



Luc Hoffmann  
Institute

**DOING SCIENCE  
DIFFERENTLY:  
CO-PRODUCING  
CONSERVATION OUTCOMES**

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**SYNTHESIS PAPER**

Luc Hoffmann Institute, Synthesis Paper  
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## EXECUTIVE SUMMARY

### Why does conservation science need to be done differently?

Despite ever-increasing knowledge of conservation problems, biodiversity continues to decline. This has led to frustrations of many conservation scientists that their knowledge has failed to influence policy and practice. At the same time, 21st century conservation challenges are increasingly complex, requiring conservationists to balance trade-offs between different social, political, ecological and economic objectives, constituents and sectors.

Tackling these problems requires approaches that draw on diverse expertise, integrate the concerns of actors at different scales, and evaluate trade-offs while building capacity to support adaptive learning and action. Given that the barriers to action largely revolve around the way decisions are made, simply describing problems and producing knowledge misses a core component of the conservation challenge.

### What is knowledge co-production?

Approaches that involve collaborations between scientists and other stakeholders to produce knowledge are often referred to as 'knowledge co-production'. These processes bring people with different knowledge and expertise, or from different sectors of society, into partnership with those with formal scientific training to develop knowledge and engage with its use in policy and practice. It is important to view knowledge co-production as a

process rather than a product, as the process builds both legitimacy for action and a coalition of actors who have ownership over knowledge and outcomes. This ownership means that actors are more likely to act on shared findings. Well-supported and designed co-production processes also build networks of people and institutions that can enable effective and novel responses to address the state of biodiversity decline.

## Principles for the practice of co-production

In synthesising the diverse contributions of research and practice, we identified seven principles that the conservation community should pay attention to when seeking to use co-production processes to support policy and practice:

1. **Create knowledge-action collaborations** in which knowledge and action are tightly coupled and both are a means to an end (improved, scientifically informed decision-making);
  2. **Acknowledge the interdependence between facts and values** when seeking to change policy and practice through knowledge co-production;
  3. **Understand the decision-making context** in which knowledge will be used, including understanding how current decision-making processes respond to different types of evidence, and the barriers or enablers to the use of knowledge in this specific context;
  4. **Ask critical questions** about whose objectives, knowledge and values are driving the process, and who is likely to win or lose when outcomes are realised;
  5. **Build capacity** within science-policy-practice networks to allow for effective reciprocal engagement, build trust to encourage reflection and learning from mistakes and inequities, and address differences in access, control and power;
  6. **Develop flexible governance norms and rules** that enable diverse stakeholders to jointly define goals and objectives, take responsibility for developing an understanding of a problem, and develop and implement strategies to address it; and
  7. **Support adaptive learning** through formal procedures for evaluating processes and outcomes.
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## INTRODUCTION

Conservation as a science and a practice aims to prevent biodiversity decline. Despite many years of excellent research and the dedication and resources of many conservation organisations working in policy and practice, the list of endangered species continues to grow and habitat destruction continues largely unabated. In light of this, the conservation community has attempted various approaches to improve the relationship between research, policy and practice. Within this work, there is a growing recognition that useful research often emerges from the collaboration between researchers and other stakeholders within the decision-making context in which knowledge is intended to be used (van Kerkhoff and Lebel, 2006).

This collaboration is often referred to as ‘knowledge co-production’ and the development of collaborations between ‘science and society’ has become an aspiration of many sustainability-related fields, from conservation and development to public health, urban planning and many more. Growing interest in co-production within the conservation community over the last five years has emphasised the importance of collaborations between scientists, managers, policymakers and other stakeholders, promising that such collaboration will lead to the development of ‘actionable science’ (see Beier et al., 2017; Nel et al., 2016; Toomey et al., 2016; Cook et al., 2013).

This paper is intended as an introduction for those who are not familiar with co-production. We:

- provide an overview of why there is a growing demand for conservation science to be done differently;
- show how the emerging methodology of knowledge co-production can address this problem; and
- articulate a set of principles for the practice of co-production.

