Implementation strategies for systematic conservation planning

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Word count: abstract, 149, main body, 5011

References: 55

Tables: 3

Figures: 3

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.

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.

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 mean 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 & 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, Figure 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 (Figure 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 provide 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).

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 et al. 2012, Bottrill and Pressey 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 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 legitimizing management decisions (Bottrill et al. 2012, Bottrill and Pressey 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, Laurian et al. 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. 2004). 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 conservation thinking into the activities of other sectors (Bottrill et al. 2012, Bottrill and Pressey 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 recognized (Bottrill et al. 2012, Bottrill and Pressey 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 et al. 2012, Bottrill and Pressey 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 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

200 relationships, and connecting with appropriate governance processes; supporting the technical
201 aspects of assessment; and supporting implementation and on-ground action.
202
203 Because an implementation strategy will be integrated into the conservation assessment, or sit
204 alongside the assessment, it is useful to understand how the strategy inputs and processes align
205 with the conservation planning steps. Therefore, we have mapped the inputs and processes onto
206 the stages of systematic conservation planning to indicate the planning stages they are most
207 relevant to and how they relate to assessment and implementation (Figure 1).
208
209 **Diagnosing the social-ecological context of planning**
210 Numerous studies have demonstrated that the outcomes of conservation actions are strongly
211 influenced by the socioeconomic, political, and biophysical contexts within which those
212 initiatives are undertaken (Reed 2008, Knight et al. 2011, Ban et al. 2013, Opdam et al. 2013,
213 Guerrero and Wilson 2016). The context of planning can thus be defined by the characteristics of
214 the relevant social-ecological system (SES; Figure 2) in which planning is introduced (Ostrom
215 2009, Ban et al. 2013).
216
217 Although the complexity of the relevant SES context is often considered, it is rarely documented
218 in the structure of planning processes (Knight et al. 2006). Depending on the context in which
219 planning is taking place, individual process elements can encapsulate a range of possible
220 approaches. For example, *ensuring a legitimate hierarchy of decision-making* (process element
221 3, Table 2), might require a bottom-up, community-driven approach in which decisions are made
222 through consensus in a group of stakeholders, or a top-down approach with a government

223 creating and enforcing laws, or a mixture of the two. The best approach to input elements will
224 also be context-dependent. *Ensuring capability for adequate enforcement*, for example, might
225 require boats and planes for surveillance in a large, multiple-use marine park (Day 2008) or, in
226 another setting, arrangements for community governance of shared resources to protect
227 livelihoods (Arias et al. 2015). Consequently, one way of understanding the influence of context
228 on planning, and more specifically on the design of an implementation strategy, is to analyse
229 characteristics of the SES context.
230
231 We employ Ostrom's (Ostrom 2007, 2009) SES framework to diagnose the SES context in
232 which planning is taking place and to subsequently identify associations between context and
233 elements of processes and inputs (Table 1, 2) that could contribute to an effective
234 implementation strategy. We choose Ostrom's SES framework because it is one of the most
235 widely used approaches to understanding SESs (Binder et al. 2013) and it has been used in
236 previous work that relates context to the stages of the planning process (Ban et al. 2013) and
237 implementation (Guerrero and Wilson 2016).
238
239 Ostrom's SES framework depicts components of the SES that are thought to influence outcomes
240 in situations involving common-pool natural resources such as biodiversity (Ostrom 2007). It
241 describes four core subsystems: the resource system (e.g. forest); resource units (e.g. trees);
242 actors (e.g. resource users); and governance (e.g. decision-making process, and formal and
243 informal rules of resource use). The subsystems are composed of second-tier variables that
244 describe characteristics of each subsystem that are suggested to be relevant to common-pool
245 resource management. These characteristics shape 'interactions' among actors (e.g. harvesting

246 level) and thus, social-ecological 'outcomes' (e.g. equity of costs and benefits of conservation
247 actions, improved species persistence).
248
249 We adapted Ostrom's SES framework by merging the resource system and resource unit
250 subsystems into the biophysical subsystem in Figure 2. Planning at landscape or seascape scales
251 means that these subsystems can commonly be understood as a single subsystem. The actor
252 subsystem is referred to here as 'stakeholders' because planners who will use this framework are
253 more familiar with this term.
254
255 We explore below how the SES context in which planning is taking place – consisting in Figure
256 2 of the stakeholders, governance, and biophysical subsystems – can influence required inputs
257 for assessment and implementation, which in turn limit the processes which can be supported or
258 undertaken.
259
260 *Stakeholders*
261 Stakeholders are the actors who can affect, or be affected by, the outcomes of assessment and
262 implementation (Freeman 2010). Relevant stakeholders can include resource users, government
263 and non-government organisations, political authorities, and local residents (Pierce et al. 2005).
264 Key characteristics of stakeholders that can influence the requirements of assessment and
265 implementation of conservation actions are: dependence on natural resources, number,
266 socioeconomic attributes, values, and history of use. Importantly, the stakeholder subsystem
267 considers both the total number of stakeholders and their diversity (Ostrom 2009). For example,
268 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 actions that influence 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, Figure 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

