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Transformative conservation of ecosystems

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Non-technical summary. Many conservation initiatives call for 'transformative change' to counter biodiversity loss, climate change, and injustice. The term connotes fundamental, broad, and durable changes to human relationships with nature. However, if oversimplified or overcomplicated, or not focused enough on power and the political action necessary for change, associated initiatives can perpetuate or exacerbate existing crises. This article aims to help practitioners deliberately catalyze and steer transformation processes. It provides a theoretically and practically grounded definition of 'transformative conservation', along with six strategic, interlocking recommendations. These cover systems pedagogy, political mobilization, inner transformation, as well as planning, action, and continual adjustment.

Technical summary. Calls for 'transformative change' point to the fundamental reorganization necessary for global conservation initiatives to stem ecological catastrophe. However, the concept risks being oversimplified or overcomplicated, and focusing too little on power and the political action necessary for change. Accordingly, its intersection with contemporary biodiversity and climate change mitigation initiatives needs explicit deliberation and clarification. This article advances the praxis of 'transformative conservation' as both (1) a desired process that rethinks the relationships between individuals, society, and nature, and restructures systems accordingly, and (2) a desired outcome that conserves biodiversity while justly transitioning to net zero emission economies and securing the sustainable and regenerative use of natural resources. It first reviews criticisms of area-based conservation targets, natural climate solutions, and nature-based solutions that are framed as transformative, including issues of ecological integrity, livelihoods, gender, equity, growth, power, participation, knowledge, and governance. It then substantiates six strategic recommendations designed to help practitioners deliberately steer transformation processes. These include taking a systems approach; partnering with political movements to achieve equitable and just transformation; linking societal with personal ('inner') transformation; updating how we plan; facilitating shifts from diagnosis and planning to action; and improving our ability to adjust to transformation as it occurs.

Social media summary. Curious about stemming the global biodiversity and climate crises? Browse this article on transformative conservation!

1. Promises and potential hazards of transformative change

Recent global assessments have heightened awareness of how growth and globalization threaten society with unprecedented ecological decline, biodiversity loss, and climate change impacts (IPBES, 2019; WWF, 2020). The international community has not made significant progress toward many United Nations (UN) sustainable development goals and partly overlapping UN Convention on Biological Diversity's (CBD) Aichi biodiversity targets (Secretariat of the CBD, 2020; UN, 2020). A large gap remains between the climate change-amplified impacts of ecological degradation, on the one hand, and the political and economic will and resources necessary to mitigate greenhouse gas emissions and adapt, on the other (UNEP, 2020, 2021). These types of findings have generated widespread protests (e.g. Fridays for the Future, Extinction Rebellion, and the Dakota Access Pipeline Protests) regarding humanity's apparent inability to modify mindsets, cultural practices, and institutions, and work toward its collective self-interest.

Calls for 'transformative change' have increased commensurately in conservation, energy, business, and urban planning sectors, and a variety of academic disciplines (Scoones et al., 2020). The term has popular appeal because it points to the fundamental, broad, and durable changes necessary to stem catastrophe, but it is not always clear what 'transformation' means (Massarella et al., 2021; Mehta et al., 2021; Scoones et al., 2020). Within the field of ecosystem stewardship, 'transformation' derives from Holling's (2001) concept of panarchy, which foregrounds the interdependent relationship between social and ecological systems and seeks to enhance sustainability in a rapidly changing world (Chapin et al., 2009). The corresponding

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social-ecological systems (SES) framework, summarized in Holling (2001) and further developed by Ostrom (2009), is significant insofar as it provides an overarching theory that sustainability science often lacks (Mooney et al., 2013). The SES concept of 'transformation' refers specifically to the process by which a system reorganizes its structure, functions, and identity when disturbances exceed its ability to adapt (Folke et al., 2010; Walker et al., 2004). The SES framework is central to the new conservation paradigm of 'people and nature' (Mace, 2014), and has informed numerous studies on transformation. These include the modeling of ecosystem services in relation to social and economic dynamics in brownfield landscapes (Kolosz et al., 2018), climate change adaptation (Fedele et al., 2020), and the operationalization of tipping points (Lenton et al., 2022).

It is important to situate the SES framework in relation to contemporary theorizing about system transformation. Scoones et al. (2020) helpfully distinguish between structural, enabling, and systemic approaches to transformation, yet an SES perspective would inevitably combine these approaches in the practice of conservation. Structural elements would include the laws and policies that support economic growth regardless of the social and ecological consequences, and how these affect ecosystems at local and landscape scales. Similarly, enabling approaches would be necessary to develop the capacity for local communities to respond effectively to global change. Equally important, SES scientists (Cundill et al., 2012) distinguish between hard systems approaches that involve engineering toward an ideal state, and soft systems approaches that involve socially complex processes of learning and decision-making, and refute the idea of engineering people (Checkland, 2000; Cundill et al., 2012). Furthermore, while both approaches share the concept of feedback (the science of communication and control in living and engineered systems), living systems also possess the ability to organize themselves and create novel structures and behaviors (Capra & Luisi, 2014). Conservation and development practitioners do not always appreciate this important distinction, given the influence of Cartesian and Newtonian frameworks on natural and social sciences, which emphasized viewing people and nature as mechanical objects (*ibid.*). As a result, practitioners may impose centrally defined technocratic solutions, instead of fostering bottom-up transformation that addresses the social, political, and economic structures and processes that perpetuate injustice and ecological degradation (Bastiaensen et al., 2021; Li, 2011). Practitioners can move beyond such mechanistic science by fostering complexity thinking in action research (Rogers et al., 2013).

