Title
Implementation strategies for systematic conservation planning.

Journal
Ambio, 48(2)

Authors
Adams, Vanessa
Mills, Morena
Weeks, Rebecca
et al.

Publication Date
2019-02-01

DOI
10.1007/s13280-018-1067-2

Peer reviewed

Ambio 2019, 48:139–152
https://doi.org/10.1007/s13280-018-1067-2

PERSPECTIVE

Implementation strategies for systematic conservation planning

Vanessa M. Adams, Morena Mills, Rebecca Weeks, Daniel B. Segan, Robert L. Pressey, Georgina G. Gurney, Craig Groves, Frank W. Davis, Jorge G. Álvarez-Romero

Received: 25 February 2018 / Revised: 23 May 2018 / Accepted: 28 May 2018 / Published online: 9 June 2018

Abstract The field of systematic conservation planning has grown substantially, with hundreds of publications in the peer-reviewed literature and numerous applications to regional conservation planning globally. However, the extent to which systematic conservation plans have influenced management is unclear. This paper analyses factors that facilitate the transition from assessment to implementation in conservation planning, in order to help integrate assessment and implementation into a seamless process. We propose a framework for designing implementation strategies, taking into account three critical planning aspects: processes, inputs, and context. Our review identified sixteen processes, which we broadly grouped into four themes and eight inputs. We illustrate how the framework can be used to inform context-dependent implementation strategies, using the process of 'engagement' as an example. The example application includes both lessons learned from successfully implemented plans across the engagement spectrum, and highlights key barriers that can hinder attempts to bridge the assessment-implementation gap.

Keywords Conformance-based evaluation · Plan implementation · Planning-implementation gap · Performance-based evaluation · Protected areas · Research-implementation gap

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s13280-018-1067-2) contains supplementary material, which is available to authorized users.

INTRODUCTION

In 2018, systematic conservation planning turns 35 years of age. Its inception is dated at 1983 (Pressey 2002), the year that Jamie Kirkpatrick published two papers that first used the principle of complementarity (a term coined later by Vane-Wright et al. 1991) to identify priority conservation areas. During the last three decades, systematic conservation planning has become productive and influential, with many hundreds of publications in the peer-reviewed literature (Moilanen et al. 2009; Álvarez-Romero et al. 2018) and numerous applications to regional conservation planning by government and non-government organisations (Groves and Game 2016).

Important questions remain, however, about the extent to which plans, as recommendations for future conservation management, have led to effective actions on the ground or in the water. Frequent reference is made to the "research-implementation" gap (Knight et al. 2008) or the "assessment-implementation" gap (a "knowing-doing" gap; Pfeffer and Sutton 1999; Knight et al. 2011), and even the "implementation crisis" (Knight et al. 2006) in conservation planning. This discussion mirrors earlier literary debates in related planning fields. Examples are from land-use planning, regarding the assessment-implementation gap, and the need to progress implementation research within spatial planning disciplines (Talen 1996b; Berke et al. 2006). The lack of evaluations focused on measuring implementation success in conservation planning means the precise nature or size of the assessment-implementation gap remains unknown. However, it seems likely that the transition between regional-scale plans and local-scale actions (Pressey et al. 2013) (i.e. successful bridging of the assessment-implementation gap) has been navigated by a relatively small number of conservation scientists and practitioners (e.g. Fernandes et al. 2009; Henson et al. 2009; Pressey and Bottrill 2009; Knight et al. 2011; Fisher and Dills 2012; Mills et al. 2015; Sinclair et al. 2018).

The broad goal of this paper is to contribute to an understanding of the factors that facilitate the transition from assessment to implementation in conservation planning. We define conservation planning as a planning process that includes a map of conservation priority areas (Bottrill and Pressey 2012). This definition is consistent with the 11 stages of conservation planning defined by Pressey and Bottrill (2009) which include the inception of planning and decisions about priority areas as well as the implementation of priorities and ongoing monitoring (all 11 stages of Pressey and Bottrill 2009, Fig. 1). As a basis for discussing the relationship between "assessment" of priorities and "implementation" of actions, we define assessment as stages 1–9 of the framework (Fig. 1) and implementation as stage 10. Stage 11 refers to post-implementation management and monitoring of conservation actions.

We propose that, to facilitate the transition from assessment to implementation, conservation planners need to assimilate an implementation strategy into the assessment phase of planning. We consider an assessment to detail *where* to act, while an implementation strategy would be a plan of *how* to act. An implementation strategy complements an assessment by ensuring that the appropriate resources and processes are in place to implement the priorities identified within the assessment. Implementation theory for related planning and policy disciplines provides conceptual frameworks for developing implementation strategies which are explicit and separate to a policy or plan (Rein and Rabinovitz 1980; Sabatier and Mazmanian 2005; Berke et al. 2006). Drawing from this body of theory, we suggest that designing an explicit implementation strategy has the potential to resolve many assessment-implementation gaps by ensuring that (1) adequate and context-appropriate processes and resourcing are in place; (2) the implementing agency is engaged in and committed to implementation; and (3) there are clear and explicit actions identified for implementation that align with the assessment goals (Najam 1995; Laurian et al. 2004a; Sabatier and Mazmanian 2005; Berke et al. 2006; Wong and Watkins 2009).

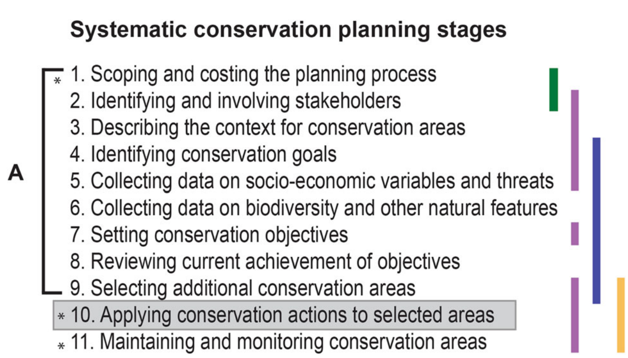

Fig. 1 Definitions of assessment and implementation in relation to the planning stages of Pressey and Bottrill (2009). Stages in brackets marked "A" (1–9) constitute assessment. The implementation stage (10) is indicated by shading. Asterisks indicate where assessment and implementation *inputs* (Table 1) should be appropriately scoped and resourced for subsequent stages. The stages that are most aligned with the four broad types of *processes* (Table 2) are indicated by coloured bars: green (Identify and ensure enabling factors such as timeline, roles, legitimacy, resources, and institutions are in place), pink (Engaging with stakeholders, building relationships, connecting with appropriate governance processes), purple (Supporting the technical aspects of assessment getting data, proposing actions, selecting places), and orange (Supporting implementation, on-ground action). We note that there is further overlap in these stages and processes, and that planners can draw on processes across multiple stages but, for simplicity, indicate only those stages most relevant to each type of process

Our aim here is to establish the foundations for implementation strategies, by adding to the growing understanding of factors conducive to the successful transition from assessment to implementation, and organising this knowledge into a conceptual framework. We first discuss the nature of implementation and different methods for evaluating implementation success, drawing upon concepts and theories from the wider literature of (non-conservation) planning. We then propose a framework for designing implementation strategies, taking into account three aspects that have been identified as critical in implementation success: planning processes, inputs, and context (Najam 1995; Laurian et al. 2004a; Berke et al. 2006; Wong and Watkins 2009; Bottrill and Pressey 2012; Bottrill et al. 2012). We draw on our collective experience in conservation planning and diverse disciplinary backgrounds (ecology, planning, and social sciences) to explore each framework component. Finally, we use case studies of planning processes that have been implemented to demonstrate how understanding the three components of our framework—processes, inputs, and context—can help conservation planners and practitioners design a context-specific implementation strategy.