The research reviewed here emerges largely from the social sciences; however, co-production is increasingly being promoted as central to global environmental change research for sustainable development (see Turner et al., 2016; Future Earth Research, 2014; Mauser et al. 2013). This paper draws on three areas of social science research on co-production that focus on:

- the design of interventions to enable public, private and civil society sector groups and individuals to work together to create public benefits;
- pragmatic and process-oriented approaches to bringing scientists into productive dialogue with policymakers, practitioners and other stakeholders; and
- analytical research which provides an insight into the complex relationships between science and society, knowledge, policy and practice.

Over the past three years, the Luc Hoffmann Institute has drawn on this literature to develop a novel and practical approach to the design and delivery of co-production processes. Our experimentation and learning has allowed us to examine some of the widespread assumptions underpinning the connections between conservation science, policy and practice.

## Doing science differently

While there have been some successes in using conservation science to catalyse action, many within the conservation community have recognised that science alone is not enough (Mace, 2014; Kareiver and Marvier, 2012; Biggs et al., 2011). Much has been written about the “gap” between conservation science, policy and practice. In the past, this has been dominated by calls for scientists to communicate more frequently and more effectively with other stakeholders. Moving beyond activities focussed around better databases (Sutherland et al., 2004), clearer messages (Stirzaker et al., 2010) and greater resolve (Fischer et al., 2007), there is a growing recognition that applied conservation research needs to be more than a one-way transmission of information at the end of a research project (Phillips et al., 2010; Roux et al., 2006).

There is broad agreement across the literature of the barriers to and enablers of research uptake in policy and practice. The most commonly identified barriers include: lack of relevant research; shortage of time or opportunity to use evidence; timing of and inconsistencies within policy cycles; limited funding; and limited ability or skill to understand research or to integrate knowledge from multiple contexts or disciplines (Balian et al., 2016; McNie et al., 2016; Oliver, 2014; Elliott and Popay, 2000). Many decision-making processes are often not amenable to responding to academic knowledge in an adaptive or flexible way (Van Kerkhoff, 2013; Rijke et al., 2012; Reed et al., 2008; Olsson et al., 2006), serving to further exacerbate these barriers. The most prevalent enablers include: easy access to relevant

This paper will not dive into the complexity of the social science literature; rather, it outlines how this work has informed the development of an approach to knowledge co-production that culminates in a substantial offering from the Luc Hoffmann Institute to the broader conservation community.

research; promoting an organisational culture of research use; and sustained collaboration and relationships between policymakers, practitioners and researchers (McNie et al., 2016; Cherney et al., 2015; Oliver et al., 2014; Elliott and Popay, 2000).

However, conservation issues are often complex and contested, and easy technical solutions that can be readily translated into policy and practice to provide win-win outcomes are often impossible to reach (Beier et al., 2017; Adams and Sandbrook, 2013; Mauser et al., 2013). Given that these contexts are often rife with controversy and uncertainty, there is increasing awareness that conservation science needs to innovate and engage with societal actors in order to effectively support positive environmental change. In particular, the following points have been raised:

- There are unsatisfactory relationships between what is known about complex problems and the decisions that are made to manage or govern those problems (in policy or in practice);
- Complex problems are interconnected, as are the cause and effect processes shaping them. Consequently, they cannot be addressed or understood through a single disciplinary lens (i.e. economics or conservation biology) or through academic knowledge alone;
- Developing solutions and understanding their implications requires the knowledge and insight of many different perspectives;



- Collaborative approaches are commonly used to support learning and build trusting relationships across sectors and stakeholders (within and outside academia). Using an adaptive management cycle, these groups then identify shared understandings of complex problems, develop and pilot solutions, and monitor, adapt and learn;
- Research is more likely to be used when it is relevant, credible and legitimate. Research is more likely to meet these criteria when its production is supported by ongoing dialogue between those who are producing the research and those who intend to use it;
- Research is more likely to be used when it is developed with an understanding of who is going to use it, how they are going to use it, and in what context it will be used.

Conservation scientists are searching for alternative approaches to how we understand and manage conservation challenges. This has resulted in a range of approaches to 'doing science differently', from suggestions that implementation needs to be integrated into the research process (Arlettaz et al., 2010), to broadening interpretations of 'expertise'

(Game et al., 2013), to setting research objectives in collaboration with stakeholders (Nel et al., 2016; Reyers et al., 2015; Caudron et al., 2012). Such collaboration is particularly prominent in the conservation planning literature. It is framed as a 'solution' to the 'gap' between research and implementation, particularly in complex contexts which involve multiple stakeholders, objectives and jurisdictions where action requires decision-makers to address trade-offs between different sectors (Álvarez-Romero et al., 2015; Mills et al., 2014; Caudron et al., 2012; Reyers et al., 2010; Knight et al., 2006).