In this context, if 'transformative change' is to help stem the biodiversity and climate crises, practitioners need to guard against the concept losing its distinctive value (Bennett & Roth, 2019). This can occur in various ways. First, the concept can be oversimplified, with interest groups, lobbyists, and media sources continuing to pose narrow, isolated, often technocratic solutions, rather than systemic analyses and comprehensive rewiring (Lamb et al., 2020). Second, practitioners can overlook how power relations shape the framing and strategies of conservation. Such uncritical use may perpetuate or even exacerbate dispossession and marginalization (Bennett et al., 2019; Blythe et al., 2018). Third, the energy and rigor required to turn academic theory into practice may overwhelm those in the field who do not have the training or resources to engage in extensive analyses and long-term experiments. If people working toward transformation cannot understand and integrate tenets such as inner dimensions and equity in their projects, the concept will have little value beyond the university (Martin et al., 2020; Wamsler et al., 2020; Woiwode et al., 2021). Finally, the concept may devote too much attention to criticisms of inaction, and too little to the everyday, always shifting, site and issue-specific strategizing and organizing that is necessary to win political battles and redirect resources (Bluwstein, 2021). Transformation, in other words, may become a widely supported goal, but make little material difference for nature and people.

Accordingly, this article advances the praxis of 'transformative conservation'. We first situate the concept in relation to area-based conservation targets (ABCT) (Woodley et al., 2019). International conservation organizations have increasingly used spatial extent as the basis for setting what they characterize as transformative goals for biodiversity protection and climate change mitigation. Natural climate solutions and nature-based solutions constitute two prominent types of mechanisms for achieving such goals (Griscom et al., 2017; Palomo et al., 2021). The former consists of 'conservation, restoration, and improved land management actions that increase carbon storage and/or avoid greenhouse gas emissions across global forests, wetlands, and grasslands, and agricultural lands' (Griscom et al., 2017); the latter consists of 'actions to protect, sustainably manage and restore natural and modified ecosystems that address societal challenges [such as biodiversity loss and climate change] effectively and adaptively, simultaneously providing human well-being and biodiversity benefits' (IUCN, 2016). ABCT initiatives and these related mechanisms have great potential, yet also often have weaknesses or pose dangers that undermine their contributions. After reviewing associated criticisms, we provide our definition of 'transformative conservation' and six strategic recommendations that counter such shortcomings and can accelerate systemic changes.

Fundamentally, transformative conservation will require supporting practitioners and stakeholders to mobilize and take simultaneous individual and collective action. This includes especially those who live and work where conservation occurs. Many structural challenges that face conservation projects – for example, the general growth paradigm that underlies contemporary economies, or power asymmetries between people and between countries – resist the reductions in habitat degradation, resource consumption, human exploitation, and inequality necessary for sustainability and regeneration. Accordingly, our recommendations do not advocate for specific tactics regarding how, for example, to protect a species or integrate indigenous knowledge. Instead we focus on strategies that practitioners and stakeholders can apply to increase their adeptness in facilitating transformation processes, including working effectively at local scales, and linking their initiatives with networks that operate at larger scales.

The impetus for the article emerges from two concerns shared by the coauthors. First, many international conservation organizations appear unable or unwilling to initiate the profound interventions needed to arrest and reverse the biodiversity and climate crises. Second, academic and research institutions have provided high-quality theory and cases of transformative change, yet this work can have limited relevance for practitioners and stakeholders who have more experience and insight than academia typically acknowledges (Fazey et al., 2018). The coauthors collectively embody over 150 years of conservation praxis at local through national and global scales. For several years we have convened dialogs on SES as part of the International Union for the Conservation of Nature's (IUCN) Commission on Ecosystem Management, within which we play or have played leadership roles. IUCN practitioners and stakeholders are a key audience

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for this article, and are especially well-positioned to lead change on all continents. At the same time, we present our recommendations for the full range of audiences working on conservation, including those in the capitalist democracies of the global North as well as more restrictive countries, since issues of power, participation, and equity remain central to conservation regardless of the political-economic context. Our ultimate aim is to help people, especially those who work in the field, to deliberately catalyze and steer participatory transformation processes that contest existing power relations and improve both the ecological and social outcomes of conservation.

2. Current emphasis on ABCTs

International conservation campaigns that involve ABCT while invoking transformative change have proliferated. Despite the adoption of the 1992 CBD, global rates of species extinctions continued to increase in the following two decades, and in 2012 the Parties to the agreement modified their approach by adopting the Aichi Targets as part of a 10-year strategic plan (Locke, 2013). Target 11 included the goal of protecting 17 percent of the Earth's terrestrial and inland waters, and 10 percent of its coastal and marine areas, through protected areas and other effective area-based conservation measures. Scientists had started calculating such ABCTs in the 1980s, and, following an agreement at IUCN's 2014 World Parks Congress, redoubled their efforts (Dinerstein et al., 2017). Today ABCTs form the basis of prominent global biodiversity campaigns (Table 1 lists select examples).

Climate change mitigation campaigns have evolved concurrently. Although the 1997 Kyoto protocol established quantitative greenhouse gas emission reduction targets, and had some success, the successor 2015 Paris Climate Agreement appears unlikely to meet its goal of keeping global warming well below 2°C (UNEP, 2020). Set against this specter, numerous countries have attempted to integrate biodiversity and climate benefits in their most recent climate pledges by emphasizing 'natural climate solutions' (Griscom et al., 2017). Concurrently, in 2018 the CBD incorporated climate change in national biodiversity strategies. However, the two policy realms remain largely separate, as many Nationally Determined Contributions to the Paris Agreement illustrate (Seddon et al., 2020).

As part of their biodiversity and climate visions, the international conservation community has started to promote the idea of 'transformative change' because it seems capable of matching the scope and scale of the crises. Although the concept has existed for many years, several international institutions and their member countries have recently entered the discursive field of 'transformation', and begun creating new knowledge and objectives to justify their continued or expanded exertion of power over biodiversity, territory, and people. The UN 2030 Agenda for Sustainable Development is entitled 'Transforming our world', and its Environment Program calls for systemically transforming humankind's relationship with nature by justly transforming societies, finance and economics, agriculture forestry and fisheries, energy and infrastructures, and values and governance (UNEP, 2019, 2021). The Secretariat for the CBD and IUCN have woven transformation into their Post-2020 Global Biodiversity Framework and Nature 2030 quadrennial work program, respectively. The Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has initiated a Transformative Change Assessment. The UN Global Environment Facility and Green Climate Fund have embraced transformation as a desideratum (UNGEF, 2021). Worldwide, the COVID-19 pandemic has amplified appeals for transformation by foregrounding the conjuncture of ecological degradation, zoonoses, socioeconomic inequality, gender and racial injustice, and climate change vulnerability (McElwee et al., 2020a). The momentum of these parallel initiatives points to a conjunctural moment when highly motivated actors in global networks have the opportunity to steer the Earth toward a new trajectory.