THE NATURE OF IMPLEMENTATION AND THE ASSESSMENT-IMPLEMENTATION GAP

The extent to which the assessment-implementation gap exists, and conversely the extent to which implementation is successful, depends upon how we define and measure plan implementation. We therefore start by discussing systematic conservation planning within the broader planning disciplines and consider two methods for measuring the extent to which a plan is implemented. Understanding measures of implementation is critical for interpreting

Table 1 Planning inputs identified in the literature as influencing implementation (see Supplementary Materials for all references)

	Input element
1	Favourable conditions for long-term engagement
2	Adequate funding
3	Data of high quality and relevance
4	A clear and accepted planning framework
5	A planning team with broad interdisciplinary skill bases
6	Capacity of local stakeholders including implementers, government, and groups of people likely to be affected by planning decisions
7	Effective leadership and partnerships in political processes, agencies, and non-government organisations
8	Capability for adequate enforcement

implementation evaluations and lessons learned for designing successful implementation strategies (Talen 1997; Wong and Watkins 2009).

Systematic conservation planning is a small subset of a much broader spectrum of land-use and environmental planning disciplines. Within conservation this spectrum includes both spatial and non-spatial planning, such as strategic planning processes that involve conservation assessments and integrated planning (e.g. land use and natural resource management) (Ekoko 2000). Systematic conservation planning differs from these approaches by always considering biodiversity, being based on explicit and usually quantitative objectives, and considering complementarity among existing and proposed conservation actions (Margules and Pressey 2000). Although conservation assessments are commonly focused on identifying priority areas, non-spatial conservation planning, such as strategic plans that identify priority actions rather than locations or that provide guidance on operational strategies, can have a number of different goals, including fundraising, policy influence, guiding investment in action, and legitimising management decisions (Bottrill and Pressey 2012; Bottrill et al. 2012).

The degree to which an assessment is evaluated as being successfully implemented should depend on the motivations and goals of the assessment, as well the outputs of the assessment itself. Traditionally, in the context of non-spatial planning, an assessment is implemented to the extent that its findings, recommendations, and priorities are manifested in decision-making processes and associated conservation actions in the planning region (Baer 1997). The broader fields of land-use and environmental planning have wrestled with how to define and evaluate plan implementation (Talen 1996a; Baer 1997; Laurian et al. 2004b, 2010), providing useful guidance for conservation planners. Laurian et al. (2004b) distinguished conformance- and performance-based implementation and evaluation as divergent traditions in planning that stem from different assumptions about the purpose and function of planning.

Conformance-based evaluation focuses on tangible outcomes and considers an assessment implemented to the extent that ensuing development patterns adhere to assessment policies, objectives, and spatial allocation of uses. This mode of evaluation presumes that the assessment should serve as a blueprint for land-use decisions and that the assessment is explicit enough that future actions can be quantitatively or at least qualitatively measured against it (Laurian et al. 2004a). In some planning efforts, such as planning for a marine reserve network in California, United States, conformance-based evaluation is appropriate because the planning is mandated under California's Marine Life Protected Act for the explicit purpose of redesigning the State's system of marine protected areas (Saarman and Carr 2013). Similarly, multispecies habitat conservation planning under the U.S. Endangered Species Act constitutes blueprint planning for development and conservation activities and, as such, is amenable to conformance-based implementation evaluation.

In contrast, performance-based evaluation is more focused on planning as a process that helps to guide rather than prescribe future decisions. In this case, an assessment is implemented to the extent that it is consulted during the decision-making processes that affect where and how action occurs (Laurian et al. 2004b). Performance-based plan implementation assumes that assessments might need adjustment to unforeseen and dynamic conditions in the planning region. By analogy, performance-based implementation of a systematic conservation plan would depend on the extent to which assessment influences or is consulted in making conservation decisions. Performance measurements will be context-specific, and could include achievement of objectives for species targeted by the assessment, policy or legislative influence, the use of assessment outputs for parallel planning processes, and better understanding of conservation requirements among stakeholders.

In many cases, performance-based implementation will be more practical for systematic conservation planning, avoiding the unrealistic and sometimes undesirable expectation that implemented actions will be spatially aligned with those proposed in assessments (Pressey et al. 2013). In particular, performance-based implementation also acknowledges the many additional benefits of planning, including the generation of financial, social, human, and institutional capital. Examples include fundraising, stakeholder collaboration and buy-in, raised awareness and expectations about conservation needs, refined analytical methods, organisational learning, and incorporation of

Table 2 Planning processes, grouped into four themes, identified in the literature as influencing implementation (see Supplementary Materials for all references)

Identify and ensure enabling factors such as timeline, roles, legitimacy, resources, and institutions are in place
1. Create timelines with clear deadlines
2. Define roles for different groups (e.g. scientists and stakeholders) in the process
3. Ensure a legitimate hierarchy of decision-making power, resources, and expertise
4. Create institutions, governance processes, and opportunities that foster connections and information-sharing between stakeholders
Engaging with stakeholders, building relationships, connecting with appropriate governance processes
5. Involve all relevant stakeholders (representative of all types of human uses of the study region) through a participatory and collaborative approach
6. Create opportunities for dialogue between diverse stakeholders whose uses and values of the region might conflict
7. Understand and engage in political attitudes and decisions, and look for opportunities to gain political support
8. Identify brokers and people in strategic positions who can facilitate negotiations between stakeholders
9. Understand and align the stages of conservation planning with existing governance arrangements, legislation, other planning processes, pre-existing priorities, and human activities in the study region, including linking agencies with different but complementary mandates and considering the multiple spatial scales of perspectives that influence decisions
Supporting the technical aspects of assessment (getting data, proposing actions, selecting places)
10. Ensure clear communication regarding the importance of biodiversity, objectives, potential actions, proposed actions, and expected outcomes
11. Consider a suite of strategies and tools when selecting the appropriate action for sites, keeping in mind that proposed actions need to be aligned with the needs of stakeholders
12. Integrate local and scientific knowledge
13. Select planning units that reflect implementation units
14. Plan for adaptation, including a rationale for sequential implementation of actions in terms of type and spatial location, updating of assessment as new information comes to hand, and ongoing monitoring of the effectiveness of actions, with feedback to assessment as needed
Supporting implementation, on-ground action
15. Create accessible products from the assessment, tailored to context and stakeholders
16. Incorporate planning outputs into the strategic plans and work programs of relevant organisations, including those with mandates for development and extraction of natural resources

conservation thinking into the activities of other sectors (Bottrill and Pressey 2012; Bottrill et al. 2012).

Our conceptual framework for developing an implementation strategy, discussed below, is applicable to both conformance- and performance-based implementation. For our case studies, we draw primarily upon conformance-based plan evaluations because these are more commonly documented. However, we note that the perceived assessment-implementation gap may be due to a lack of documenting performance-based implementation. Furthermore, by ignoring performance-based outcomes, many benefits of the assessment phase may not be recognised (Bottrill and Pressey 2012; Bottrill et al. 2012).