Collaborative research is increasingly presented as able to foster meaningful interactions among stakeholders that ultimately lead to substantive outcomes. In a study of regional climate assessments in the United States of America, Lemos and Morehouse (2005) found that iterative engagement between science and policymakers was a critical factor in enabling the development of more useable science. On the same topic, Dilling and Lemos (2011) found that the iterative dialogue had to be 'owned' by individuals or organisations tasked with building the conditions and mechanisms for climate assessments and their use. Various

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studies stress the importance of inclusive and iterative processes (Rodela et al., 2015; Sarkki et al., 2015; Kirchhoff et al., 2013; Reid et al., 2009). In their examination of co-management in the Canadian Arctic, Armitage et al. (2011) stress that co-production can and should contribute to long-term capacity building within scientific and policy networks, particularly by enabling policy processes that draw on science in a way that is integrated with more democratic stakeholder engagement. Such iterative and long-term engagement can lead to the development of common ground, mutual understanding and trust, through which difficulty and controversy can be dealt with (Leith et al., 2015).

This research illustrates the value of integrating diverse perspectives into the research processes early on. These processes are more likely to be effective when attention is paid to the additional skills required to work across science, policy and practice (van Kerkhoff and Lebel, 2015); funding is provided to support

collaboration, mediation and communication (Cash et al., 2003); and when sufficient time is allowed to develop a shared understanding of a problem and collaborative goals (Reed et al., 2014; Armitage et al., 2011). While the studies reviewed here use diverse approaches to support collaboration, many found that these processes of dialogue and exchange between different perspectives improved learning, decision-making and research influence (Nel et al., 2016; Reyers et al., 2015; Caudron et al., 2012; Jolibert and Wesselink, 2012; Lauber et al., 2011; Lombard et al., 2010). Other studies caution that socio-cultural context and power relations will influence the success of participation processes (Schuttenberg and Guth, 2015). Moreover, while collaboration between science, policy and practice actors is commonly proposed to improve knowledge uptake, it has also been noted that it is a necessary – but not sufficient – element to build effective relationships between knowledge and decision-making (van Kerkhoff and Lebel, 2015).

## What is knowledge co-production?

Calls to 'do science differently' within the conservation literature adopt a range of terms, including: transdisciplinary research; action research; participatory and/or community-engaged research; Mode 2 science; post-normal science; and knowledge co-production. These concepts, which stem from different literatures and disciplines, share a common approach in that they are seeking to incorporate academic and non-academic types of knowledge to address real-world problems. Of these, knowledge co-production has become the concept

du jour, underpinning calls from funding agencies and global research networks. While it is possible to parse out conceptual differences between these terms, for our purposes, co-production can serve as a catch-all for approaches to 'doing science differently' in collaboration with diverse stakeholders.

More specifically, knowledge co-production can be defined as **an iterative research process that actively engages those responsible for, or who have a stake in, a problem in the**

**process of generating knowledge to support decision-making.** Knowledge co-production is a methodology that can draw on diverse methods to undertake research. Some methods are more collaborative (i.e. companion modelling, participatory GIS), while others are less so (i.e. interviews, climate modelling). However, the use of less collaborative methods to conduct research doesn't necessarily mean that research has not been 'co-produced'. **Rather, it is how those methods are used to engage with non-academic actors to design an iterative research process and/or produce knowledge that is tied to a decision context that defines whether or not the research can be labelled as co-production.**

Iterative engagement is critical to develop knowledge that is credible, salient and legitimate (Sarkki et al., 2015; Cash et al., 2003), and to build an understanding of how knowledge will be used and that the context that it will be used within (Clark et al., 2016). Iterative engagement processes work to ensure that science is methodologically **credible** (e.g. through peer-review), but also that it is **relevant** to the decision-making context, and that it is seen as **legitimate** in terms of the processes that were involved, who was included in them, and how (Cash et al., 2003). Similar findings resonate across diverse fields, including in linking climate research with communities of water managers (Jacobs et al., 2016; Kirchoff et al., 2013), across different scales of government decision-making (Cash et al., 2006), agricultural research (Clark et al., 2011; Kristjanson et al., 2009; Reid et al., 2009), and global health (van Kerkhoff and Szlezák, 2016).