361 the nature of the engagement process and the complexity of the stakeholder subsystem, so an
362 empowered engagement process can be achieved with modest resources, provided there are a
363 small number of stakeholders with shared interests (see the Kubulau example in Table 3).
364
365 Our case studies include examples of a predetermined planning context and inputs prescribing
366 the processes of stakeholder engagement, and others for which a particular engagement process
367 was identified as necessary for effective implementation at the outset, requiring the planning
368 context and inputs to be defined accordingly.
369
370 The Pullen Pullen Nature Reserve was established in 2016 to protect the endangered Night
371 Parrot (Figure 3A). Because the land was purchased outright, the stakeholder and governance
372 complexity was minimal, and the managing non-profit was able to 'inform' stakeholders, rather
373 than undertake more participatory engagement. The planning process was therefore supported by
374 the small NGO planning team over a relatively short time-frame (~2 years). Implementation of
375 the assessment through acquisition of the property did, however, demand substantial financial
376 inputs ($1.15 million); off-reserve conservation achieved through a covenant negotiated with the
377 landholder would likely have required fewer inputs, but a more participatory engagement process
378 (Garnett et al. 2016).
379
380 The context for rezoning Australia's Great Barrier Reef Marine Park (GBRMP) was largely
381 predetermined by legislation that mandated planning within the boundaries of the GBRMP
382 (Fernandes et al. 2005, Fox et al. 2012). These boundaries dictated the complexity of the
383 stakeholder, governance, and biophysical subsystems. Though the governance subsystem is

384 relatively streamlined under an Act that defines the relationship between management agencies
385 and their individual roles, the stakeholder complexity was huge: a large number of stakeholders
386 with a diversity of interests, ranging from broad support for, or opposition to, conservation, to
387 specific preferences for particular conservation actions in particular locations (Day 2003). Even
388 with substantial inputs, in the form of a multi-year timeframe for planning, staff dedicated to
389 stakeholder engagement, and millions of dollars invested, this stakeholder complexity limited
390 stakeholder engagement to a 'consultative' process (Figure 3B).
391
392 In California, following the failure of previous planning processes aimed at creating a network of
393 marine protected areas (attributed to insufficient public engagement and subsequent lack of
394 support) the MLPA mandated a more participatory process of stakeholder engagement (Fox et al.
395 2012) (Figure 3C). This requirement for stakeholder 'involvement' in planning was matched by a
396 financial commitment that enabled this level of participation. Thus, the greater participation of
397 stakeholders in marine zoning in California ('involve' c.f. 'consult' for the GBR) was achieved
398 with greater inputs (one extra year and 4 times the financial investment). It is also notable that
399 the complexity of the conservation actions was lower in California (four use zones, c.f. multiple
400 zones, special management areas, and additional non-spatial management for the GBR), which
401 would have facilitated stakeholder-led designs.
402
403 For the New South Wales Regional Forest Agreement, planners recognised that opposing
404 stakeholder interests would produce a highly contentious planning process, resolvable only
405 through a 'collaborative' engagement process in which key stakeholders could see how their
406 preferences directly influenced the spatial design of conservation areas (Pressey 1998) (Figure

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) (Figure 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 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

453 insights about tailoring implementation strategies to different contexts, avoiding the need for
454 planners to develop new strategies for each assessment (Pressey et al. 2013, Mills et al. 2015,
455 Groves and Game 2016). Groves and Game (2016) identified and synthesized lessons learned
456 across existing reviews (e.g., Mazmanian and Sabatier 1989, Joseph et al. 2008, Beever et al.
457 2014, Meretsky and Fischman 2014) into a "top 10" list; this list emphasizes the importance of
458 relevant engagement processes throughout assessment and implementation and the need to
459 integrate implementation strategies into assessment from the outset of the planning process.
460
461 To embed implementation into the planning process from the outset, continuity between the
462 assessment and implementation teams is critical and non-trivial. Transitioning assessments to
463 implementation of local-scale actions can require time and resourcing as well as iterative updates
464 of assessments as further local knowledge is revealed throughout work on-ground (Mills et al.
465 2010, Pressey et al. 2013). This transition is often long, typically 5-10 years in our case studies.
466 Yet conservation planning is often conducted by scientists and practitioners who are not located
467 in the planning region and not necessarily well connected to the team tasked with
468 implementation (Wilson et al. 2016, Álvarez-Romero et al. 2018). This lack of exchange and
469 continuity can hinder both the design and implementation of assessments. First, the planning
470 context can be misinterpreted, leading to failure to identify appropriate inputs and processes for
471 implementation. Second, particularly in the case of performance-based evaluation, the
472 interpretation of the assessment and subsequent adaptation of priorities for on-ground actions can
473 be hindered. Continuity between assessment and implementation might require capacity-building
474 to create local commitment to the process of adaptive planning and management, or bridging
475 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 customized 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).