IMPLEMENTATION STRATEGY FRAMEWORK

We draw on both conservation focused plan implementation literature and the broader (non-conservation) literature, and suggest that an implementation strategy should consider three primary components: inputs, processes, and context. We argue that a successful strategy must consider these three components as they relate to the conservation assessment and resulting priorities because the components have been shown to have a positive influence on successful plan implementation (Najam 1995; Laurian et al. 2004a; Berke et al. 2006; Wong and Watkins 2009; Bottrill and Pressey 2012; Bottrill et al. 2012). We define *inputs* as resources invested in assessment and implementation, including time, money, data, and expertise. *Processes* are structured activities or tasks that relate to the production and implementation of assessments. For example, bringing together the planning team, diagnosing the social-ecological context, and engaging with stakeholders are all planning processes. *Context* (also referred to as the situation analysis; CMP 2013; Groves and Game 2016) refers to the biophysical features, stakeholders, and governance regimes within planning regions, as well as the objectives and associated actions of the conservation assessment (adapted from Bottrill et al. 2012). Every planning context is unique, and there will be no "one size fits all" strategy for moving from assessment to implementation. Depending on the context, different elements of assessment and implementation are likely to assume greater or lesser importance, requiring more or less investment in inputs and processes. Being aware of the context at the outset of planning will thus facilitate the design of an implementation strategy that draws together the right mix of planning inputs and processes to better prepare for implementation.

Our intent in describing a conceptual framework for developing an implementation strategy is not to be prescriptive, but rather to guide critical analysis relevant to diverse planning contexts. We discuss each of the three conceptual framework components below. We then describe five case studies in relation to the framework components to demonstrate how understanding each component and the nexus between them provides the foundations for designing a successful implementation strategy.

Planning inputs and processes

We conducted a literature review to identify peer-reviewed articles that explicitly described attempts at implementation of conservation assessments. We then supplemented this search with references provided by experts in the field. By analysing these papers, we identified critical elements facilitating the transition from assessment to implementation. Eight of these elements relate to inputs (Table 1) and sixteen relate to processes (Table 2) (and see Supplementary Materials S1 for full list of papers that were included in identifying these elements). Our review identified broad process themes, which we used to group-related process elements (Table 2): identifying and ensuring that enabling factors are in place; engaging with stakeholders, building relationships, and connecting with appropriate governance processes; supporting the technical aspects of assessment; and supporting implementation and on-ground action.

Because an implementation strategy will be integrated into the conservation assessment, or sit alongside the assessment, it is useful to understand how the strategy inputs and processes align with the conservation planning steps. Therefore, we have mapped the inputs and processes onto the stages of systematic conservation planning to indicate the planning stages they are most relevant to and how they relate to assessment and implementation (Fig. 1).

Diagnosing the social-ecological context of planning

Numerous studies have demonstrated that the outcomes of conservation actions are strongly influenced by the socioeconomic, political, and biophysical contexts within which those initiatives are undertaken (Reed 2008; Knight et al. 2011; Ban et al. 2013; Opdam et al. 2013; Guerrero and Wilson 2016). The context of planning can thus be defined by the characteristics of the relevant social-ecological system (SES; Fig. 2) in which planning is introduced (Ostrom 2009, Ban et al. 2013).

Although the complexity of the relevant SES context is often considered, it is rarely documented in the structure of planning processes (Knight et al. 2006). Depending on the context in which planning is taking place, individual process elements can encapsulate a range of possible approaches. For example, *ensuring a legitimate hierarchy of decision-making* (process element 3, Table 2) might require a bottom-up, community-driven approach in which decisions are made through consensus in a group of stakeholders, or a top-down approach with a government creating and enforcing laws, or a mixture of the two. The best approach to input elements will also be context-dependent. *Ensuring capability for adequate enforcement*, for example, might require boats and planes for surveillance in a large, multiple-use marine park (Day 2008) or, in another setting, arrangements for community governance of shared resources to protect livelihoods (Arias et al. 2015). Consequently, one way of understanding the influence of context on planning, and more specifically on the design of an implementation strategy, is to analyse characteristics of the SES context.

We employ Ostrom's (Ostrom 2007, 2009) SES framework to diagnose the SES context in which planning is taking place and to subsequently identify associations between context and elements of processes and inputs (Tables 1, 2) that could contribute to an effective implementation strategy. We choose Ostrom's SES framework because it is one of the most widely used approaches to understanding SESs (Binder et al. 2013) and it has been used in previous work that relates context to the stages of the planning process (Ban et al. 2013) and implementation (Guerrero and Wilson 2016).

Ostrom's SES framework depicts components of the SES that are thought to influence outcomes in situations involving common-pool natural resources such as biodiversity (Ostrom 2007). It describes four core subsystems: the resource system (e.g. forest), resource units (e.g. trees), actors (e.g. resource users), and governance (e.g. decision-making process, and formal and informal rules of resource use). The subsystems are composed of second-tier variables that describe characteristics of each subsystem that are suggested to be relevant to common-pool resource management. These characteristics shape 'interactions' among actors (e.g. harvesting level) and thus, social-ecological 'outcomes' (e.g. equity of costs and benefits of conservation actions, improved species persistence).

We adapted Ostrom's SES framework by merging the resource system and resource unit subsystems into the biophysical subsystem in Fig. 2. Planning at landscape or

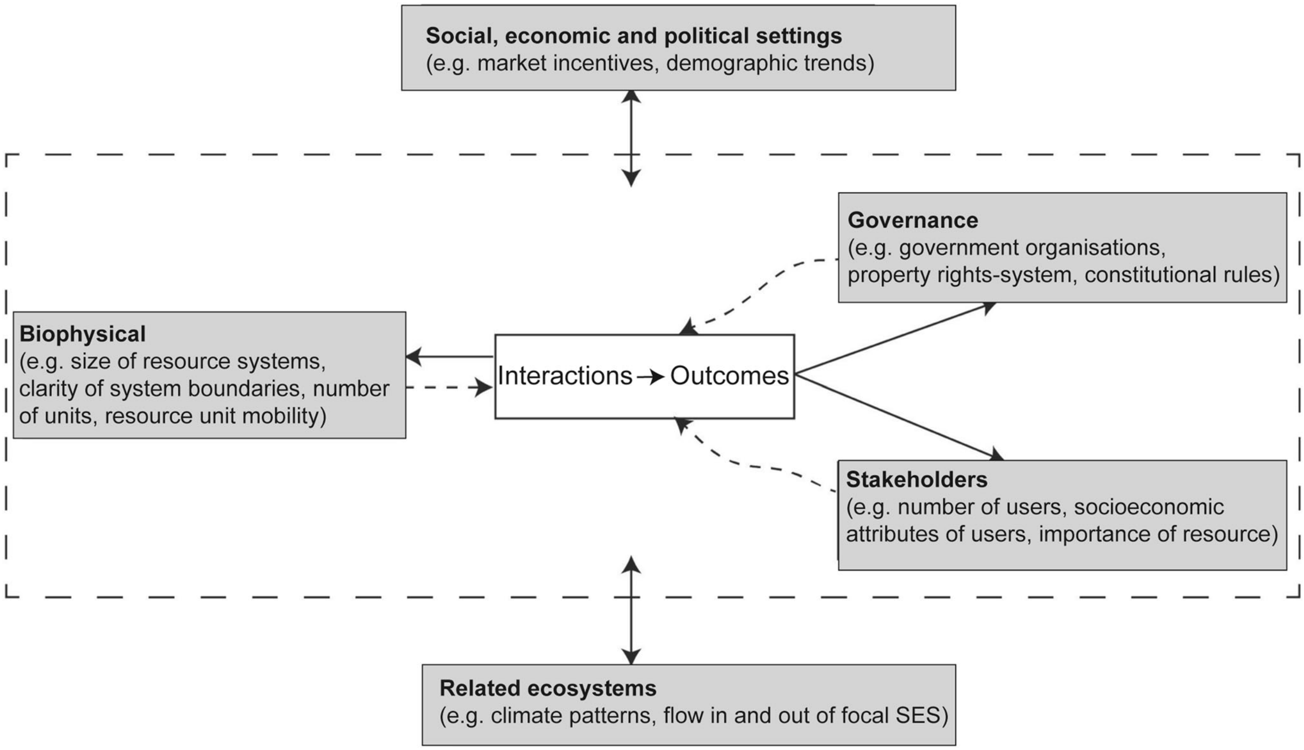

Fig. 2 Simplified representation of the components of a social-ecological system, adapted from Ostrom (Ostrom 2007, 2009). The *biophysical*, *governance,* and *stakeholder* boxes represent the local core subsystems (grey boxes inside the dashed rectangle) for understanding social-ecological outcomes in the context of managing common-pool resources such as biodiversity. Interactions among characteristics of the subsystems and their combined effect on stakeholders' interactions and behaviours shape social-ecological outcomes. External subsystems (grey boxes outside the dashed line), including *social, economic and political settings* and *related ecosystems,* affect the local social-ecological system, thus also influencing outcomes