3. Existing concerns with conservation

Conservation initiatives that invoke transformation take mainstream through radical positions on ecological integrity, livelihoods, gender, equity, growth, power, participation, knowledge, and governance. In this section, we briefly review criticisms of existing initiatives. We first cover concerns about natural climate solutions – particularly forest-based carbon emission offsets – and nature-based solutions. International conservation organizations often identify these types of interventions as primary mechanisms for achieving ABCTs. Second, we turn to criticisms about conservation generally, covering concerns about neoliberalism and neoprotectionism, economic growth as a paradigm, equity and justice, and reductionist approaches to complexity. In hereby raising awareness about 'transformation' as a contested field, and then setting forth six recommendations, we hope to help practitioners and stakeholders clarify where they position themselves in relation to these critical issues, and generate improved outcomes for people and nature.

ABCTs that incorporate natural climate solutions raise a wide range of concerns. Projects may lack adequate analysis and discussion of risks to ecosystem stability, of co-benefits for species conservation and ecosystem services, and of climatological feedbacks; lack feasibility at large scales; and reduce the imperative for mitigation by the energy and industrial sectors (Anderegg et al., 2020; Anderson et al., 2019; Seddon et al., 2019). They can marginalize women and local and indigenous land users, create new emissions from associated woodfuel substitution and agricultural intensification, and concentrate land in the hands of the state or private enterprise or international donors (Gingrich et al., 2019; Seymour, 2020). Forest-based carbon emission offsets form a major branch of natural climate solutions. These include the UN Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+), and voluntary forest carbon emission offset projects implemented by a variety of public institutions and private companies, and involve combinations of forest protection, forest restoration, and reforestation. REDD+ is extensively criticized for interrelated cultural, ecological, institutional, and livelihood issues (Bayrak & Marafa, 2016). While these projects can generate co-benefits for emission producers and local communities, they can also marginalize locals, increase rural poverty, and decrease biodiversity. Tree plantations in particular can accelerate land use change, replace biodiverse with homogenous land covers, destabilize carbon stocks, and threaten food security (Cook-Patton et al., 2020; Heilmayr et al., 2020; Seymour, 2020).

Nature-based solutions generate parallel concerns. When focused narrowly on single objectives such as carbon sequestration, such mechanisms can negatively impact ecosystem connectivity, biodiversity value, and resilience (Seddon et al., 2020). They may also lack performance indicators, require perpetual public investment, and have limited efficacy or longevity under higher levels of climate change (Seddon et al., 2020; UNEP, 2021). In Europe, for example, the deployment of

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Table 1. Prominent ABCTs[a]

#	Initiative	Origin date	Primary conveners	Goals	Key components
1	Great Green Wall	2007	African Union	Restore 100 million hectares of degraded land, sequester 250 million tons of carbon, and create 10 million jobs along the southern Sahel by 2030	Landscape restoration, food security, employment, climate change, reduced conflict and migration
2	Nature Needs Half	2009	WILD Foundation	Protect 50 percent of the planet as soon as possible, and end the sixth mass extinction	Clean air and water, abundant life-support services, a stable climate
3	Bonn Challenge	2011	Germany and IUCN	Restore 350 million hectares of degraded and deforested land by 2030	Soil, forest, and biodiversity conservation, human livelihoods, carbon sequestration
4	Global Deal for Nature and Global Safety Net	2016 and 2020	RESOLVE	Protect half the terrestrial realm by 2050 to halt the extinction crisis while sustaining human livelihoods	Habitat protection and restoration, indigenous peoples, climate change mitigation, public health and zoonoses
5	Half-Earth Project	2016	E.O. Wilson Biodiversity Foundation	Protect half the world's land and sea to manage sufficient habitat to reverse the extinction crisis and ensure the planet's long-term health	Habitat protection and restoration, indigenous peoples, sustainable development
6	Campaign for Nature	2018	Wyss Campaign for Nature and National Geographic Society	Protect 30 percent of sea and land in a natural state by 2030	Biodiversity, mobilization of financial resources, indigenous and community conserved areas
7	Zero Draft of the Post-2020 Global Biodiversity Framework	2020	United Nations Convention on Biological Diversity	Protect at least 30 percent of sea and land in a natural state by 2030	

[a]See (1) Great Green Wall (https://www.greatgreenwall.org/); (2) Nature Needs Half (https://natureneedshalf.org/what-we-do/); (3) Bonn Challenge (https://www.bonnchallenge.org/); (4) Global Deal for Nature and Global Safety Net (Dinerstein et al., 2019; Dinerstein et al., 2020); (5) Half-Earth Project (https://www.half-earthproject.org/ and Wilson E. 2016); (6) Campaign for Nature (https://www.campaignfornature.org/); (7) Zero Draft of the Post-2020 Global Biodiversity Framework (https://www.cbd.int/article/zero-draft-update-august-2020). Each website last accessed October 31, 2021.

nature-based solutions has had a bias toward market solutions and short-term economic gains, and focused more on providing ecosystem services than conserving biodiversity (Carsten et al., 2017). Furthermore, these approaches may lack a commitment to long-term stability, methods for managing complexity and uncertainty, and sufficient monitoring (Cohen-Shacham et al., 2019). In 2020 IUCN issued a Global Standard for nature-based solutions to try and proactively address these concerns, though an analysis of its effectiveness is not yet available.

