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Measuring success in rewilding? Coping with socio-ecological uncertainties in rewilding projects

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Abstract

What is success in rewilding, from a social perspective? Scholars of policy suggest that the production of success is a claim, not an objective state. I first examine procedural approaches to enacting success, since these are the only kinds of success criteria that exist specifically for human dimensions of rewilding or elements of rewilding (e.g. translocation). I then consider the kinds of criteria of success implied or recommended by various approaches to theorising human dimensions of socio-ecosystems or human dimensions of conservation more generally. I divide these into two kinds, approaches that focus on socio-ecological system properties, and approaches that focus on the quality of human-environment, human-wildlife and human social interactions. Next, I point out that the choice of measure of success from these three broad approaches—procedural, system-level, or interaction-focused—can itself be a process proper to the social and management aspects of rewilding projects, and as such can also be evaluated. I end with a critique of evaluating success in rewilding. I suggest that measures of success can ironically lead to project failure, but that qualitative judgments embedded in local worldviews can allow projects to evolve and continue. Rather than aiming for successful states, rewilding might focus on helping people cope with and develop psychological and social resiliency to the unknown and the unpredictable.

Commenté [SAHI]: Some text missing here.

Introduction

What does it mean for rewilding to be successful? Many rewilding projects never define short-term fixed goals, making assessment of their progress, and thus assessment of their success or failure, difficult. As I have shown in previous work with colleagues (Root-Bernstein et al. 2018), this obfuscation of success is deliberate, and is critical to maintaining the place-based, adaptive, vision-led, long-term aspects of most rewilding projects. Indeed, it is critical to maintaining these projects at all. Rewilding projects that were integrated directly into government conservation services, and thus depended on short-term measures of success and were less motivated by personal visions, also were more likely to be terminated at the first sign of social conflicts or other difficulties (Root-Bernstein et al. 2018). I posit that there is thus a potential trade-off between developing standard measures of success and promoting and generating long-term social acceptance and resilience in rewilding contexts.

In this chapter I focus on the social elements of rewilded socio-ecological systems, or the “human dimensions” of rewilding projects. I will examine three kinds of measure of success that can be used to evaluate whether “human dimensions” of rewilding are moving in the direction that project managers or other stakeholders want and intend. I first examine procedural approaches to enacting

success, that is, best-practice processes and recommended steps that are intended to guarantee successful outcomes, since these are the only kinds of success criteria that exist specifically for human dimensions of rewilding or elements of rewilding (e.g. translocation). I then consider the kinds of criteria of success implied or recommended by various approaches to theorising human dimensions of socio-ecosystems or human dimensions of conservation more generally. I divide these into two kinds, approaches that focus on socio-ecological system properties, and approaches that focus on the quality of human-environment, human-wildlife and human social interactions. Next, I point out that the choice of measure of success from these three broad approaches—procedural, system-level, or interaction-focused—also needs to be evaluated and reflected on. As a second iteration, one may also evaluate and assess the success of decision procedures for selecting success criteria for the human dimensions of projects. This is pertinent since it would be easy for a powerful social group to select project success criteria that emphasize their own interests to the detriment of other interests. Thus, the roles and use of power within decision-making processes about what success will consist of is an important, if often overlooked, issue. Here again there are multiple approaches to select between in order to assess if power in decision making is being used “successfully”. Finally, I end with a critique of the need to assess success in rewilding. I suggest that objective, narrow and precise measures of success can ironically lead to project failure, but that qualitative, judgement-based evaluations, especially when embedded in local worldviews that are not fully translatable into scientific or bureaucratic terms, can resist premature declarations of failure. Rather than expecting rewilding projects to achieve some kind of successful state, we might focus on helping people cope with and develop psychological and social resiliency to the unknown and unpredictable aspects of rewilding, and nature itself.