seascape scales means that these subsystems can commonly be understood as a single subsystem. The actor subsystem is referred to here as 'stakeholders' because planners who will use this framework are more familiar with this term.

We explore below how the SES context in which planning is taking place—consisting in Fig. 2 of the stakeholders, governance, and biophysical subsystems—can influence required inputs for assessment and implementation, which in turn limit the processes which can be supported or undertaken.

Stakeholders

Stakeholders are the actors who can affect, or be affected by, the outcomes of assessment and implementation (Freeman 2010). Relevant stakeholders can include resource users, government and non-government organisations, political authorities, and local residents (Pierce et al. 2005). Key characteristics of stakeholders that can influence the requirements of assessment and implementation of conservation actions are dependence on natural resources, number, socioeconomic attributes, values, and history of use. Importantly, the stakeholder subsystem considers both the total number of stakeholders and their diversity (Ostrom 2009). For example, a small number of stakeholders could have highly divergent values and, conversely, a large number of stakeholders could share a narrow spectrum of values or opinions. Similarly, the number of stakeholders and their roles will result in different levels of complexity. For example, there might be a large number of stakeholders but only one with a role in decision-making. Conversely, there might be a small number of stakeholders but each with a role in decision-making. If there are many stakeholders and all have an equal role in decision-making for the resource, then an appropriate process to foster ownership of and compliance with the decision would need to be managed by the community (Table 2, process 5). This process could require a long time and a large financial budget (Table 1, input 1). In the case of a single stakeholder making decisions about the resource, and if time and funds are limited (Table 1, input 1), an appropriate process might be to work with that stakeholder as a broker to facilitate negotiation and implementation of final decisions (Table 2, process 8). When dealing with a minority of stakeholders in a region, planners should be alert to the risks of elite capture of assessment and implementation (Ferse et al. 2010), with possible detrimental outcomes for the some social subgroups, leading to lack of acceptance of decisions.

Governance

The governance subsystem defines the formal and informal rules regulating access to and use of resources and how those rules are made (Armitage 2008). Any conservation action that influences access to resources will therefore need to be designed with the nature of the existing governance system in mind (assessment) and enabled via that governance system (implementation). The planning region could encompass one governance system with clearly defined and non-overlapping jurisdictions, or could have multiple governance systems with overlapping jurisdictions. Governance systems with clear, non-overlapping boundaries can facilitate implementation because jurisdiction of decision-making is clear. For example, individual owners of freehold properties have clear legal rights to make decisions regarding the use of their land. In contrast, where multiple governance systems have overlapping jurisdictions, planning will need to interface with these (Table 2, process 9) such that rules for resource use can be negotiated and aligned with the relevant groups (Table 2, process 16). This situation will require appropriate planning inputs such as effective partnerships with the relevant groups or agencies (Table 1, input 7) and capacity within those groups or agencies to ensure effective incorporation of the assessment into their relevant programs (Table 1, input 6).

Biophysical

The biophysical subsystem consists of the natural resources, their attributes, and the specific resource units considered in planning. Relevant attributes of resource systems include the type of system (e.g. coral reefs, rainforests), the intrinsic and perceived biophysical complexity of the system (e.g. climatic, topographic, bathymetric, soil, habitat, species diversity, ecosystem processes, and ecological interactions), and the location and boundaries of the resource. Relevant attributes of resource units include their type (e.g. species, vegetation types, ecoregions), number, spatial and temporal distribution, and ecology. The biophysical subsystem could be relatively simple if the resource system is homogeneous (e.g. a forest containing only a few tree species) or if the resource unit of interest is well-defined (e.g. a single tree species within a tropical rainforest). Biophysical complexity might interact with the conservation action by constraining appropriate goals or actions for an assessment; therefore, depending on biophysical complexity, and how this subsystem is defined for the purposes of planning, the planning team might need to consider a suite of conservation actions for a site (Table 2, process 11).

THE NEXUS BETWEEN PLANNING PROCESSES, INPUTS, AND CONTEXT

Assessments focus on achieving high-level goals and associated quantitative objectives. The conservation problem to be addressed, and the context for achieving goals and objectives, is defined by characteristics of the subsystems, their combined effects on stakeholders' interactions and behaviours, and the conservation action.

Moving from assessment to implementation first requires selecting actions that address the conservation problem and then identifying appropriate processes and inputs to facilitate implementation of the actions. A problem might be relatively simple and addressed adequately by a single action when, for example, the action is a private protected area with a single owner to protect a single species from habitat clearing. Alternatively, a problem might be quite complex, requiring a suite of actions (e.g. different conservation strategies such as no-take zones, fisheries management, and habitat restoration) aligned with different stakeholders (e.g. different types of fishers), with the jurisdiction responsible for developing and implementing rules being shared across multiple groups or agencies. A complex problem could require the planning team to consider and consult on a suite of actions before selecting one (or more) to implement (Table 2, process 11), and a planning input that might require particular attention is building a planning team with a broad interdisciplinary skill base (Table 1, input 5). Complex problems might also require sequential implementation of actions in terms of both type and spatial location (Table 2, process 14), thus requiring long-term engagement (Table 1, input 1) and adequate, sustained funding (Table 1, input 2). This is particularly true when considering planning for climate change and the associated time horizons for both planning and implementation (Adams et al. 2017) and possible suite of actions which can require dynamic iterative implementation such as moveable reserves (Reside et al. 2017) and governance arrangements to facilitate this (Adams et al. 2017).

To illustrate the possible relationships between planning context, inputs, and processes, we explore five successfully implemented conservation assessments. We chose these case studies because (1) we were either involved in their assessment or implementation phases or have been in contact with planners who have vetted the details of the case studies, and (2) several of these case studies had implicit implementation strategies in place that we could leverage for describing the required components for an explicit strategy. We focus our analysis of the case studies on one process theme (Table 2): *Engaging with stakeholders, building relationships, connecting with appropriate governance processes*. We chose this theme because engagement is critical for implementation, regardless of context, but the shape that engagement takes is highly variable and dependent on context. We use the Public Participation Spectrum (IAP2 Federation 2014) to classify five levels of stakeholder engagement (inform, consult, involve, collaborate, empower), and for each, we present a case study of a conservation assessment that was successfully implemented following that process (Table 3, Fig. 3). We also characterise the contextual subsystems (stakeholders, governance, biophysical) and summarise key inputs (time and financial/human resources) to those planning processes (Table 3 and for full details see Table S3).

