006), blending the science of assessment with the pragmatic issues surrounding real-world planning.

We present the fruits of an informal social learning institution—our network of conservation planners who periodically work together on a range of different processes, testing, swapping, and debating approaches. We, among a growing group of conservation planners, formally meet every year. A common cause, coupled with the belief we are more effective as a group than we are individually, provides the foundation for our social learning institution. Ultimately, we learn more from our difficulties and failures than our successes; openness, trust, and mutual respect have been essential elements in developing the "safe-fail" culture (Redford & Taber 2000; Knight 2006) that underpins our advancement. Documenting experiences so they can be shared is vitally important (Redford & Taber 2000). Our diverse approaches then offer opportunities for rapidly improving the practice of both assessment and planning. Quantifying and formally monitoring our improvements constitute the next logical advance in our social learning institution.

The best practice presented herein, however, represents a snapshot in time, derived from a small group of individuals working in one country under a common philosophy. There is the risk we may create a dogma and entrench an orthodoxy that stifles innovation and limits the adaptive ability of this group to grapple with the constant change we face. Orthodoxy precedes organizational decline into the "pathology of natural resource management" (Holling & Meffe 1996), where maintaining the efficiency of planning activities becomes more important than implementing conservation action. Ultimately, our success in fostering consilience—the fusion of different knowledge traditions (Wilson 1998)—through the continued effective operation of our social learning institution will determine our ability to adapt our approaches to ensure we are effective conservation planners.

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Literature Cited

Clark, F. S., and R. B. Slusher. 2000. Using spatial analysis to drive reserve design: a case study of a national wildlife refuge in Indiana and Illinois (USA). Landscape Ecology **15:**75–84.

Cole, N. S., A. T. Lombard, R. M. Cowling, D. Euston-Brown, D. M. Richardson, and C. E. Heijnis. 2000. Framework for a conservation plan for the Agulhas Plain, Cape Floristic Region, South Africa. 2nd edition. Institute for Plant Conservation, University of Cape Town, Cape Town.

Cowling, R. M., et al. 2003*a*. A conservation assessment for the Subtropical Thicket Biome. Report 46. Terrestrial Ecology Research Unit, University of Port Elizabeth, Port Elizabeth, South Africa.

Cowling, R. M., and A. T. Lombard. 1998. A strategic and systematic framework for conserving the plant life of the Succulent Karoo. Institute for Plant Conservation Report to the Leslie Hill Succulent Karoo Trust. IPC 9802 LHSK. Institute for Plant Conservation, University of Cape Town, Cape Town.

Cowling, R. M., R. L. Pressey, M. Rouget, and A. T. Lombard. 2003*b*. A conservation plan for a global biodiversity hotspot—the Cape Floristic Region, South Africa. Biological Conservation **112:**191–216.

Cowling, R. M., R. L. Pressey, A. T. Lombard, P. G. Desmet, and A. G. Ellis. 1999*a*. From representation to persistence: requirements for a sustainable reserve system in the species-rich mediterranean-climate deserts of southern Africa. Diversity and Distributions **5:**51–71.

Cowling, R. M., R. L. Pressey, A. T. Lombard, C. E. Heijnis, D. M. Richardson, and N. Cole. 1999*b*. Framework for a conservation plan for the

Cape Floristic Region. Institute for Plant Conservation, University of Cape Town. Cape Town.

Cowling, R. M., A. T. Knight, D. P. Faith, S. Ferrier, A. T. Lombard, A. Driver, M. Rouget, K. Maze, and P. G. Desmet. 2004. Nature conservation requires more than a passion for species. Conservation Biology **18:**1674–1677.

Davie, J. 1997. Is biodiversity really the link between conservation and ecologically sustainable management ? A reflection on paradigm and practice. Pacific Conservation Biology **3:**83–90.

Davis, F. W., D. M. Stoms, and S. J. Andelman. 1999. Systematic reserve selection in the U.S.A.: an example from the Columbia Plateau ecoregion. Parks **9:**31–41.

Desmet, P., and R. M. Cowling. 2004. Using the species-area relationship to set baseline targets for conservation. Ecology and Society **9:** http://www.ecologyandsociety.org/vol9/iss2/art11.

Dick, R. C. editor. 2000. A multi-faceted approach to regional conservation assessment in the Cobar Peneplain biogeographic region. New South Wales National Parks and Wildlife Service, Sydney.

Dinerstein, E., et al. 2000. A workbook for conducting biological assessments and developing biodiversity visions for ecoregion-based conservation. Part 1: terrestrial ecoregions. World Wildlife Fund, Washington, D.C.