Broader criticisms of conservation including ABCTs draw on numerous fields, including geography, anthropology, political ecology, environmental justice, ecological economics, and development, feminist, and post-colonial studies. A longstanding and significant line of inquiry argues that international conservation organizations have in many cases subordinated nature to neoliberal capitalism (Büscher et al., 2012; Igoe & Brockington, 2007). Such organizations often endorse the role of markets in 'solving' environmental problems (*ibid.*), with tools ranging from natural capital protocols through emissions-trading schemes. This widespread acceptance of growth as an underlying economic paradigm generates broad criticisms and tension with the aspirations of ABCTs. Growth requires a perpetual increase in the use of natural resources and ecosystem services, and more fundamentally the use of energy including fossil hydrocarbons (Hagens, 2020; Kallis et al., 2020). This use occurs regardless of whether political economic institutions emphasize neoliberal, neopopulist, state-led, or other approaches to growth. Such criticisms question the eighth sustainable development goal's call for economic growth, and the ability to resolve tensions between growth and the conservation of nature through 'sustainable development' (Hickel, 2019; Kothari et al., 2015). Nonetheless, many international conservation organizations have not acknowledged biophysical limits or the infeasibility of decoupling growth and biodiversity loss (Hickel, 2019; Martin et al., 2016). A majority of international biodiversity and sustainability policies still advocate for economic growth, and fail to consider post-growth socioeconomic pathways or development models (Otero et al., 2020).

Another line of argument centers on how 'neoprotectionist' conservation initiatives enclose vast tracts of intact lands and open access waters in the name of saving them (Büscher & Fletcher, 2019). These new protected areas and marine reserves replicate the historical primitive accumulation that formed the basis of capitalism by dispossessing and marginalizing indigenous people, peasant farmers, and small-scale fishers (Bennett et al., 2015; Corson & MacDonald, 2012; Tauli-Corpuz et al., 2020). Half-Earth and similar global ABCT initiatives to protect 30 percent of the Earth's land and waters can deepen or create conflicts over land tenure, undermine livelihoods, disproportionately impact women, threaten food security, and adversely impact sustainable development (Schleicher et al., 2019; Seymour, 2020). Such proposals would physically bifurcate people and nature at a global scale (Büscher et al., 2017). These proposals typically remain silent about who would establish and control the 'natural half', and the global impacts of pollution from the 'human half' (*ibid.*). They also ignore longstanding work on the governance

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of common property resources that have demonstrated how environmental resource protection occurs in the context of trust, monitoring, and cooperation (Ostrom, 1990).

Fundamentally, many conservation initiatives including global ABCTs pay insufficient attention to the relationships between power, wealth, and the control of land and resources. To the extent that these initiatives consider equity and justice, they tend to focus primarily on distributing costs and benefits; secondarily on decision-making procedures and participation; and little on recognizing the status, values, institutions, and interests of diverse peoples (Dawson et al., 2018; Friedman et al., 2018; Martin et al., 2020; Myers et al., 2018; Zafra-Calvo et al., 2019). Their integration of social science focuses on economic valuation, behavioral change, and management effectiveness, and seldom interrogates political economy, governance, and social justice, or standards of practice and tacit philosophies (Bennett & Roth, 2019). Overall, such initiatives have had mostly mixed or negative impacts on equity, lacked legitimacy, and had produced little transformation (Friedman et al., 2018; Myers et al., 2018; O'Brien, 2012).

A final line of argument concerns the ontology and epistemology of conservation, specifically the contrast between reductionist and mechanistic approaches, on the one hand, and approaches that recognize the complexity and self-organizing ability of living systems, on the other. Conservation initiatives including ABCTs often perpetuate such reductionist approaches by focusing on single sectors, resources, or projects; positing one-dimensional solutions that appeal to markets, corporations, and individual consumers; or cordoning off territory and excluding people (Büscher & Fletcher, 2019). The inattention to systems and complexity, especially in ecosystems, reduces their effectiveness, overlooks tradeoffs and synergies, and generates market externalities (Ellis et al., 2019; Gingrich et al., 2019; Reed et al., 2016; Seddon et al., 2019). Such initiatives often disregard multiple values, fail to integrate non-instrumental and non-intrinsic relational values that bind people and nature, such as individual and cultural identity, stewardship, social cohesion, and social and moral responsibility (Chan et al., 2016; Ellis et al., 2019). This includes indigenous desires to protect and restore ways of life and to maintain the reciprocal relationship between people and other species (Lam et al., 2020).

4. Recommendations for facilitating transformative conservation

Per the preceding review, ABCT initiatives and corresponding mechanisms such as nature-based solutions and natural climate solutions have great potential to transform conservation, yet also often have notable weaknesses and pose notable dangers. Our definition of 'transformative conservation' and six strategic recommendations attempt to counter such shortcomings and accelerate systemic changes. Based on preceding concerns, we conceive of transformative conservation as both a desired process and a desired outcome. Regarding the process, transformative conservation rethinks the relationships between individuals, society, and nature, and works across multiple scales to durably restructure systems. Regarding the outcome, transformative conservation conserves biodiversity while justly transitioning to net zero emission economies and securing the sustainable and regenerative use of natural resources.

The following six strategic recommendations develop both aspects of this definition. Each recommendation examines promising areas for exploration, development, and improvement. The recommendations do not pose solutions for conserving specific species, but rather focus on how practitioners and stakeholders can improve, accelerate, and scale up transformation processes. As mentioned in the Introduction, IUCN and its members are critical proponents for changing how conservation is practiced. The recommendations are strategic insofar as they envision a desired future when transformative conservation is prevalent, and focus on cardinal areas of praxis necessary to bridge the gap between today's current conditions and that future. Despite being presented as a sequence, the recommendations overlap, build off, and depend upon one another.

4.1 Take a systems approach to transformation

Transformative conservation requires starting from and emphasizing a soft systems approach (Cundill et al., 2012) that includes tacit knowledge, competence development, unlearning, and reflective practice (Rogers et al., 2013). This is a cardinal recommendation, and addresses numerous empirical weaknesses, the inattention to power, equity, and justice, ontological and epistemological criticisms, and the danger of transformation being oversimplified. It forces one to examine how interventions in one area impact other ecosystems and livelihoods. Systems approaches demonstrably improve the outcomes of transformation initiatives (Magro & van den Berg, 2019), although the danger remains that these approaches remain difficult to conceptualize and implement in the absence of substantial training and resources.