Procedural aspects of enacting success

A variety of theorists of policy and implementation argue that project or programme success is a claim rather than an objective state or outcome (Hoag 2014; Webber 2015). Factors affecting how claims of success are formed include the choice of evaluation metrics, which can be selected to ensure attainment of something appearing to be positive, misalignment of different criteria of success for different actors, or assumptions that an ultimate goal necessarily follows from attaining a proximate goal. We should not understand claims of success as necessarily dishonest or as misrepresentations. Rather, they are attempts to approximate the measurement of a state—success—which is actually multidimensional, complex, perspective-dependent, and often temporally unpredictable. For example, following best-practice guidelines is a popular way to help support claims of success. Best-practice guidelines provide measures or tick-boxes for a series of proximate goals, implying that the ultimate goal is likely to have been attained as the outcome, even if it is not or cannot be measured (or even if the outcome appears, by some metric, to be unsatisfactory). The claim of success in the case of following best practice guidelines is thus a claim about the relationship between proximate goals and ultimate goals.

This makes procedural approaches to assessing success particularly apt for rewilding, which often does not have short- or medium-term goals or predicted outcomes. To my knowledge, the only measures of success specifically designed for rewilding are procedural in nature. The IUCN Rewilding Thematic Group published a set of “universal guidelines for rewilding” (IUCN 2019; see Chapter 18 of this volume). They aim for consensus, and are thus broad, inclusive, and non-prescriptive. Regarding social and economic aspects of rewilding, three of the principals stand out as particularly relevant and a fourth may have additional implications.

Commenté [SAH2]: Can this highlighted section be made clearer – is this a fourth form of success evaluation? Or is this highlighting that the process of choosing one of the three approaches above also needs to be evaluated/reflected upon? It may just be a case of changing to something like “it is important to also reflect on why a certain approach is chosen over another, acknowledging roles and use...”

I think this introductory paragraph can be made a little clearer overall. Perhaps earlier in the paragraph spell out the three approaches, like... “In this chapter I will examine three potential approaches to evaluating success relating to the human elements of rewilding. The first is...” etc. Just bearing in mind that some readers may not be familiar with project management tools/processes.

6. *Rewilding requires local engagement and support.* This guideline emphasizes that rewilding projects should engage stakeholders in ways that are participatory, transparent and inclusive. The goals of engagement should be to take into account concerns around human-wildlife conflicts and the perturbations caused by natural processes, and to educate the public about nature.

7. *Rewilding is informed by both science and indigenous and local knowledge.* Although there are many ways of engaging with indigenous and local knowledge (ILK), the guideline does not prescribe any particular methods. This guideline emphasizes mutual learning between local or indigenous groups, scientists, and managers, drawing on natural history and historical ecological knowledge, for the purposes of generation of new knowledge and adaptive management.

10. *Rewilding requires a paradigm shift in the co-existence of humans and nature.* Although quite vague about what paradigm this would actually be, this guideline indicates that rewilding projects should be aware that rewilding implies “transformative change” towards new ways of coexisting with nature. Beyond implying support for innovative solutions to human-wildlife conflict, it gives the green light to those who wish to integrate rewilding with social and economic change to support sustainability.

4. *Rewilding recognises that ecosystems are dynamic and constantly changing.* While this guideline is focused on calling for management (or lack of management) to promote and allow autogenic and allogenic disturbances, successional processes, and species’ range shifts, it would seem to also have implications for social and economic processes in and around rewilding areas. In order to allow rewilded ecosystems to evolve spontaneously, social and economic structures and processes will also need to be flexible.

Additionally, the Human - Wildlife Interactions Working Group of the IUCN SSC Conservation Translocation Specialist Group has published a report on “Working with people towards conservation solutions” (Consorte-Crea & Bath 2020). Their recommendations are shown in Box 1. These emphasise that good or successful engagement with social aspects of species translocation—a common element of rewilding projects—involve listening and engaging local communities in decision making over the long term, as well as trying to fully consider the complexities of human emotions, attitudes, actions, and social dynamics. Ethnographic methods that produce rich qualitative material over periods of months (at a minimum) are mentioned as useful for this approach.

<Box 1 here>

System-level perspectives: moving towards optimal socio-ecological systems?