We found that relationships between context, inputs, and processes are complex, but not counterintuitive. *Ceteris paribus*, more participatory engagement processes require greater inputs than less participatory engagement processes. However, the inputs required depend upon both the nature of the engagement process and the complexity of the stakeholder subsystem, so an empowered engagement process can be achieved with modest resources, provided there are a small number of stakeholders with shared interests (see the Kubulau example in Table 3).

Our case studies include examples of a predetermined planning context and inputs prescribing the processes of stakeholder engagement, and others for which a particular engagement process was identified as necessary for effective implementation at the outset, requiring the planning context and inputs to be defined accordingly.

The Pullen Pullen Nature Reserve was established in 2016 to protect the endangered Night Parrot (Fig. 3a). Because the land was purchased outright, the stakeholder and governance complexity was minimal, and the managing non-profit was able to 'inform' stakeholders, rather than undertake more participatory engagement. The planning process was therefore supported by the small NGO planning team over a relatively short timeframe (~ 2 years). Implementation of the assessment through acquisition of the property did, however, demand substantial financial inputs ($1.15 million); off-reserve conservation achieved through a covenant negotiated with the landholder would likely have required fewer inputs, but a more participatory engagement process (Garnett et al. 2016).

The context for rezoning Australia's Great Barrier Reef Marine Park (GBRMP) was largely predetermined by legislation that mandated planning within the boundaries of the GBRMP (Fernandes et al. 2005, Fox et al. 2012). These boundaries dictated the complexity of the stakeholder, governance, and biophysical subsystems. Although the governance subsystem is relatively streamlined under an Act that defines the relationship between management agencies and their individual roles, the stakeholder complexity was huge: a large number of stakeholders with a diversity of interests, ranging from broad support for, or opposition to, conservation, to specific preferences for particular conservation actions in particular locations (Day 2008). Even with substantial inputs, in the form of a multi-year timeframe for planning, staff dedicated to stakeholder engagement, and millions of dollars invested, this stakeholder complexity limited stakeholder engagement to a 'consultative' process (Fig. 3b).

In California, following the failure of previous planning processes aimed at creating a network of marine protected areas (attributed to insufficient public engagement and subsequent lack of support), the MLPA mandated a more participatory process of stakeholder engagement (Fox et al. 2012) (Fig. 3c). This requirement for stakeholder 'involvement' in planning was matched by a financial commitment that enabled this level of participation. Thus, the greater participation of stakeholders in marine zoning in California ('involve' c.f. 'consult' for the GBR) was achieved with greater inputs (one extra year and 4 times the financial investment). It is also notable that the complexity of the conservation actions was lower in California (four use zones, c.f. multiple zones, special management areas, and additional non-spatial management for the GBR), which would have facilitated stakeholder-led designs.

For the New South Wales Regional Forest Agreement, planners recognised that opposing stakeholder interests would produce a highly contentious planning process, resolvable only through a 'collaborative' engagement process in which key stakeholders could see how their preferences directly influenced the spatial design of conservation areas (Pressey 1998) (Fig. 3d). This level of engagement was achievable with available resources, given that planning was limited to public forests (excluding forests on private lands), thus reducing governance complexity and limiting stakeholder complexity. Although they held strongly opposing views, the number of stakeholders was small enough for them to be able to participate directly in iterative planning.

In Kubulau, Fiji, marine management is implemented under a customary governance system, requiring an 'empowered' engagement process (Weeks and Jupiter 2013) (Fig. 3e). This was achieved with modest inputs only because stakeholder complexity was simplified, by restricting the planning region to a small geographic extent. If a highly participatory process had not been required, or if resources had been available to support engagement with a

Table 3 The nexus between planning processes, inputs, and context. Five case studies of conservation assessments that were successfully implemented, with details on their planning context, inputs, and stakeholder engagement process (for full case study details of each context component see Supplementary Materials S1)

Case study	Pullen Pullen Nature Reserve, Australia Pullen Pullen (560 km^2) was established as a sanctuary to protect what was, at the time, the only known population of endangered Night Parrots	Great Barrier Reef Marine Park (GBRMP), Australia The GBRMP (344 400 km^2) is a multiple-use marine park which supports a wide range of uses, including commercial and recreational fishing, other recreation, shipping, tourism, and traditional indigenous use	California Marine Life Protection Act (MLPA) Initiative, USA The MLPA (14 374 km^2) mandated the redesign of California's existing marine protected areas to create a state-wide network to achieve ecosystem-based managed goals	New South Wales Regional Forest Agreement, Australia The Regional Forest Agreement (24,000 km^2) was a 20-year plan for the sustainable management and conservation of public native forests in eastern New South Wales	Kubulau traditional fishing grounds, Fiji The Kubulau District Management Plan (260 km^2) seeks to provide for the sustainable management of coastal and marine ecosystems in Kubulau's traditional fishing grounds
Context	Simple	Complex	Complex	Moderate	Simple
Stakeholders	Simple	Complex	Complex	Moderate	Simple
Governance	Simple	Moderate	Simple	Simple	Simple
Biophysical	Simple	Complex	Complex	Complex	Moderate
Conservation action	Simple	Complex	Moderate	Simple	Simple
Inputs	Moderate	High	High	High	Low
Timeframe	2 years	6 years	7 years	5 years	18 months
Resources	High	High	High	High	Low
Engagement process type[a]	Inform *we will keep you informed*	Consult *we will keep you informed, listen to your concerns, and provide feedback on how public input influenced decisions*	Involve *we will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed*	Collaborate *we will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible*	Empower *we will implement what you decide*
Engagement process description	The location of the reserve was initially kept secret, to protect the highly endangered population from poachers. Following acquisition of the property, the public were informed of the location of the reserve, to which all access is restricted	Stakeholders were informed about the planning process via community meetings and widespread media outreach. A summary of > 10 000 written public submissions received, and how key issues raised were addressed, was included with the zoning plan	Protected area designs were proposed by regional stakeholder groups, who received guidance from a science advisory team. A government-appointed Blue-Ribbon Task Force recommended preferred designs for legislation by the California Fish and Game Commission	Conservation planning software C-Plan was used interactively by multi-stakeholder planning teams to identify conservation designs that were acceptable to all parties	Management options were developed through collaboration between scientists and community representatives. These were presented to customary leaders, who decided which to implement
The nexus between context, inputs, and engagement.	By purchasing the land outright, Bush Heritage Australia were able to 'inform' stakeholders, rather than undertake more participatory engagement. However, greater financial inputs were required, *c.f.* off-park conservation via an agreement or covenant with the landholder	A greater level of engagement (i.e. 'involve' or 'collaborate') was prohibited by the number of stakeholders involved and the complexity of conservation actions	Involving stakeholders (*c.f.* consulting) was facilitated through the formation of regional stakeholder groups, who could interact iteratively with scientific advisory groups to develop plans. Note that the planning region is far smaller than the GBRMP, but the planning process was better resourced	Divergent stakeholder interests made this planning process highly contentious, requiring a participatory process that allowed key stakeholders to see how their preferences directly influenced the spatial design of conservation areas and implications for conservation and employment. This process required extensive resources	Customary resource use rights demanded an empowered engagement process. This, combined with limited inputs and a short timeframe, constrained the spatial extent of the planning region
Key references	Garnett et al. (2016)	Day (2017)	(Gleason et al. 2010; Fox et al. 2013)	(Pressey 1998; Pressey et al. 2009)	Weeks and Jupiter (2013)

[a] Types of engagement process adapted from the International Association for Public Participation's Public Participation Spectrum (IAP2 Federation 2014)

Fig. 3 Stakeholder engagement processes vary depending upon the planning context and inputs available for planning. **a** Pullen Pullen Nature Reserve was established to protect the endangered night parrot (*Pezoporus occidentalis*); following acquisition of the property, the public were informed of the location of the reserve, to which all access is restricted (Photo: Nicholas Leseberg). **b** As part of the planning process for the Great Barrier Reef rezoning, public meetings were held in many small local communities; a summary of how public concerns were addressed was published along with the final zoning plan (Photo: GBRMPA). **c** Stakeholders are involved in drafting marine protected area proposals at a public workshop in California (Photo: Marine Life Protection Act Initiative). **d** During the New South Wales Regional Forest Agreement process, conservation planning software was used interactively by multi-stakeholder planning teams to identify conservation designs that were acceptable to all parties (Photo: Bob Pressey). **e** In Kubulau, Fiji, community members and traditional leaders made the final decision on the design of spatial management to be implemented (Photo: Rebecca Weeks)

greater number of stakeholders, a larger planning region might have been better able to account for ecological processes.