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685

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

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

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).

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	Stakeholders were informed about the planning process via	Protected area designs were proposed by regional stakeholder	Conservation planning software C-Plan was used interactively by multi-	Management options were developed through collaboration between

	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.	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.	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.	stakeholder planning teams to identify conservation designs that were acceptable to all parties.	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)

Figure Legends

Figure 1. Definitions of assessment and implementation in relation to the planning stages of Pressey & 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 colored 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.

Figure 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.

Figure 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).

Figure 1

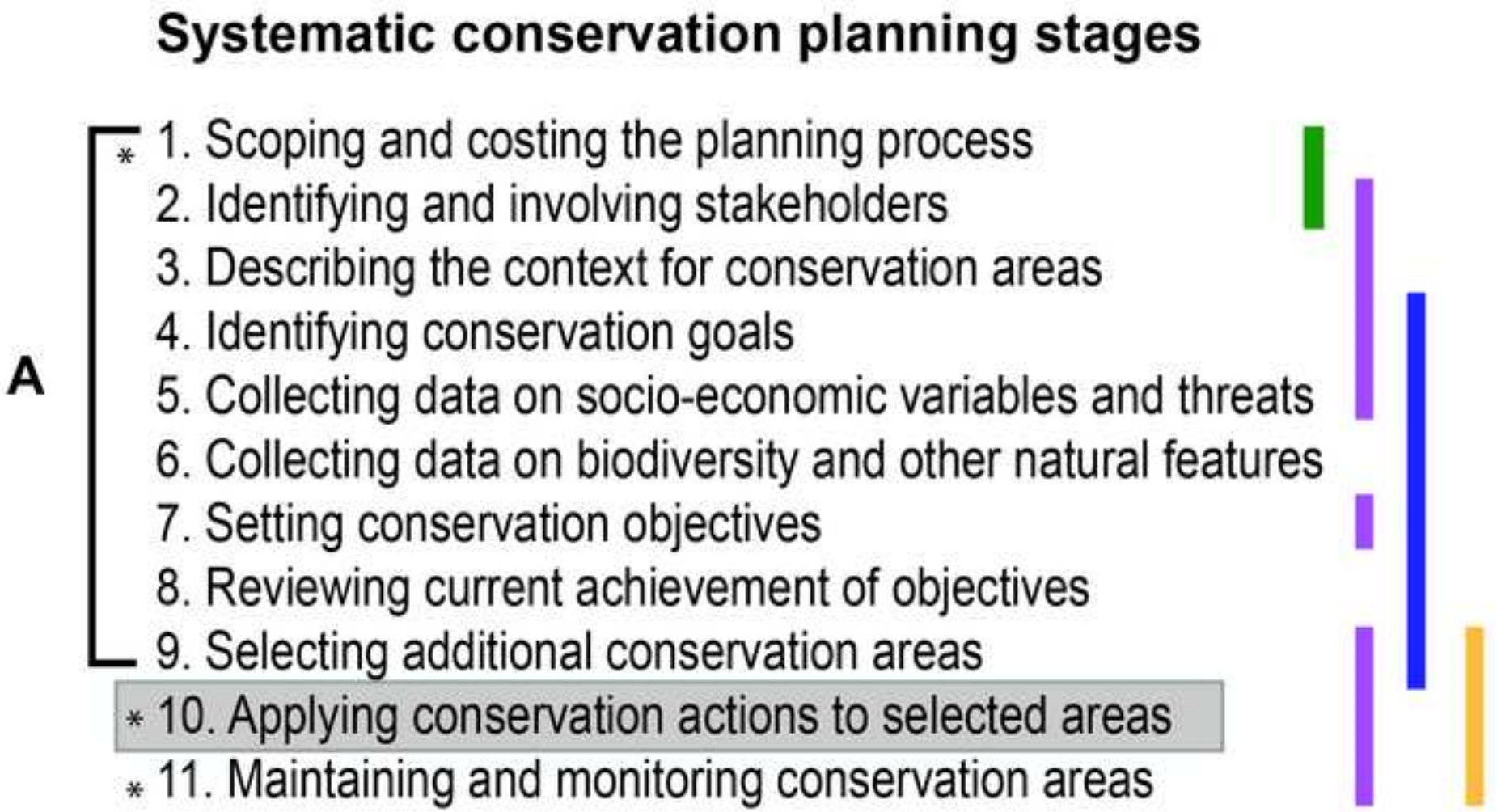

Systematic conservation planning stages
A
* 1. Scoping and costing the planning process
2. Identifying and involving stakeholders
3. Describing the context for conservation areas
4. Identifying conservation goals
5. Collecting data on socio-economic variables and threats
6. Collecting data on biodiversity and other natural features
7. Setting conservation objectives
8. Reviewing current achievement of objectives
9. Selecting additional conservation areas
* 10. Applying conservation actions to selected areas
* 11. Maintaining and monitoring conservation areas