Currently, much emphasis is placed on systems thinking and system-level characteristics like resilience for social and environmental change management (e.g. Laspidou et al. 2020). The IUCN Rewilding Guidelines provide some qualitative descriptive indications of desirable system properties of socio-ecological systems. However, we need to use more specific models or frameworks to define socio-ecosystem characteristics that can be measured to ensure that rewilding is moving towards desirable parts of socio-ecological parameter space. There are several frameworks and models to draw on to find suitable measures.

Resilient trait networks

The ecological literature on ecosystem networks has inspired similar approaches for socio-ecological systems, in which human interactions with other species are modelled as an integrated set of interactions (Sayles et al. 2019). Just as it is unclear in ecological modelling that it is possible for all kinds of functional traits or functional interactions to be optimally resilient at the same time—because this is too complex to assess, and because each set of traits may be expected to be structured independently—the key question seems to be *which traits should be structured in resilient ways* to ensure socio-ecological system stability/ resilience? Although quantification of socio-ecological network structures might be used to assess rewilding success *post hoc*, it is less clear how to actively design or manage socio-ecosystems in order to develop these structures among particular types of traits or interactions, which traits and interactions one should focus on, or what a network that is part-way to developing the correct structure would look like.

Panarchy

The idea that networked interactions are key to understanding socio-ecological dynamics also occurs in other kinds of theory. The panarchy model (Holling & Gunnerson 2002), which proposes a specific cycle of socio-ecosystem change, also considers “connectedness” to be one of three variables controlling the movement through this cycle. Unlike network theory, however, Holling & Gunnerson (2002) do not believe that connectedness *causes* resilience, as the two are considered to be two separate, parallel variables. In the panarchy model, resilience is the ability of the system to absorb shock, which declines as biological legacies accumulate and reach some exogenously-determined peak. Biological legacies, in the panarchy context, refer to accumulations of biotic materials such as species, seeds, or soils. Upon reaching the peak the ecosystem is fragilized due to its incapacity to further accumulate biological legacy, leaving it open to collapse from external shocks. The role of connectedness in the panarchy model is to control the level of endogenous vs. exogenous control of a given system. Under low connectedness, associated with impoverished and randomly structured socio-ecosystems, endogenous control is low over system dynamics and exogenous control is high. As connectedness increases, increasingly rigid aggregates of components are formed, such that endogenous control over system dynamics is high and exogenous influence is low. This, however, is a relatively negative development because it is correlated with (although does not cause) loss of systemic resilience. Since the panarchy model proposes a constant cycle of socio-ecological change, it would seem that, according to this model, phases in which designers and managers cannot influence system dynamics should be expected. While they may be tempted to regain control by working towards highly complex and integrated socio-ecosystems, these should also be expected to be fragile and rigid in their responses to exogenous shocks.

Telecoupling

The connectedness measure in panarchy seems somewhat contradictory to the claims of the telecoupling literature. Telecoupling is an empirically-driven approach to analysis of environmental and social dynamics, which makes the point that causes of socio-ecological change are often remote to the site of change, especially when economic drivers may affect human behaviour (Liu et al. 2019). Thus endogenous dynamics can be strongly controlled by exogenous connections (Friis & Nielson 2019). Better integration across telecoupling, panarchy and socio-ecological network modelling would assist assessments of how connectedness across scales affects change in socio-ecological systems.

Land-use allocation

Another set of models of optimal socio-ecological states are not primarily concerned with cross-scalar connections or their network structures. These are land-use allocation models, often but not always drawing on the IPBES Nature's Contributions to People (ecosystem services) framework (which I discuss more below). In such models, given a set of exogenous variables such as climate or soil, land is allocated to different uses (including nature conservation) in order to maximize specific benefits and reduce specific costs (Deng et al. 2016). In terms of such models, rewilding is successful if it forms part of an optimal allocation of land-uses within a landscape.

Desireable interactions perspective: promoting particular qualities of human-wildlife coexistence

Other perspectives on what makes good or desirable “human dimensions” of rewilding projects focus not on system-level territorial or network structure, and more on the qualities or values of specific kinds of interactions, often between humans and wildlife but also between humans or between humans and the environment more broadly.