DISCUSSION

Our review of the components of implementation strategies demonstrates the importance of matching appropriate inputs and processes with the planning context. Therefore, while there might be a thirst for ‘one size fits all’ advice for designing implementation strategies, we suggest that context-specific implementation strategies will need to be developed alongside conservation assessments. With an understanding of the planning context, appropriate implementation processes and inputs can be identified and brought together (Knight et al. 2006) by attending to lessons from prior successful (and failed) implementation strategies undertaken within similar contexts.

“Similar” contexts should be identified on the basis of elements of stakeholder, governance, and biophysical subsystems and overall problem complexity. Importantly, readily apparent differences in geography, ecosystems, or conservation actions can mask similarities in context that have greater relevance to implementation (and vice versa). For example, implementing a network of marine protected areas across customary tenure areas might have more in common with negotiating conservation easements with private agricultural landowners than with the implementation of a marine protected area network in a region with more centralised governance arrangements (Pressey et al. 2013). Thus, planners should seek insights and tools from a variety of contexts with which they have similarities. Trialling different implementation strategies and documenting the impacts will speed up learning within the conservation planning community.

Unfortunately, only the assessment phase of planning processes is typically documented, so less is known about the implementation and monitoring stages, limiting our ability to identify best practices. We urge planners to document their case studies, especially if they represent failures from which we can learn (e.g. Kareksela et al. 2018 document the extent to which spatial prioritizations were implemented and lessons learned). Currently, there is a move towards synthesising existing conservation plans to identify lessons learned and guide future research (McIntosh et al. 2016, Álvarez-Romero et al. 2018). Building on these systematic approaches to data collection and synthesis of plans would expand systematic recording of experiences with planning inputs and processes and characterisation of planning contexts. Gathering numerous examples of documented planning processes and recording the extent to which they have been implemented (considering both conformance- and performance-based metrics) will contribute to insights about tailoring implementation strategies to different contexts, avoiding the need for planners to develop new strategies for each assessment (Pressey et al. 2013; Mills et al. 2015; Groves and Game 2016). Groves and Game (2016) identified and synthesised lessons learned across existing reviews (e.g. Mazmanian and Sabatier 1989; Joseph et al. 2008; Beever et al. 2014; Meretsky and Fischman 2014) into a "top 10″ list; this list emphasises the importance of relevant engagement processes throughout assessment and implementation and the need to integrate implementation strategies into assessment from the outset of the planning process.

To embed implementation into the planning process from the outset, continuity between the assessment and implementation teams is critical and non-trivial. Transitioning assessments to implementation of local-scale actions can require time and resourcing as well as iterative updates of assessments as further local knowledge is revealed throughout work on-ground (Mills et al. 2010; Pressey et al. 2013). This transition is often long, typically 5-10 years in our case studies. Yet, conservation planning is often conducted by scientists and practitioners who are not located in the planning region and not necessarily well connected to the team tasked with implementation (Wilson et al. 2016; Álvarez-Romero et al. 2018). This lack of exchange and continuity can hinder both the design and implementation of assessments. First, the planning context can be misinterpreted, leading to failure to identify appropriate inputs and processes for implementation. Second, particularly in the case of performance-based evaluation, the interpretation of the assessment and subsequent adaptation of priorities for on-ground actions can be hindered. Continuity between assessment and implementation might require capacity-building to create local commitment to the process of adaptive planning and management, or bridging institutions that support enduring relationships between all the people involved (Weeks et al. 2014). Continuity may also be achieved by looking for opportunities to integrate proposed conservation actions with other activities and processes in the region (Headwaters Economics 2012).

CONCLUSION

Our review of implementation inputs, processes, and context identified key barriers that can hinder attempts to bridge the assessment-implementation gap. First, the need to develop customised implementation strategies for each conservation plan will likely be a daunting task for many planners. Just as transferable tools and approaches have been developed to support the planning process (e.g. CMP 2013), parallel approaches to support development of implementation strategies are needed. A growing body of documented implementation successes and failures can provide guidance to planners in transferring relevant lessons learned from similar contexts. Second, continuity between assessment and implementation is critical but requires investment in multiple aspects of assessment and implementation, including financial resourcing, human capacity, and institutional support (Knight et al. 2011; Fox et al. 2012; Beever et al. 2014; Meretsky and Fischman 2014). Organisations and donors must come to realise that funding a planning process only to the end of the assessment phase will often consign the assessment to the shelf, with little chance of implementation (Pressey et al. 2013).

Acknowledgements This paper evolved from the symposium and associated workshop "From plans to outcomes: towards an implementation strategy for conservation planning" at the International Congress for Conservation Biology 2013 held in Baltimore, Maryland USA. We thank all contributors to that symposium for sharing their ideas and case studies. VMA, RW, GG, RLP, and JGAR acknowledge support of the Australian Research Council.

REFERENCES

Adams, V.M., J.G. Álvarez-Romero, S.J. Capon, G.M. Crowley, A.P. Dale, M.J. Kennard, M.M. Douglas, and R.L. Pressey. 2017. Making time for space: The critical role of spatial planning in adapting natural resource management to climate change. *Environmental Science & Policy* 74: 57–67.

Álvarez-Romero, J.G., M. Mills, V.M. Adams, G.G. Gurney, R.L. Pressey, R. Weeks, N.C. Ban, J. Cheok, et al. 2018. Research advances and gaps in marine planning: Towards a global database in systematic conservation planning. Biological Conservation (in press).

Arias, A., J.E. Cinner, R.E. Jones, and R.L. Pressey. 2015. Levels and drivers of fishers' compliance with marine protected areas. *Ecology and Society* 20: 1–4.

Armitage, D. 2008. Governance and the commons in a multi-level world. *International Journal of the Commons* 2: 7–32.

Baer, W.C. 1997. General plan evaluation criteria: An approach to making better plans. *Journal of the American Planning Association* 63: 329–344.

Ban, N.C., M. Mills, J. Tam, C.C. Hicks, S. Klain, N. Stoeckl, M.C. Bottrill, J. Levine, et al. 2013. A social–ecological approach to conservation planning: Embedding social considerations. *Frontiers in Ecology and the Environment* 11: 194–202.

Beever, E.A., B.J. Mattsson, M.J. Germino, M.P.V.D. Burg, J.B. Bradford, and M.W. Brunson. 2014. Successes and challenges from formation to implementation of eleven broad-extent conservation programs. *Conservation Biology* 28: 302–314.

Berke, P., M. Backhurst, M. Day, N. Ericksen, L. Laurian, J. Crawford, and J. Dixon. 2006. what makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand. *Environment and Planning B* 33: 581–600.