Knowledge co-production has diverse intellectual roots (see, for example, Lemos and Morehouse, 2005; Jasanoff, 2004; Ostrom, 1996). Although a relatively recent arrival to conservation, the concept of knowledge co-production has a longer presence in social science or social-ecological systems research (see, for example, Bouska et al., 2016; Schuttenberg and Guth, 2015; Roux et al., 2006); in environmental policy (Moll and Zander, 2013; Jolibert and

Wesselink, 2012); and in public services and community development (Loeffler and Bovaird, 2016; Tuurnas, 2016; Vorberg et al., 2015). There have, however, been some recent and important contributions in the conservation field (Beier et al., 2017; Nel et al., 2016; Tinch et al., 2016; Toomey et al., 2016; Reyers et al., 2015; Prenernig, 2014; Young et al., 2014; Cook et al., 2013). From this literature, we have identified the following critical insights that can usefully inform the design of co-production processes:

- The relationship between science, policy and practice is not linear; the often quoted 'gap' between knowledge and policy is more aptly characterised as a complex interface of multiple competing agendas, perspectives, and types of knowledge (see van Kerkhoff and Lebel, 2006);
- Knowledge is a necessary – but not sufficient – ingredient to generate changes in policy and practice (van Kerkhoff and Lebel, 2015; Jasanoff, 2012; Ostrom, 1996);
- While the direct translation of research papers into policy decisions is rare, scientific understanding of environmental systems can slowly permeate to change how these systems are governed and managed (Jasanoff, 2004; Miller, 2004; Forsyth, 2003);
- Engagement between scientists and other societal stakeholders requires facilitation and mediation, making sure that values and emotions are not eclipsed by facts (or vice-versa), and ensuring that scientific knowledge is not only credible but also relevant and legitimate to all stakeholders (Cash et al., 2003);
- Modes of engagement will be context specific. In some cases, co-production will require large-scale stakeholder engagement, whereas in others, it will require collaboration to be integrated throughout the lifecycle of a project, or strategic iterative engagement with a limited set of stakeholders (Reid et al., 2009; Reed et al., 2008);

- The skills and capacities needed to work effectively across science, policy and practice are many and diverse, and are very different from those taught within standard scientific training programmes (Bednarek et al., 2016; Parsons and MacPherson, 2015; Rietig, 2014; Ho-Lem et al., 2011);
- Successful co-production processes require all participants to learn. They are not based on the transfer of knowledge from scientists to decision makers; rather, they are collaborative processes that change all participants' understanding of the problem (Reyers et al., 2015);
- Individuals, organisations or institutions provide a critical role in brokering between research production processes and policy processes/context to support communication, mediation and translation between different perspectives, needs and objectives (Cvitanovic et al., 2017; Cash et al., 2006);
- Long time frames are required to build trust, relationships and the capacity to engage in co-production, and to see the results of these processes appear in policy and practice (Reed et al., 2014);
- Research projects and programmes that are seeking to influence policy and practice should be designed as such from the outset, supported by iterative and early engagement between researchers, policymakers, practitioners, and other relevant partners in the process (Moser, 2016; Page et al., 2016);
- Decisions are political, as is the use of scientific knowledge in decision-making. The use of knowledge in decision-making is often likely to be contested by stakeholders who could be negatively impacted by policy change (Clark et al., 2016).

Critically, this literature suggests that to develop lasting outcomes for policy and practice, efforts to 'do science differently' must go beyond more and better engagement by scientists. This broadens out science, bringing people with different knowledge, expertise, or from different sectors of society into partnership with those with formal scientific training, to develop knowledge and engage with its use in policy and practice.