Stakeholder negotiations

One way to define success in a rewilding context would be the negotiation of an agreed management plan supported by a majority of stakeholders. Others might argue that majority support, although a venerable democratic concept, is inadequate as a measure of legitimate or successful negotiation, and would rather prefer to see evidence that principles of equity and justice are being met (Greenberg & Cohen 2014; Osborne et al. 2021). Lack of success could take the form of social and political conflicts, legal actions, human-wildlife conflict, and violence against humans and property. The IUCN Human-Wildlife Interactions Working Group makes this clear and also provides some recommendations for the methods to achieve the desired management plan outcomes (Consorte-Crea & Bath 2020). However, one might also argue that avoiding conflict will only lead to stasis rather than transformative change (e.g. Skrimizea et al. 2020). Evidently, the choice of indices of success in terms of social support or agreement and conflict avoidance is highly complex. To further complicate the issue of what to measure, there are alternative framings of what makes a desirable or good set of human social interactions that go beyond social and political concerns to explicitly consider the quality of human interactions with other species.

Service reciprocities

The Nature's Contributions to People (ecosystem services) framework provides a list of kinds of service that nature provides to humanity, including providing air, water, natural resources, cultural inspiration, and so on. These are designed to be measured and subject to assessment. There are different ways to quantify the provision of ecosystem services, and in all cases it is considered optimal to provide the largest quantity of services possible (Diaz et al. 2018). Some researchers have also asked how people make contributions to nature through management (Comberti et al. 2015). While these contributions are not the object of quantification exercises in the Nature's Contributions to People framework, there is no reason that similar measures could not be developed. Similarly to the human contributions to nature concept, other approaches to human ecology have suggested that humans could even be considered to have megafaunal ecosystem processes to contribute to ecosystems, forms of which may currently be reduced or missing in some habitats (Root-Bernstein & Ladle 2019). Thus, it might be possible to develop an assessment framework in which humans are active endogenous parts of the ecosystem, both receiving and providing ecosystem processes or services. Although this may sound promising as the basis for a “paradigm shift” in relations to nature (IUCN 2019), a service tit-for-tat between humans and other

Commenté [SAH3]: It could help with clarity to include sub-headings for the types of interactions above each below paragraph? E.g. “Stakeholder support”, “Valuing Nature's Contributions to People”

species strikes me as intractable and difficult to assess. Reciprocity-based interspecies relationships, in which humans and other species exchange roles, favours, or services, do, of course, exist in many societies. However, many of the reciprocal acts are symbolic and derive their meaning from an ontology (worldview) that permits interpretation, interconversion, and negotiation of interspecies debts in social terms, e.g. in the same terms as between human community members or kin (e.g. Willerslev 2007). Unfortunately, these symbolic acts are unlikely to travel well outside their worldviews to form universal best-practice solutions (Webber 2015).

Sustainable Development

A sustainability approach focused on the Sustainable Development Goals (see <https://sdgs.un.org/goals>) could be used to assess the qualities of the human dimension of rewilding projects. The difficulty in using the SDGs for assessment is the large number of goals that should be pursued and optimized simultaneously, some of which are not clearly related to rewilding. At the same time, the SDGs, unlike Nature's Contributions to People, are not closely associated with a methodology of quantification and evaluation, as they are less the subjects of technocratic command-and-control, and more subject to political negotiations.

Coping, tolerance, and resilience

Finally, a promising approach that can deal with some of the challenges of the previously discussed frameworks and models, is to consider the coping strategies and community resilience of stakeholders involved in rewilding. Strangely neglected in the conservation literature, coping mechanisms refer to a range of social and psychological methods for managing, minimizing, avoiding, tolerating, compensating for, changing, or accepting the stress, negative emotions, loss and damage caused by risks (Gogoi 2018). It is thus broader than risk tolerance, which implies having or expecting minimal psychological or material damage from a risk, and is often lowest precisely when dealing with the unknown (Carter & Linnel 2016). Coping strategies may involve tolerance, but can also include ways of living with uncertainty and recovering from harms with significant impacts. The environmental and existential risk literature argues that the best response to risk is to pro-actively develop personal and community-level networks and capacities to learn adaptively from past situations and implement solutions to mitigate or overcome harms (e.g. Paton et al. 2008). Several social characteristics promote community resilience to risks, including social equity and experience with collective action (Carpenter et al. 2012).