Binder, C.R., J. Hinkel, P.W.G. Bots, and C. Pahl-Wostl. 2013. Comparison of frameworks for analyzing social-ecological systems. *Ecology and Society* 18: 26.

Bottrill, M.C., M. Mills, R.L. Pressey, E.T. Game, and C. Groves. 2012. Evaluating perceived benefits of ecoregional assessments. *Conservation Biology* 26: 851–861.

Bottrill, M.C., and R.L. Pressey. 2012. The effectiveness and evaluation of conservation planning. *Conservation Letters* 5: 407–420.

CMP. 2013. *Open standards for the practice of conservation. Version 3.0*. http://cmp-openstandards.org/wp-content/uploads/2014/03/CMP-OS-V3-0-Final.pdf. Accessed June 2014.

Day, J. 2008. The need and practice of monitoring, evaluating and adapting marine planning and management—lessons from the Great Barrier Reef. *Marine Policy* 32: 823–831.

Day, J.C. 2017. Effective public participation is fundamental for marine conservation—lessons from a large-scale MPA. *Coastal Management* 45: 470–486.

Economics, Headwaters. 2012. *Implementing climate change adaptation: Lessons learned from ten examples*. Bozeman, MT: Headwaters Economics.

Ekoko, F. 2000. Balancing politics, economics and conservation: The case of the Cameroon Forestry Law reform. *Development and Change* 31: 131–154.

Fernandes, L., J. Day, B. Kerrigan, D. Breen, G. De'ath, B. Mapstone, R. Coles, T. Done, et al. 2009. A process to design a network of marine no-take areas: Lessons from the Great Barrier Reef. *Ocean and Coastal Management* 52: 439–447.

Fernandes, L., J. Day, A. Lewis, S. Slegers, B. Kerrigan, D. Breen, D. Cameron, B. Jago, et al. 2005. Establishing representative no-take areas in the Great Barrier Reef: Large-scale implementation of theory on marine protected areas. *Conservation Biology* 19: 1733–1744.

Ferse, S.C.A., M. Máñez Costa, K.S. Máñez, D.S. Adhuri, and M. Glaser. 2010. Allies, not aliens: Increasing the role of local communities in marine protected area implementation. *Environmental Conservation* 37: 23–34.

Fisher, J.R.B., and B. Dills. 2012. Do private conservation activities match science-based conservation priorities? *PLoS ONE* 7: e46429.

Fox, E., M. Miller-Henson, J. Ugoretz, M. Weber, M. Gleason, J. Kirlin, M. Caldwell, and S. Mastrup. 2012. Enabling conditions to support marine protected area network planning: California's Marine Life Protection Act Initiative as a case study. *Ocean & Coastal Management* 74: 14–23.

Fox, E., E. Poncelet, D. Connor, J. Vasques, J. Ugoretz, S. McCreary, D. Monié, M. Harty, et al. 2013. Adapting stakeholder processes to region-specific challenges in marine protected area network planning. *Ocean & Coastal Management* 74: 24–33.

Freeman, R.E. 2010. *Strategic management: A stakeholder approach*. Cambridge: Cambridge University Press.

Garnett, S.T., M. Kleinschmidt, M.V. Jackson, K.K. Zander, and S.A. Murphy. 2016. Social landscape of the night parrot in western Queensland, Australia. *Pacific Conservation Biology* 22: 360–366.

Gleason, M., S. McCreary, M. Miller-Henson, J. Ugoretz, E. Fox, M. Merrifield, W. McClintock, P. Serpa, et al. 2010. Science-based and stakeholder-driven marine protected area network planning: a successful case study from north central California. *Ocean & Coastal Management* 53: 52–68.

Groves, C.R., and E.T. Game. 2016. From planning to action and communication: The art of implementation. Conservation planning: Informed decisions for a healthier planet. New York: W. H. Freeman.

Guerrero, A.M., and K.A. Wilson. 2016. Using a social-ecological framework to inform the implementation of conservation plans. *Conservation Biology* 31: 290–301.

Henson, A., D. Williams, J. Dupain, H. Gichohi, and P. Muruthi. 2009. The Heartland Conservation Process: enhancing biodiversity conservation and livelihoods through landscape-scale conservation planning in Africa. *Oryx* 43: 508–519.

IAP2 Federation. 2014. *Public participation spectrum.* International Association for Public Participation-IAP2 Federation, Wollongong, NSW.

Joseph, C., T.I. Gunton, and J.C. Day. 2008. Implementation of resource management plans: Identifying keys to success. *Journal of Environmental Management* 88: 594–606.

Kareksela, S., A. Moilanen, O. Ristaniemi, R. Välivaara, and J.S. Kotiaho. 2018. Exposing ecological and economic costs of the research-implementation gap and compromises in decision making. *Conservation Biology* 32: 9–17.

Knight, A.T., R.M. Cowling, A.F. Boshoff, S.L. Wilson, and S.M. Pierce. 2011. Walking in STEP: Lessons for linking spatial prioritisations to implementation strategies. *Biological Conservation* 144: 202–211.

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

Knight, A.T., R.M. Cowling, M. Rouget, A. Balmford, A.T. Lombard, and B.M. Campbell. 2008. Knowing but not doing: Selecting priority conservation areas and the research-implementation gap. *Conservation Biology* 22: 610–617.

Laurian, L., J. Crawford, M. Day, P. Kouwenhoven, G. Mason, N. Ericksen, and L. Beattie. 2010. Evaluating the outcomes of plans: Theory, practice, and methodology. *Environment and Planning B* 37: 740–757.

Laurian, L., M. Day, M. Backhurst, P. Berke, N. Ericksen, J. Crawford, J. Dixon, and S. Chapman. 2004a. What drives plan implementation? Plans, planning agencies and developers. *Journal of Environmental Planning and Management* 47: 555–577.

Laurian, L., M. Day, P. Berke, N. Ericksen, M. Backhurst, J. Crawford, and J. Dixon. 2004b. Evaluating plan implementation: A conformance-based methodology. *Journal of the American Planning Association* 70: 471–480.

Margules, C.R., and R.L. Pressey. 2000. Systematic conservation planning. *Nature* 405: 243–253.

Mazmanian, D.A., and P.A. Sabatier. 1989. *Implementation and public policy*. Lanham, MD: University Press of America.

McIntosh, E.J., M.C. McKinnon, R.L. Pressey, and R. Grenyer. 2016. What is the extent and distribution of evidence on effectiveness of systematic conservation planning around the globe? A systematic map protocol. *Environmental Evidence* 5: 1–13.

Meretsky, V.J., and R.L. Fischman. 2014. Learning from conservation planning for the U.S. National Wildlife Refuges. *Conservation Biology* 28: 1415–1427.

Mills, M., R.L. Pressey, R. Weeks, S. Foale, and N.C. Ban. 2010. A mismatch of scales: Challenges in planning for implementation of marine protected areas in the Coral Triangle. *Conservation Letters* 3: 291–303.

Mills, M., R. Weeks, R.L. Pressey, M.G. Gleason, R.-L. Eisma-Osorio, A.T. Lombard, J.M. Harris, A.B. Killmer, et al. 2015. Real-world progress in overcoming the challenges of adaptive spatial planning in marine protected areas. *Biological Conservation* 181: 54–63.

Moilanen, A., H. Possingham, and K.A. Wilson. 2009. Spatial conservation prioritization: Past, present, and future. In *Spatial conservation prioritization quantitative methods and computational tools*, ed. A. Moilanen, H.K. Wilson, A. Moilanen, K. Wilson, and H. Possingham, 260–268. Oxford: Oxford University Press.