This recommendation necessitates some orientation to distinguish between complex adaptive systems and hard systems, and to adapt one's leadership accordingly (Snowden & Boone, 2007). Any complex system consists of variables and feedbacks that determine its structure, functioning, and identity, and exhibits qualities that include non-linearity and uncertainty. However, living systems have the unique ability to self-organize; this feature distinguishes them from mechanical systems, and makes them unpredictable and prone to unexpected change. Living systems can absorb disturbances, adapt to external drivers and internal processes, and persist within given ranges (Berkes et al., 2003; Walker et al., 2004). However, when a system's dynamics exceed certain thresholds – whether through autonomous evolution or deliberate human intervention – its configuration will become untenable, and the system will transform (Folke et al., 2010; Walker et al., 2004). A new structure, set of functions, and identity will emerge and predominate. As noted in the Introduction, the SES framework understands people and nature as integrated and interdependent, responding to and influencing one another in a dynamic evolutionary relationship (Biggs et al., 2015).

Familiarity with system transformation concepts improves the planning and implementation of transformative conservation. A well-established first step involves a resilience assessment, beginning with delineating the scope of the system, including participatory data collection and interviews, and following with analysis of the system's dynamics, including modeling and knowledge co-production (Quinlan et al., 2021). The assessment process increases understanding of the relationships between system components, their interactions across temporal and spatial scale, and transformation pathways (*ibid.*). With regard to transformation pathways, Biggs et al.'s (2018) analysis summarizes 28 generic regime shifts across aquatic, terrestrial, land–water interface, climate, and social systems. This major reference database

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identifies common alternate regimes for such systems, along with their drivers, thresholds, dominant feedbacks, and leverage points (*ibid.*).

The assessment of a system's dynamics and its potential for transformation derives from the panarchy concept, including the adaptive cycle, that Holling (2001) developed to advance sustainability. The adaptive cycle describes how a system begins with resource exploitation and exponential growth; develops efficiencies that conserve material and energy; collapses and rapidly releases material and energy because of a significant disturbance; and either renews itself or transforms to a different system (*ibid.*). Panarchy describes how variables interact within and across scales, reinforce and balance one another through feedback loops, and converge in specific instances that crystallize change (Biggs et al., 2015; Holling, 2001). Tension may exist between elements of a system that seek to persist unchanged or adapt without radical change, and those undergoing restructuring (Olsson et al., 2004). For example, several institutions responsible for global scientific assessments of environmental change have resisted efforts to integrate social sciences and humanities with the existing natural science research agenda, hence limiting transformation toward greater diversity and pluralism (Lahsen & Turnhout, 2021).

4.2. Partner with political movements to achieve equitable and just transformation

Political ecology and companion fields have demonstrated that conservation always exists in an historical, political economic, social, and institutional context. Key elements include the relations, cultural practices, and institutions through which people seek to control, extract, produce, and protect resources, as mediated through class, race, gender, and other aspects of cultural identity (Perrault et al., 2015). Conservation must therefore invariably engage power relations (Bennett et al., 2019; Fazey et al., 2018; Martin et al., 2020; Shah et al., 2018). In this regard, our second recommendation is essential. It further addresses many of the same criticisms as recommendation 1, and foregrounds the politics of change and governance. It bears an essential relationship to recommendation 3, insofar as political change requires and also must support individual changes in people's relationships with nature and with each other.

To advance equity and environmental justice, transformative conservation must combine science with an explicitly political and normative approach to social-ecological change that moves beyond neo-protectionist nature–culture dichotomies, and beyond neo-liberal growth paradigms (Büscher & Fletcher, 2019; Fazey et al., 2018). The SES framework provides a basis for understanding the complex relations and feedbacks between human and non-human elements of ecosystems (Mace, 2014). A starting point for this work is answering: Transformation of what, into what? And for and by whom? (Meerow & Newell, 2019). Conservation interventions cannot ignore the existence of multiple conceptions of biodiversity, problem framings, and potential actions if they are to move beyond long-standing policy options that have failed to gain traction (Lahsen & Turnhout, 2021). Conservation organizations must partner throughout the process with those who stand to gain and lose, including women, indigenous and local actors, and youth. Key participatory tasks include determining representation; assessing conditions, interests, and desired outcomes; designing the intervention; developing and negotiating alternatives; assessing risks and tradeoffs; mobilizing people and resources; and ongoing monitoring, reflection, and correction (Blythe et al., 2018; O'Brien & Sygna, 2013).

Many approaches exist for mobilizing to create transformative social change. Participatory action researchers, for example, experiment with disrupting power relations to democratize society (Bastiaensen et al., 2021). A growing branch of action research focuses on accelerating transformations (Bradbury et al., 2019; Fazey et al., 2018; Tschakert and Deitrich, 2010), including movements across education and investment sectors to divest from harmful economic activities (Ayling & Gunningham, 2017). Alternately, indigenous movements for just transition organize around harmony with nature and respect for the sacred; rights, law, self-determination, and territorial and food sovereignty; languages as vehicles for knowledge and wisdom; rejection of toxic industries and nature as a commodity in favor of regenerative economies; and physical, psychological, emotional, and spiritual decolonization as part of healing historical trauma (Indigenous Environmental Network, 2017). A variety of socio-technical and socio-ecological studies of 'tipping points' provide additional models and insights regarding the enabling, sensing, and triggering of transformation in SES (Lenton et al., 2022).

Transformative conservation also requires that scientists examine their own politics. Some have argued that scientists have a special responsibility to speak out about the catastrophic dangers of future environmental conditions and disasters (Bradshaw et al., 2021); or that they should engage in 'uncompromising, explicit advocacy for radical transitions in core attitudes and processes that govern our interactions with the biosphere' (Martin et al., 2016, p. 1). The urgency of scientists finding their voice has increased because of the misogyny, racism, and market fundamentalism that many right-wing governments combine with violent anti-environmentalism (Büscher & Fletcher, 2019).