An advantage of the coping and risk resilience approaches is that they do not aim for or measure the attainment of some kind of optimal or perfect form of human-wildlife interaction, or socio-ecological state. Rather, life and the world are always characterized by a series of unpredictable and uncontrolled events. This approach seems to fit well with the goals of rewilding: a rewilded landscape is likely to be less predictable and under less anthropogenic control than a conventionally managed one. The unpredictable and unknown, perhaps novel, transformations that rewilding implies disturb some commentators, who thus judge it to be unjustifiable (Rubenstein & Rubenstein 2016). Some research suggests that tolerance of ambiguity and uncertainty is a personality trait and thus varies between individuals (Furnham & Marks 2013). Coping strategies also interact with the 'locus of control' or tendency of individuals to think either that they are in control of events, or that events are controlled by outside forces (Thiruchelvi & Supriya 2012). While to my knowledge not studied in relation to environmental change or rewilding, the psychological concepts of tolerance of ambiguity and locus of control seem relevant to how individuals and groups deal with unpredictable species, climate, and socio-ecological change. Developing the coping and resilience capacities of

individuals and communities may make more palatable a tradeoff between immediate and salient everyday risks that reduce remote but more severe risks.

Creating social change: science, communication, and power relations

Frameworks of systemic properties or interaction qualities can be used to argue for and justify particular interventions intended to make rewilding successful. The implementation procedures for arguing for and coming to agreement about rewilding interventions can also be evaluated.

Garmestani et al. (2020) provide an account of using panarchy as a scientific and public communications framework to achieve change in ecological management and policy. The authors sought to enact change to prevent encroachment of a native tree onto native grasslands (Garmestani et al. 2020). In this case, the panarchy model's "imperative of destruction" was interpreted as justifying using fire management rather than tree felling as a means to control the "invasive" native trees "encroaching" on grasslands. Arguably, this reframing of fire as both destructive *and* good is a public communications success. Yet it strikes me that panarchy could just as easily be instrumentalized in defense of woody plant encroachment dynamics, for example by reinterpreting the destruction of prairies and their structural reformulation as woodlands as a natural process of ecosystem transformation. By discussing this case I am not trying to specifically single out panarchy as either excellent or problematic as a framework for developing changes in conservation practice. It is not unusual for some of the most vague, underspecified, or multiply-interpretable theories, frameworks, or ideas, to be widely adopted in guiding human dimensions of conservation interventions (Root-Bernstein 2020). Some might argue that rewilding itself, and the IUCN guidelines and recommendations discussed in the first section, are also ideas or frameworks that can be reinterpreted in many ways to justify a broad range of very different interventions and goals.

In Root-Bernstein (2020) I argue that the success of some very vague models of human dimensions of conservation can be traced to a lack of formal social theory in conservation on the one hand, and a reluctance to theorize power relations on the other hand. The above-cited tree encroachment case study seems to illustrate this. It is representative of many conservation-related science communication approaches, which frame a certain group of scientists' particular interpretations as "correct" and all other interpretations and preferences as existing "because the public has not yet been sufficiently informed". This frames the evolution of socio-ecological systems as an ontological conflict between different visions of the real and the possible. In this view, scientific managers make successful interventions in human dimensions when they impose their knowledge and values, especially by persuasion (Root-Bernstein 2020). The persuasive communication methods employed mask the fact that this is a case study in exerting power to shape reality and impose one's will on other people.