Najam, A. 1995. Learning from the literature on policy implementation: a synthesis perspective. IIASA Working Paper

Opdam, P., J.I. Nassauer, Z. Wang, C. Albert, G. Bentrup, J.-C. Castella, C. McAlpine, J. Liu, et al. 2013. Science for action at the local landscape scale. *Landscape Ecology* 28: 1439–1445.

Ostrom, E. 2007. A diagnostic approach for going beyond panaceas. *Proceedings of the National Academy of Sciences* 104: 15181–15187.

Ostrom, E. 2009. A general framework for analyzing sustainability of social-ecological systems. *Science* 325: 419–422.

Pfeffer, J., and R.I. Sutton. 1999. Knowing "What" to do is not enough: Turning knowledge into action. *California Management Review* 42: 83–108.

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

Pressey, R. 1998. Algorithms, politics and timber: An example of the role of science in a public, political negotiation process over new conservation areas in production forests. In *Ecology for everyone: Communicating ecology to scientists, the public and the politicians*, ed. R. Wills and R. Hobbs, 73–87. Sydney: Surrey Beatty and Sons.

Pressey, R.L. 2002. The first reserve selection algorithm: a retrospective on Jamie Kirkpatrick's 1983 paper. *Progress in Physical Geography* 26: 434–441.

Pressey, R.L., and M.C. Bottrill. 2009. Approaches to landscape- and seascape-scale conservation planning: Convergence, contrasts and challenges. *Oryx* 43: 451–460.

Pressey, R.L., M. Mills, R. Weeks, and J.C. Day. 2013. The plan of the day: Managing the dynamic transition from regional conservation designs to local conservation actions. *Biological Conservation* 166: 155–169.

Pressey, R.L., M.E. Watts, T.W. Barrett, and M.J. Ridges. 2009. The C-Plan conservation planning system: Origins, applications, and possible futures. In *Spatial conservation prioritization: Quantitative methods and computational tools*, ed. A. Moilanen, K.A. Wilson, and H.P. Possingham, 211–234. Oxford: Oxford University Press.

Reed, M.S. 2008. Stakeholder participation for environmental management: A literature review. *Biological Conservation* 141: 2417–2431.

Rein, M., and F. Rabinovitz. 1980. Implementation: A theoretical perspective. In *American politics and public policy*, ed. W. Burnham and M. Wienburg, 307–335. Cambridge, MA: MIT Press.

Reside, A.E., N. Butt, and V.M. Adams. 2017. Adapting systematic conservation planning for climate change. *Biodiversity and Conservation*. https://doi.org/10.1007/s10531-10017-11442-10535.

Saarman, E.T., and M.H. Carr. 2013. The California Marine Life Protection Act: A balance of top down and bottom up governance in MPA planning. *Marine Policy* 41: 41–49.

Sabatier, P., and D. Mazmanian. 2005. The implementation of public policy: A framework of analysis. *Policy Studies Journal* 8: 538–560.

Sinclair, S.P., E.J. Milner-Gulland, R.J. Smith, E.J. McIntosh, H.P. Possingham, A. Vercammen, and A.T. Knight. 2018. The use, and usefulness, of spatial conservation prioritizations. *Conservation Letters*. https://doi.org/10.1111/conl.12459.

Talen, E. 1996a. After the plans: Methods to evaluate the implementation success of plans. *Journal of Planning Education and Research* 16: 79–91.

Talen, E. 1996b. Do plans get implemented? A review of evaluation in planning. *Journal of Planning Literature* 10: 248–259.

Talen, E. 1997. Success, failure, and conformance: An alternative approach to planning evaluation. *Environment and Planning B* 24: 573–587.

Vane-Wright, R.I., C.J. Humphries, and P.H. Williams. 1991. What to protect? Systematics and the agony of choice. *Biological Conservation* 55: 235–254.

Weeks, R., and S.D. Jupiter. 2013. Adaptive comanagement of a marine protected area network in Fiji. *Conservation Biology* 27: 1234–1244.

Weeks, R., R.L. Pressey, J.R. Wilson, M. Knight, V. Horigue, R.A. Abesamis, R. Acosta, and J. Jompa. 2014. Ten things to get right for marine conservation planning in the Coral Triangle. *F1000Research* 3: 91.

Wilson, K.A., N.A. Auerbach, K. Sam, A.G. Magini, A.S.L. Moss, S.D. Langhans, S. Budiharta, D. Terzano, et al. 2016. Conservation research is not happening where it is most needed. *PLoS Biology* 14: e1002413.

Wong, C., and C. Watkins. 2009. Conceptualising spatial planning outcomes: Towards an integrative measurement framework. *Town Planning Review* 80: 481–516.

AUTHOR BIOGRAPHIES

Vanessa M. Adams (✉) is a Senior Lecturer at University of Tasmania. Her research focuses on the human dimensions of conservation and systematic environmental decision making.
Address: Geography and Spatial Sciences, School of Technology, Environments and Design, University of Tasmania, Hobart, TAS 7001, Australia.
Address: Department of Biological Sciences, Macquarie University, North Ryde, NSW 2109, Australia.
e-mail: vm.adams@utas.edu.au

Morena Mills is a Senior Lecturer at Imperial College London. Her research focuses on the human dimensions of conservation, such as what drives the adoption of different resource management interventions.
Address: Department of Life Sciences, Imperial College London, Silwood Park, Berkshire, England, UK.

Rebecca Weeks is a Research Fellow with the ARC Centre of Excellence for Coral Reef Studies. Her research focuses on solutions to resource management problems involving the design of conservation areas and the application of management actions both within and outside protected areas.
Address: Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia.

Daniel B. Segan is a Principal Natural Resource Analyst at the Tahoe Regional Planning Agency. He works with scientists, agency partners, and stakeholders to restore the environmental health of Lake Tahoe and the surrounding watershed.
Address: Global Conservation Program, Wildlife Conservation Society, Bronx, NY 10460, USA.
Address: Tahoe Regional Planning Agency, 128 Market Street, Stateline, NV, USA.

Robert L. Pressey is a Conservation Planner at James Cook University, with interests in spatial decision-making for terrestrial, freshwater, and marine environments, including pathways to implementation.
Address: Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia.

Georgina G. Gurney is an Environmental Social Science Research Fellow at the ARC Centre of Excellence for Coral Reef Studies, James Cook University. Her research focuses broadly on understanding the conditions that facilitate collaborative management of common-pool natural resources, and the multiple socioeconomic and environmental outcomes of such initiatives.
Address: Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia.

Craig Groves is the Executive Director of the Science for Nature and People Partnership, a collaboration of The Nature Conservancy, the Wildlife Conservation Society, and the National Center for Ecological Analysis and Synthesis, University of California Santa Barbara. He is also a Conservation Planner, Conservation Biologist, and Wildlife Ecologist.
Address: Science for Nature and People Partnership, Bozeman, MT, USA.

Frank W. Davis is a Professor at the Bren School of Environmental Science and Management, University of California, Santa Barbara. His research is in landscape ecology and conservation planning, with a focus on forest and rangeland ecosystems and the ecological effects of regional climate change.
Address: Bren School of Environmental Science & Management, University of California Santa Barbara, Santa Barbara, CA 93117, USA.

Jorge G. Álvarez-Romero is a Research Fellow at James Cook University. His research explores theoretical and methodological aspects of decision-making problems associated with an integrated land-sea planning approach.
Address: Australian Research Council Centre of Excellence for Coral Reef Studies, James Cook University, Townsville, QLD 4811, Australia.