4.3. Link societal with personal ('inner') transformation

The action required for transformation emerges from myriad psychological, sociological, and anthropological factors, including people's beliefs, values, worldviews, identity, interests, loyalties, ethics, and routine behaviors (O'Brien, 2012). Transformative conservation requires that people reorient how they perceive and behave in relationship with nature through personal or 'inner' transformation. This recommendation has less relevance in many societies, especially indigenous ones, that already live in accord with the belief that human well-being is reciprocal and interdependent with non-human well-being (Kothari et al., 2019; McElwee et al., 2020b). In those societies organized around growth as the dominant economic paradigm, however, such work remains critical. Indeed, this recommendation addresses several fundamental challenges identified above, such as moving past the bifurcation of people and nature; integrating relational values; complementing reductionist science with systems science; linking individuals in large-scale change; and creating post-growth narratives and pathways for development. While this area of transformation is underdeveloped in the literature, it is growing rapidly (Wamsler et al., 2021).

Inner transformation requires developing one's sense of self and connectedness through a process of self-discovery (O'Brien & Sygna, 2013). With regard to conservation, enhanced attention to human–nature connections can take material, experiential, cognitive, emotional, and philosophical forms (Ives et al., 2018), as experienced through formal education; social advocacy, action research, and action learning; or spiritual retreats involving

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mindfulness practices, meditation, or vision quests (Davis, 1998; Mezirow, 1996; Tschakert & Dietrich, 2010; Wamsler, 2019). This personal work is notable insofar as it overlaps with the aforementioned relational values that are necessary for transformative change (Chan et al., 2018). A recent literature review found that mindfulness, in particular, positively affects human–nature connections, consumption and environmental behavior, non-materialistic values, attention to equity, social activism, adaptive capacity, and subjective well-being (Wamsler et al., 2017). The connections between inner transformation and sustainability vary widely, and ongoing work is further exploring how factors such as the perception of risk, attachment to a place, gender, altruism, past action, and worldviews mediate these linkages (Brink & Wamsler, 2018).

Inner transformation holds unique significance insofar as it engages three deep leverage points for intervening in and reorienting a system (Ives et al., 2020; Woiwode et al., 2021). These leverage points include the goals of the system, the mindset or paradigm out of which the goals arise, and the power to transcend paradigms. A paradigm and goals guide the intent of a system; the intent in turn orients the design of structures and institutions, which are more superficial; and these structures and institutions in turn establish and manage feedbacks and parameters, which are the most superficial elements of a system (Abson et al., 2017).

Putting these three deep levers into productive motion requires coupling individual transformation with collective action (per recommendation 2). This needs to occur across multiple scales of conservation, and complement rather than substitute for struggles against other structural inequalities. Numerous organizations and social movements are forging such linkages between inner transformation and large-scale political change, including the creation of transformative spaces that protect and nurture such work (recommendation 5). For example, the Faith for Forests (2020) and the Extinction Rebellion (2019) movements argue that biodiversity loss and climate change are spiritual crises, and seek to use interfaith unity, ritual, and ceremony to drive conservation and justice. Reciprocally, societal transformation hinges upon how well families, workplaces, communities, institutions, and government support and amplify inner transformations in people's relationships with nature (Armitage et al., 2008; Gosnell et al., 2019). How to integrate inner transformations with sustainability policy and projects remains a cardinal area for further research (Woiwode et al., 2021).

4.4. Update how we plan for transformation

The planning of a conservation project begins to operationalize the preceding recommendations. Numerous insights exist with regard to conditions that help enable projects, good design practices, methods for managing uncertainty, and building strategies for adaptation into a project from the start. In these regards this recommendation speaks to several of the initial criticisms, including the need to ensure that projects include the full range of stakeholders and knowledge in the system, to devote more attention to scale, and to acknowledge and incorporate rather than downplay uncertainty.

Regarding conditions that help enable a project to succeed, conceptual familiarity with the application of SES concepts and a soft systems approach serve as cornerstones (recommendation 1). Other notable conditions include strong support from convening agencies, including their willingness to learn and adapt; a sustainable financial mechanism to underwrite the project over the long-term, whether through government, business, or both; and competence with supporting skills (see recommendation 5) (Magro & van den Berg, 2019; Wiek et al., 2011). Furthermore, a portfolio approach that involves a series of complementary policies, projects, and funds engages multiple fronts, creates synergies, and catalyzes a holistic shift (Magro & van den Berg, 2019). Polycentric governance approaches involving multiples sites and scales of overlapping systems, as developed in Ostrom's work, also facilitate transformation. Such formations spread risk and encourage buy-in from multiple actors (Ostrom, 1990), increase the institutional robustness of governance systems (Anderies et al., 2004), and enhance the general resilience of ecosystems (Carpenter et al., 2011).

Specific design elements also improve transformation projects. The inclusion of in-depth, place-based indigenous and local knowledge is essential to comprehensively understand human relationships with nature, generate visions of transformation based on multiple values, and increase the chances of achieving just, equitable, and sustainable outcomes (Lam et al., 2020; McElwee et al., 2020b). Scale is another key element. Regulatory, management, policy, and governance interventions often focus on single scales that are chosen for expedience rather than efficacy, and do not match the scales of social and ecological processes (Garmestani et al., 2020; Schultz et al., 2019). In this regard panarchy, described earlier, provides a valuable conceptual model and planning tool that highlights the cross-scale interdependencies and feedbacks inherent in system's functioning and transformation (Garmestani et al., 2019).

Emerging methods and tools also improve transformation planning. These include variations on scenario planning, such as recrafting climate change and biodiversity narratives. Existing narratives frequently bifurcate people and nature, depict inevitable decline, or advocate for simplistic technocratic fixes. Counternarratives foster transformation by positing alternative futures that increase understanding of SES, respect pluralism, emphasize human responsibility, and promote collaboration (Wyborn et al., 2020). Ongoing work on a Nature Future Framework incorporates multiple values and scales, and co-produces knowledge in constructing and deliberating biodiversity scenarios (Pereira et al., 2020). Of this initiative's three scenarios (Nature for Nature, for Society, and for Culture), the third envisions an approach to conservation that is similar to the concept developed in this article.