Driver, A., R. M. Cowling, and K. Maze. 2003*a*. Planning for living landscapes: perspectives and lessons from South Africa. Center for Applied Biodiversity Science at Conservation International, Washington, D.C., and the Botanical Society of South Africa, Cape Town.

Driver, A., P. Desmet, M. Rouget, R. M. Cowling, and K. Maze. 2003*b*. Succulent Karoo ecosystem plan: biodiversity component technical report. Conservation Unit Report CCU 1/03. Botanical Society of South Africa, Cape Town. Available from www.botanicalsociety.org.za (see "Conservation Unit," then "Downloads") (accessed May 2004).

Ferrier, S., R. L. Pressey, and T. W. Barrett. 2000. A new predictor of the irreplaceability of areas for achieving a conservation goal, its application to real-world planning, and a research agenda for further refinement. Biological Conservation **93:**303–325.

Goodman, P. S. 2000. Determining the conservation value of land in KwaZulu-Natal. Final report. KwaZulu-Natal Nature Conservation Service, Cascades, South Africa.

Groves, C. R., D. B. Jensen, L. L. Valutis, K. H. Redford, M. M. Shaffer, J. M. Scott, J. V. Baumgartner, J. V. Higgins, M. W. Beck, and M. G. Anderson. 2002. Planning for biodiversity conservation: putting conservation science into practice. BioScience **52:**499–512.

Hill, G. W. 1982. Group versus individual performance: are $N + 1$ heads better than one? Psychological Bulletin **91:**517–539.

Holling, C. S., and G. K. Meffe. 1996. Command and control and the pathology of natural resource management. Conservation Biology **10:**328–337.

Hulse, D. W., A. Branscombe, and S. G. Payne. 2004. Envisioning alternatives: using citizen guidance to map future land and water use. Ecological Applications **14:**325–341.

Kirkpatrick, J. B. 1983. An iterative method for establishing priorities for the selection of nature reserves: an example from Tasmania. Biological Conservation **25:**127–134.

Knight, A. T. 2006. Failing but learning: writing the wrongs after Redford and Taber. Conservation Biology **20:** DOI:10.1111/j.1523-1739.2006.00366.x.

Knight, A. T., and R. M. Cowling. 2003. Conserving South Africa's "lost" biome: a framework for securing effective regional conservation planning in the Subtropical Thicket Biome. Report 44. Terrestrial Ecology Research Unit, University of Port Elizabeth, Port Elizabeth, South Africa.

Knight, A. T., R. M. Cowling, and B. M. Campbell. 2006. Planning for implementation: an operational model for implementing conservation action. Conservation Biology **20:**408–419.

Knight, A. T., A. F. Boshoff, R. M. Cowling, and S. L. Wilson. 2003. Keeping people on the land in living landscapes: a cooperative strategy for conserving landscapes and enhancing livelihoods in the Subtropical Thicket Biome, South Africa. Report 46. Terrestrial Ecology Research Unit, University of Port Elizabeth, Port Elizabeth, South Africa.

Lawton, J. H. 1996. Corncrake pine and prediction in ecology. Oikos **76:**3–4.

Lawton, J. H., and R. M. May, editors. 1995. Extinction rates. Oxford University Press, Oxford, United Kingdom.

Lombard, A. T., T. Wolf, and T. Strauss. 2004. GIS specialist services, Gouritz initiative: final report. Sedgefield, South Africa.

Maarleveld, M., and C. Dangbégnon. 1999. Managing natural resources: a social learning perspective. Agriculture and Human Values **16:**267–280.

Margules, C. R. 1986. Conservation evaluation in practice. Pages 297–314 in M. B. Usher, editor. Wildlife conservation evaluation: attributes, criteria and values. Chapman & Hall, London.

Margules, C. R., and R. L. Pressey. 2000. Systematic conservation planning. Nature **405:**37–47.

Meffe, G. K., C. R. Carroll, and Contributors. 1997. Principles of conservation biology. Sinauer Associates, Sunderland, Massachusetts.

Mittermeier, R. A., I. A. Bowles, R. B. Cavalcanti, S. Olivieri, and G. A. B. da Fonseca. 1995. A participatory approach to biodiversity conservation: the regional priority setting workshop. Conservation International, Washington, D.C.

Nel, J., S. Davies, I. Kotze, C. Gelderblom, B. van Wilgen, L. Schonegevel, S. Hughes, G. I. H. Kerley, R. M. Cowling, and A. F. Boshoff. 2002. Terrestrial conservation planning for the Greater Addo Elephant National Park. Final report. Environmentek CSIR, Stellenbosch, South Africa.