“Co-production is best defined by what it sets out to achieve, rather than by the specifics of how it is implemented or what methods it uses”

While useable knowledge products are often thought of as the primary focus of co-production, to effectively inform decision-making, co-production requires changing how scientific knowledge and other forms of knowledge are used in decision-making, and may involve changing how decisions are made (Wyborn, 2015; van Kerkhoff, 2013; Muñoz-Erikson, 2013; Buizer et al., 2011). Recall the barriers to knowledge uptake in the previous section, many of these stem from incentive structures and governance arrangements that undermine efforts to generate knowledge that is useful to and used in decision-making (Clark et al., 2016; van Kerkhoff, 2013). Consequently, it is naive to assume that efforts to produce knowledge products, collaborative or otherwise, that do not focus on understanding **and addressing** the specific barriers and enablers of knowledge uptake in a particular context will lead to lasting changes in policy and practice. Changing decision-making processes is a long-term process, hence why the network, trust and relationship-building elements of co-production are so critical.

In summary, knowledge co-production is an approach that:

- brings together diverse groups and individuals with different perspectives to understand problems and address challenges;
- actively links scientific and other knowledge with values to develop visions and goals for the future;
- requires developing and implementing actions to achieve these goals through direct engagement with decision-making;
- requires building capacity to produce and use knowledge through engagements between researchers and other societal actors; and
- builds networks and relationships of trust to connect different groups. These processes build networks across communities; they challenge entrenched assumptions and power relationships within these networks.

**Co-production is best defined by what it sets out to achieve**, rather than by the specifics of how it is implemented or what methods it uses. **Co-production is a process of iterative engagement between researchers and other stakeholders to conduct research that is used to inform a specific context of decision-making and action.** It is notable that despite the promises of knowledge co-production, further work is required to identify when, where, and in what contexts – supported by what types of processes – the approach is more likely to improve conservation policy and practice.

Drawing on our experiences over the past three years and our collaborations with other individuals and organisations working with knowledge co-production approaches, the Luc Hoffmann Institute seeks to contribute further understanding in this area. Given the proliferation of calls for knowledge co-production, this work will be critical to support the design and implementation of fit-for-purpose processes that lead to more effective conservation policy and practice.

## Putting knowledge co-production into action

As outlined here, the process of co-production can be 'operationalised' in many different ways. Co-production is characterised by some sort of collaboration or dialogue between those with interest, knowledge or stake in an issue. This could take the form of ongoing engagement with decision makers (policymakers, government agencies, business, industry, practitioners, communities, etc.) throughout a research process that provides a clear understanding of where and how the research will be used; however, the bulk of the research is still completed by researchers. In such scenarios, ongoing engagement is essential to provide the decision makers with the opportunity to assess the relevance of the research as it is being produced. At the other end of the spectrum, co-production can be a deeply collaborative process with researchers, decision makers, community members or other relevant actors who are all in it together the whole time.

Drawing on both empirical research and practical experience, the Luc Hoffmann Institute has found that the interactions between different actors in co-production, how it is operationalised, and what methods are used, will necessarily be defined by the context, the problem, the people involved, the available time, and resources. Each co-production process will be specific, and each group will need to learn to work effectively together to generate new knowledge and support action.

Common approaches to supporting co-production include:

- global/regional/thematic assessments that synthesise and evaluate the best available knowledge to produce summaries to inform decision making;
- task forces formed to address a specific topic or question to collate knowledge or identify gaps in knowledge to inform decision-making;
- collaborative action-research projects that are tied to decision-making contexts;
- knowledge-brokering individuals or networks seeking to support dialogue and/or knowledge exchange between producers and users of academic research;
- science-policy dialogues seeking to support dialogue and/or knowledge exchange between science and policy.

Conservation science and practice have come to recognise that scientific worldviews can marginalise local or traditional knowledge (Adams and Sandbrook, 2013). Consequently, efforts to strengthen relationships between science and policy should be aware of whose knowledge is being co-produced and the extent to which this may marginalise other perspectives. Social science literature on co-production considers how relationships between science and policy can perpetuate particular forms of power (Jasanoff, 2004). However, discussions about co-production within conservation have largely neglected questions of power and how it manifests in both the process and outcomes of co-production (see for example Beier et al., 2016; Nel et al., 2015). Co-production processes that seek to change policy and practice are doing more than simply producing knowledge; they are advocating for a particular outcome that may or may not be shared or may involve trade-offs between different perspectives.