Assumption-based planning moves beyond scenario planning, and is another emerging field. These approaches acknowledge the deep uncertainty inherent in complex problems, which cannot be reduced by gathering more information and is not subject to statistical analysis (Shortridge & Camp, 2018; Walker et al., 2013). Rather than focusing on high-plausibility futures, they examine each assumption that underlies a decision, and what would happen if the assumption were false. The resulting enhanced awareness of uncertainties allows planners to commit to short-term actions while keeping future options open; to maintain enough flexibility to connect short- and long-term goals in different ways than they anticipated at the start; and to rapidly take action based on monitoring (Walker et al., 2013).

Within this field, the dynamic adaptation pathways approach incorporates systems properties such as feedback loops, thresholds, emergence, and scale, as well as experimentation, mistakes, and learning (Elmqvist et al., 2019; Hasnoot et al., 2013; Wise et al., 2014). These pathways help practitioners and stakeholders to better identify opportunities for intervention, actions

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that are unlikely to have undesired outcomes, actions that would lock in a given trajectory of change, and the timing of actions (Walker et al., 2013). In transformation work, this approach has demonstrated the importance of understanding how historical path dependency, unequal access to resources, divergent values, knowledge biases, and power dynamics situate people in relation to multiple, intertwined, often competing pathways (Fazey et al., 2015; Werners et al., 2021).

4.5. Facilitate shifts from diagnosis and planning to transformative action

Vulnerability assessments, policy frameworks, strategic plans, and funding sources are essential prerequisites – but not replacements – for action in the field (Biagini et al., 2014; Wise et al., 2014). Global scientific institutions that specialize in environmental change, however, often remain overly focused on updating assessments and improving modeling of future changes, and shy away from examining social and political obstacles to transformation (Lahsen & Turnhout, 2021). These institutions fear that entering such debates will erode their credibility and authority, and will undercut the idea that global consensus on scientific issues is both possible and desirable (*ibid.*). Within government and conservation organizations, prosaic considerations also stymie the shift toward action. These include the desire of new administrations to establish their own foundations for policy; the turnover of staff who have institutional memory of existing studies and resources; and the political benefit and ease of launching a new endeavor, in contrast to the persistence and continued funding necessary to complete an existing, often no longer glamorous one. Accordingly, this recommendation responds to the critical concern that transformation initiatives seldom pay sufficient attention to the everyday political struggles necessary to force and then institutionalize change. It spans participation and the co-production of knowledge, building and leveraging political networks, and mobilizing collective action (see also recommendation 2).

In this context, we argue that transformative conservation requires finding ways to shift diagnostic and planning resources into innovative projects and corresponding monitoring arrays; institutionalizing advances achieved; widely sharing the accrued wisdom and tools; and weaving the expertise of the network back into the next round of intervention. As a first step, establishing such cycles of continuous improvement involves building competence in participatory action research (recommendation 2), including establishing safe spaces for experimentation and learning, described further below. In this context, the concept of double and triple loop learning aids practitioners and stakeholders in interrogating not just how a system functions (single loop), but the assumptions (double loop) and the underlying beliefs and values (triple loop) that frame and inform decisions to begin with (Roux et al., 2008). Similarly, learning loops help groups reach 'social tipping points', whereby small social changes lead to rapid and transformative uptake (Otto et al., 2020). Such critical approaches to learning help shift conservation practice from minor to transformative change.

The concept of a 'competence' provides another useful model for transformative conservation. A competence combines the knowledge, skills, and attitudes necessary to successfully perform tasks and solve problems (Wiek et al., 2011). A foundational list of competences for sustainability transitions includes systems-thinking, anticipatory, normative, strategic, and interpersonal (including mediation) competencies (*ibid.*). This last competence includes conflict resolution methods and facilitation and mediation skills, which are a critical component of the work (Maguire and Boiney, 1994; Ostrom, 1990; Wiek et al., 2011). A review of inner transformation competencies identified five 'clusters' of skills and qualities, including openness, self-awareness, and reflection; compassion and empathy; perspective-seeking and relationality; agency, empowerment, and sense-making; and values-based courage and engagement (Wamsler et al., 2020). Similarly, a list of 'essentials' for transformation and climate research includes working within systems and with normative aspects, focusing on practical knowledge, and being reflexive, along with six other topics (Fazey et al., 2018).

Transformative spaces also accelerate learning and action. Such spaces are especially important for inner transformation, which involves examining and questioning one's identity, values, and worldviews (Woiwode et al., 2021). Variously named transformation labs, action research co-labs, peer mentoring networks, and other venues provide places for people to express differing views; envision and experiment with alternate futures; reflect and learn; coproduce transdisciplinary knowledge; and cultivate leadership (Bradbury, 2020; Charli-Joseph et al., 2018; Pereira et al., 2015). The Science for Climate Action Network, for example, employs social learning experiments that involve community science, effectiveness indicators, and artificial intelligence to produce and apply knowledge that links adaptation, mitigation, and sustainable development (Moss et al., 2019).

Conservationists also need to institutionalize advancements for transformation to continue once a proximate intervention concludes. Often rooted in SES frameworks, landscape approaches to conservation offer one approach to establishing governance arrangements based on greater pluralism, participation, and equity. While not a panacea for unequal power relations, these approaches directly examine diverse values and negotiate the multiple competing uses. They thereby increase the interpersonal relationships and collaborative capacity necessary for small collective actions to yield new, formal governance institutions and corresponding large-scale, sustainable stewardship in historically contested, socially heterogeneous landscapes (Cockburn et al., 2019; Winkler & Hauck, 2019).

4.6. Improve the ability to adjust to transformation as it occurs

Facilitating transformative conservation requires not only good planning (recommendation 4) and implementation of a project (recommendation 5), but ongoing long-term monitoring of and engagement with the system to ascertain whether it is trending in the desired direction. Such effectiveness monitoring, and subsequent evaluation of ecological and social impacts followed by necessary adjustments, often requires data sets that extend over many years or even decades after project completion, depending on the scale and depth of the intervention. This long time horizon is the context for recommendation 6. The recommendation addresses technical criticisms about insufficient monitoring, foregrounds the importance of adaptive governance, and devotes attention to both conservation efficacy and undesired outcomes in situations of rapid change.