North, D. C. 1990. Institutions, institutional change and economic performance. Cambridge University Press, Cambridge, United Kingdom.

Noss, R. F. 2003. A checklist for wildlands network designs. Conservation Biology **17:**1270–1275.

Noss, R. F., C. Carroll, K. Vance-Borland, and G. Wuerthner. 2002. A multicriteria assessment of the irreplaceability and vulnerability of sites in the Greater Yellowstone ecosystem. Conservation Biology **16:**895–908.

Pfeffer, J., and R. I. Sutton. 1999. Knowing "what" to do is not enough: turning knowledge into action. California Management Review **42:**83–107.

Pierce, S. M. 2003. The S.T.E.P. handbook. Integrating the natural environment into land use decisions at the municipal level: towards sustainable development. Report 47. Terrestrial Ecology Research Unit, University of Port Elizabeth, Port Elizabeth, South Africa.

Pierce, S. M., R. M. Cowling, T. Sandwith, and K. MacKinnon. 2002. Mainstreaming biodiversity in development: case studies from South Africa. The World Bank, Washington, D.C.

Pierce, S. M., R. M. Cowling, A. T. Knight, A. T. Lombard, M. Rouget, and T. Wolf. 2005. Systematic conservation assessment products for land-use planning: interpretation for implementation. Biological Conservation **125:**441–458.

Poiani, K. A., B. D. Richter, M. Anderson, and B. Richter. 2000. Biodiversity conservation at multiple scales: functional sites, landscapes, and networks. BioScience **50:**133–146.

Prendergast, J. R., R. M. Quinn, and J. H. Lawton. 1999. The gaps between theory and practice in selecting nature reserves. Conservation Biology **13:**484–492.

Pressey, R. L. 1994. Ad hoc reservations: forward or backward steps in developing representative reserve systems. Conservation Biology **8:**375–384.

Pressey, R. L. 1998. Algorithms, politics & timber: an example of the role of science in a public, political negotiation process over new protected areas in production forests. Pages 73–87 in R. T. Wills, R. J. Hobbs, and M. D. Fox, editors. Ecology for everyone: communicating ecology to scientists, the public and the politicians. Surrey Beatty and Sons, Sydney.

Pressey, R. L. 2002. The first reserve selection algorithm—a retrospective on Jamie Kirkpatrick's 1983 paper. Progress in Physical Geography **26:**434–442.

Pressey, R. L., and R. M. Cowling 2001. Reserve selection algorithms and the real world. Conservation Biology **15:**275–277.

Pressey, R. L., and V. S. Logan. 1998. Size of selection units for future reserves and its influence on actual vs. targeted representation of features: a case study in western New South Wales. Biological Conservation **85:**305–319.

Pressey, R. L., R. M. Cowling, and M. Rouget. 2003. Formulating conservation targets for biodiversity pattern and process in the Cape Floristic Region, South Africa. Biological Conservation **112:**99–128.

Pretty, J., and H. Ward. 2001. Social capital and the environment. World Development **29:**209–227.

Redford, K. H., and A. Taber. 2000. Writing the wrongs: developing a safe-fail culture in conservation. Conservation Biology **14:**1567–1568.

Rouget, M. 2003. Measuring conservation value at fine and broad scales: implications for a diverse and fragmented region, the Agulhas Plain. Biological Conservation **112:**217–232.

Rouget, M., and B. Egoh. 2003. Planning in South Africa: opportunities and limitations for the NBI. Institute for Plant Conservation, University of Cape Town, Cape Town.

Rouget, M., R. M. Cowling, A. T. Lombard, A. T. Knight, and G. I. H. Kerley. 2006. Designing large-scale conservation corridors for pattern and process. Conservation Biology **20:**549–561.

Sayer, J. A., and B. M. Campbell. 2004. The science of sustainable development: local livelihoods and the global environment. Cambridge University Press, Cambridge, United Kingdom.

Soulé, M. E., and M. A. Sanjayan. 1998. Conservation targets: do they help? Science **279:**2060–2061.

Stewart, W. I., R. M. Cowling, A. P. Martin, D. R. du Preez, and A. T. Lombard. 2003. Framework for a conservation plan for the Nelson Mandela Metropole (the Five Biome City), Cape Floristic Region, South Africa. 1st edition. World Wide Fund for Nature (WWF)–South Africa, Cape Town.

von Hase, A., M. Rouget, K. Maze, and N. Helme. 2003. A fine-scale conservation plan for Cape Lowlands Renosterfeld: technical report. Report CCU 2/03. Cape Conservation Unit, National Botanical Institute of South Africa, Cape Town.

Wilson, E. O. 1998. Consilience: the unity of knowledge. Abacus, London.