Many have embraced co-production on the assumption that better outcomes for conservation policy and practice will be achieved through collaborative processes with diverse stakeholders who co-produce knowledge to be applied in specific decision-making contexts. However, in many cases, these approaches are rarely informed by the social science research outlined above. Such research has studied the complex and often contested relationships between science and society, as well as the ways in which science informs (or not) policy and practice, for over 30 years. In synthesising the diverse contributions of this literature, we identified seven principles that the conservation community should pay attention to when seeking to use co-production processes to support policy and practice:

1. Create knowledge-action collaborations in which knowledge and action are tightly coupled and both are a means to an end (improved scientifically informed decision-making);
2. Acknowledge the interdependence between facts and values when seeking to change policy and practice through knowledge co-production;
3. Understand the decision-making context in which knowledge will be used, including understanding how current decision-making processes respond to different types of evidence, and the barriers or enablers to the use of knowledge in this specific context;
4. Ask critical questions about whose objectives, knowledge and values are driving the process, and who is likely to win or lose when outcomes are realised;
5. Build capacity within science-policy-practice networks to allow for effective reciprocal engagement, build trust to encourage reflection and learning from mistakes and inequities, and address differences in access, control and power;
6. Develop flexible governance norms and rules that enable diverse stakeholders to jointly define goals and objectives, take responsibility for developing an understanding of a problem, and develop and implement strategies to address it; and
7. Support adaptive learning through formal procedures for evaluating processes and outcomes.

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## Create knowledge–action collaborations

Co-production is a process that builds connections between knowledge production and decision-making. As mentioned earlier, it involves iterative collaboration among people with different knowledge, expertise, or from different sectors of society, to develop knowledge and actively engage with decision-making processes. There are many barriers that delimit how science influences conservation

decision-making, including cultures, incentive structures, power relations and governance arrangements. Consequently, focussing on knowledge gaps alone is insufficient; co-production processes must also be paired with efforts to understand and then address the specific barriers and enablers of knowledge uptake to lead to lasting changes in policy and practice.

## Acknowledge the interdependence between facts and values

Co-production processes do not separate facts and values. Rather they identify shared goals and produce legitimate, rigorous and relevant knowledge that can be used to inform action to achieve those goals through direct engagement between researchers, decision makers and other stakeholders. This requires agreement on goals, the values that the effort seeks to conserve, the knowledge needed to realise those goals, and the means of achieving them. For example, to develop climate adaptation strategies (goal) for threatened ecological com-

munities (values), a group of researchers, land managers and local landowners undertake a vulnerability assessment (knowledge), and identify the resources and capacities needed to implement those strategies within a given policy and landscape context (means). Producing knowledge to contribute to changes in policy and practice inherently involves a commitment to a particular set of goals and objectives, so it is important to acknowledge this stance and be clear about this from the outset.

## Understand the decision-making context

Developing research that is useful and usable requires an understanding of how knowledge is generated and used, for and with whom. It also involves understanding the diversity of factors – policies, organisations, social and ecological communities, history and relationships between groups - that shape the contexts in which scientific programmes and projects are situated. In relatively simple contexts where options are uncontroversial and science has high degrees of certainty, communication to inform ‘next users’ can often be the straightforward provision of technical information or information translated

into terms that users will understand. Where issues are more complex – involving multiple disciplines, substantial uncertainty, and conflicting goals, norms and values of stakeholders – processes become much more complex. This requires ongoing iterative negotiation and bargaining about priorities, options, risks and uncertainties. Addressing questions of whose views, perspectives and knowledge will be used and useful requires an understanding of the formal and informal rules that shape how knowledge is created, disputed or deployed in decision-making.

## Ask critical questions

Change occurs within arenas of power, politics and trade-offs among differing, sometimes-conflicting values, interests and ways of

seeing the world. If co-production processes are to contribute to conservation outcomes, they must acknowledge that some stakehold-

ers who are affected by an issue may not share the goals and objectives of a project. Particularly when a project seeks to challenge the status quo, the knowledge and outcomes from co-production processes are likely to be contested. Asking critical questions about whose objectives, knowledge and values are driving the process, and who is likely to win or lose

when outcomes are realised provides a useful starting point. Do not assume that perspectives on what will be 'useful' will be shared, that scientific knowledge offers the only legitimate source of knowledge to address a particular problem, and accept that issue-based politics are likely to influence co-production processes.