Figure 2

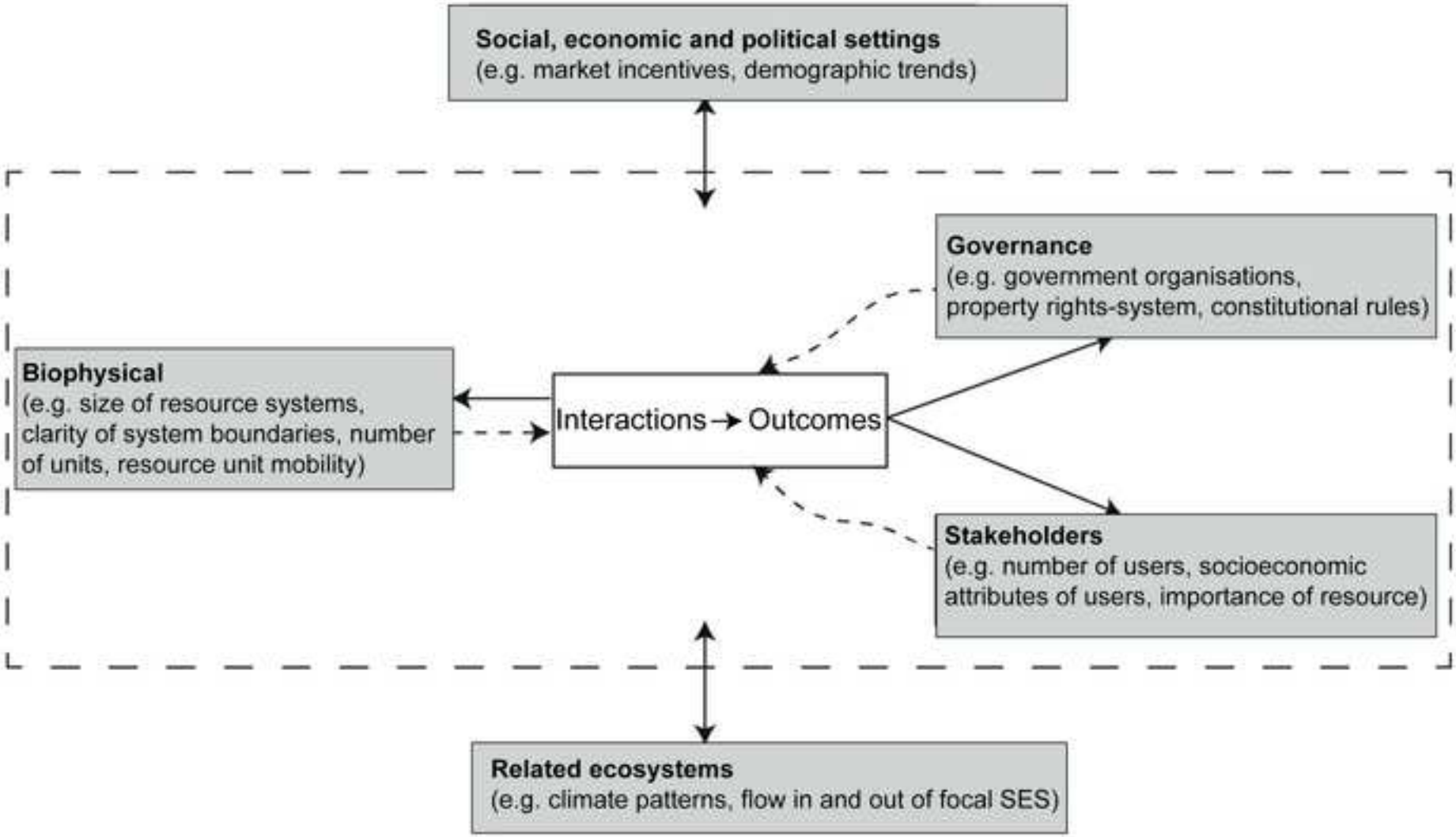

Social, economic and political settings
(e.g. market incentives, demographic trends)
Governance
(e.g. government organisations, property rights-system, constitutional rules)
Biophysical
(e.g. size of resource systems, clarity of system boundaries, number of units, resource unit mobility)
Interactions → Outcomes
Stakeholders
(e.g. number of users, socioeconomic attributes of users, importance of resource)
Related ecosystems
(e.g. climate patterns, flow in and out of focal SES)

Figure 3