As a transformative initiative moves into monitoring, evaluation, and adjustment, practitioners and stakeholders will continue to face challenges involving system complexity, self-organization, and the emergence of novel properties. Part of this stems from people within the system continuing to exert new influences and inflect the trajectory of past interventions, through livelihood practices as

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well as adaptive management. Additionally, observed climate changes frequently outpace modeled projections (O'Reilly et al., 2012). For both reasons transformative conservation must incorporate procedures for adjusting rapidly to new dynamics and trajectories. For example, aforementioned planning approaches help to accommodate deep uncertainty (recommendation 4). Narratives of change also contribute to adaptation by changing perceptions of human–nature interaction (Paschen & Ison, 2014), and to long-term impact assessment by considering the cultural complexity that underlies maladaptive system structures (Kalra et al., 2021). And the ways that people learn to observe, process, and apply new information during monitoring can bring greater flexibility and nimbleness to praxis, including specifying steps for collaborative adaptive management (Armitage et al., 2008; Hertz et al., 2021), and maximizing opportunities for learning (recommendation 5).

Monitoring provides the requisite information for determining divergence from expectations. Yet monitoring transformation poses numerous challenges. First one must determine what to measure to provide meaningful information. This hinges on clearly conceptualizing the system, describing desired outcomes, identifying what data sets will be available or possible to collect, and the availability of long-term funding. System transformation poses particular challenges insofar as it often involves measuring changes at multiple scales across different sectors; measuring a series of parallel, sequential, and/or multiple-stage projects; and tracking effects that manifest outside the project boundary (Savage et al., 2020). Stakeholders should play a critical role in shaping these processes, given that the people living and working within a system will have a place-based understanding and practical ability to operationalize conservation work. Multilevel monitoring is one approach that leverages partners and networks to encompass several spatial and temporal scales, and helps with anticipating and tracking transformation (Schultz et al., 2019).

Assuming one has a monitoring system in place, innovations in resource management and emergency response can also catalyze transformation. Adaptive governance is a burgeoning field that involves the willingness and ability of laws and institutions to accommodate environmental change and transformation while maintaining sufficient psychological, social, and economic stability and predictability (Craig et al., 2017; Garmestani et al., 2019). The ability to perceive transformation is equally crucial. Conservation practitioners and stakeholders often have difficulty in recognizing and then navigating alterations to system structure and novel system properties as they emerge (Moore et al., 2018). They can improve their ability to facilitate transformation by increasing their institutional reflexivity, understood as the 'capacity to see, interrogate, and reimagine the taken-for-granted structures that sustain current systems' (Moore et al., 2018, p. 3).

The technique of 'horizoning', for example, specializes in situations of runaway change where abrupt departure from historical baselines makes it exceedingly difficult to project the future (Petryna, 2018). In the western United States, the size and intensity of wildfires have dwarfed projections and rendered impossible the historical management strategy of suppression and containment; accordingly, the Federal U.S. Forest Service is revisiting its own basic understandings of fuels and fire spread to rethink what responses are efficacious and to improve judgments in the field (*ibid.*) Such horizoning work produces local and highly practical research that interrogate and recast how a runaway future is understood as an object of knowledge and intervention (*ibid.*).

5. Conclusion

'Transformative change' holds marked appeal because it connotes action at a scale, scope, and depth that is equal to the biodiversity and climate crises. It appears to have the potential to succeed where past efforts have languished, and to fill an unmet need for hope and mobilization. Part of its appeal is its malleability: people can imbue the concept with whatever meaning they choose. Yet this same malleability can undercut the theoretical and practical advances that the concept provides.

The recommendations for transformative conservation presented in this article seek to address this danger. The work includes beginning with a soft systems approach to avoid oversimplification (recommendation 1), while guarding against the concept becoming too difficult for practitioners and stakeholders to use (recommendation 5). Such an approach recognizes that people and nature together make up ecosystems, and requires attention to the potential integration yet intrinsic limitations of hard systems interventions in complex, self-organizing systems (recommendations 1, 4, and 6). The work also requires engaging the unavoidably social, political, and economic context of conservation, and putting power, justice, and equity at the center of projects (recommendation 2). This orientation necessitates analyzing and engaging the site and issue-specific terrain of conservation politics (recommendations 2 and 5), rethinking individual relationships with nature (recommendation 3), and linking personal transformation with collective action (recommendations 2 and 3). Ultimately, we seek to help ensure that transformation in the name of conservation actually preserves biodiversity while securing sustainable and regenerative livelihoods.

The recommendations also respond to potential dangers associated with ABCTs, which provide the goals for many contemporary conservation initiatives that seek to catalyze transformative change. In particular, natural climate solutions (including forest-based carbon emission offsets) and nature-based solutions provide key mechanisms for achieving such targets, yet can introduce technical, ecological, and social problems that undermine their desired benefits. The recommendations respond not from a tactical standpoint, but from the perspective of strategically facilitating transformations. The recommendations span systems pedagogy, political mobilization, inner transformation, and planning, action, and continual adjustment. Through the review of established and emerging concepts and tools, we hope to help practitioners and stakeholders within and beyond the IUCN community to create change across multiple scales.

We recognize that our package of recommendations has its own limitations. What we propose requires a wide range of competencies involving theoretical, technical, and political dimensions of transformation. Such a range is rare in a single individual, and typically requires building a high-functioning team. Furthermore, recommending that conservationists partner with political movements often prompts the response that such a stance will undercut the power of science as an objective arbiter of conservation, ignoring longstanding research that demonstrate how science itself is a political and economic endeavor (e.g. Latour, 1987). This concept remains anathema in many conservation circles and limits the adoption of the second recommendation. Finally, inner transformations are an emerging and unfamiliar field of inquiry. We have found that conservationists with a predilection for instrumental control or hard outputs often dismiss this third recommendation, which drastically undermines the value of the package as a whole (recall that this

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recommendation intervenes at the three deepest leverage points in a system). Nonetheless, we hope this contribution spurs further dialog, debate, and specification of how conservation can transform ecosystems in ways that avert today's interlinked biodiversity and climate crises while ensuring participation and justice.

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Author contributions.

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