## Develop flexible governance norms and rules

Co-production processes are often complex and challenging. They require significant time and resources to be dedicated to supporting communication between participants, and require clear definition of roles and responsibilities of the different parties. Solid relationships that are based on trust, a shared objective, and commitment to a programme of work, are critical. Co-production processes need to have governance that is flexible to change.

This is because they are often unfolding in changing policy contexts, or as the collective understanding of a problem grows, a project may need to shift focus to address a new formulation of a problem or a policy window as it arises. Flexible governance norms and rules can enable diverse stakeholders to jointly take responsibility for developing an understanding of a problem, and developing and implementing strategies to address it.

## Build capacity within science–policy–practice networks

Capacity is the realised ability to perform actions, solve problems, and set and achieve objectives. As individuals, institutions and networks of actors respond to complex and urgent challenges through co-production processes, there is a need to revisit assumptions about the skills and abilities required. Roles and responsibilities in collaborations are often negotiated and may change with each new encounter or depend on the sphere in which the collabora-

tion is taking place. Accordingly, individuals and institutions require an expanded set of capacities, enabling them to know, sense, act, and relate in new ways across diverse scenarios. In addition to discipline or sectoral expertise, co-production processes also need to be supported by expertise in facilitation, mediation, communication and translation. These expertise are necessary to enable diverse groups to work effectively together.

## Support adaptive learning

Co-production assumes that both the process and the outcomes of co-production make a contribution to conservation policy and practice. This is because, if well designed and managed, co-production builds new relationships, networks, understanding and capacities that provide the foundation for longer-lasting changes in policy and practice. Conversely, it is also important to recognise that an excellent co-production process, which has effectively and ethically engaged with the relevant actors and has produced high-quality outputs, may

fail to reach its objectives. This may be because of barriers to change or changes in a policy environment (such as a change of government) that are beyond the control of participants in the process. In each of these contexts, monitoring and evaluation of the processes and outcomes of co-production is critical, both to support adaptive learning in the design and delivery of projects to increase their capacity to achieve their goals, and to satisfy donors and partners that increasingly require evidence of impact.



## CONCLUSION

Many conservationists operate on the premise that science is critical to effective conservation practice. However, conservation as a science and a practice is increasingly realising that science alone is insufficient to bring about change. The various traditions of social science research outlined in this paper provide critical insights that can be used to understand and improve the relationship between research, policy and practice. This requires legitimate and ethical approaches to co-production that are fit for purpose, able to adapt in response to new knowledge, and are able to provide meaningful outcomes, often within tight time frames and budgets. The barriers to effective decision making for conservation largely extend beyond a lack of information, so focussing only on how we produce knowledge misses a core component of the challenge (Wyborn, 2015). However, too often, calls to 'engage with all the stakeholders' or to 'understand user needs' lead to either scattergun or overly prescriptive processes that do not address issues of power, politics and equity in conservation policy and practice.

Effective co-production often requires institutional changes to overcome silos, perverse incentives, and other socio-cultural barriers and constraints that shape the science-policy interface. A key point of the research outlined here is that policy and practice can and do co-evolve in response to shifts in knowledge or societal values (Jasanoff, 2004). While these studies are descriptive accounts of past events and are not put forward as predictions or prescriptions of what could be done, the Luc Hoffmann Institute has drawn on this theory and evidence base to develop a unique set of approaches that can be used to craft effective engagements across science, policy and practice.



These approaches focus on developing a solid understanding of the context in which knowledge will be used, as well as the barriers to and enablers of knowledge uptake in policy and practice. To complement this understanding, we have designed a unique approach that builds the capacity of researchers and practitioners alike to effectively engage and collaborate to generate knowledge and support its use in policy and practice. This approach culminates in a significant contribution to the conservation community, and a solid foundation for the Luc Hoffmann Institute's work.

Conservation challenges are complex and not easily amenable to one-shot 'silver bullet' solutions. While there are some similarities, they manifest in different ways across different social and political contexts, and are tackled by individuals and organisations that have different capacities and constraints. As such, there are no 'cookie-cutter' approaches to co-production that can be applied everywhere. Rather, the task is to develop an understanding of the processes, capacities and enabling conditions that will allow co-production processes to provide a crucial connection between knowledge and action. When effective, these approaches can generate collective learning and new knowledge to support societal and policy change in the service of delivering more effective conservation and social development outcomes.

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