Despite the vagueness and open-ended flexibility of rewilding, or of the human dimensions frameworks that it may choose to draw on, it is not inevitable that rewilding projects and programmes need fall into the same trap of not developing or using ideas and analysis of how to best negotiate power, and of thus enacting power in a way that risks being controlling, heavy-handed or insensitive. Various rewilding projects use co-production and participative-style methods, to explicitly work towards socio-ecological reform and to develop shared visions with stakeholders (Zamboni et al. 2017; Root-Bernstein et al. 2018). There is a large amount of literature arguing for and justifying co-production and participation methods as superior to other modes of working with communities (Turnhout et al. 2020). This literature, while useful and well-meaning,

also does not provide a theory of social power, but often contents itself with unrealistic platitudes to the effect that equal and evenly distributed power relations will result in socially and ontologically neutral outcomes. A theory of social power cannot be limited to claims about the conditions under which social power is not supposed to operate. The development of more realistic theories of social power in conservation and rewilding will be useful to guide human dimensions changes in such projects (Turnhout et al. 2020).

Evaluation issues: the design of measures of socio-ecological success

As we have seen, there is an interesting tension and contrast between using vaguely-defined theories to justify rewilding interventions, and using overly prescriptive measures to evaluate their success. The vagueness of certain socio-ecological frameworks or models, and even of the concept of rewilding itself, may be taken advantage of to motivate and justify a wide range of specific, contextual visions. Certain forms of imprecision can be necessary to allow people with different practices, knowledges, and ontologies to work together towards common goals (Root-Bernstein et al. under review). At the same time, this vagueness can be an intellectual weakness that can be turned against projects as a critique, if the intervention is not broadly supported through a shared vision. The specificity of evaluative measures can, by contrast, prevent unpredictable and long processes of adaptive learning and socio-ecological transformation from taking their course. Evaluative measures for success can produce failures that would otherwise be understood not as failures, but as inevitable exposures to environmental risk and unpredictability, conflicts arising from situated inequities, and learning opportunities.

Pragmatically, if we wish to avoid the co-optation of pragmatic guidelines on how to do adaptive learning, coping, or participative management, as restrictive assessment tools, these guidelines should be designed to be unfit for use as standard measures: they should avoid proxy measures readily available in datasets, resist synthesis in quantitative summary statistics, include qualitative analysis, and depend on the judgement of local stakeholders. One way to make them particularly robust to co-optation as evaluative measures may be to embed them in community ILK through co-production approaches, which often defy simple conversion to scientific and bureaucratic data (Whyte et al. 2016), providing an added benefit of working with ILK in rewilding (IUCN 2019). In addition, an interesting avenue to explore is the establishment (also potentially drawing on participative and co-production approaches) of qualitative modes of evaluation such as those used to decide on things like public purchasing of artworks (Heinich 2017). What this means is not simply that qualitative evaluations must be negotiated by decision-makers, but that these negotiations can be made on the basis of judgements of quality, emotional attachments, and costs (Heinich 2017), each of which integrate multiple aspects of the contextual social value of a project. While such negotiations of value are not inherently less biased or more reliable than the use of quantitative measures, they are arguably more integrative and less constraining.

Conclusions

Some forms of rewilding have narrowly-defined ecological visions, while others propose that rewilding is at the core of a complete reform of human relations to nature. Arguably, even rewilding projects that do not specifically intend to influence society or human dimensions of conservation, do so in any case by altering landscapes, affecting experiences, and challenging norms and regulations. The more diverse the impacts that a project has, or wishes to have, on society, the more difficult it is to assess any such changes in terms of success or failure.

Whether any particular socio-ecological change is good or bad is a highly positional, political, moral, and ontological, consideration. While socio-ecological models and frameworks can be pragmatically useful to justify interventions and persuade stakeholders, visions that are jointly developed through participative and co-production approaches can avoid some of the problems of scientific and bureaucratic evaluation, by presenting outcomes as complex socially embedded values. While there are no universal standards of socio-ecological optimization, a pragmatic and realistic intervention we can implement and measure is helping people to cope with and enact resiliency in the face of uncertainty, risk, and conflict.

Bibliography

- Carpenter, S. R., Arrow, K. J., Barrett, S., Biggs, R., Brock, W. A., Crépin, A. S., ... and Zeeuw, A. D. (2012). General resilience to cope with extreme events. *Sustainability*, 4(12), 3248-3259.
- Comberti, C., Thornton, T. F., de Echeverria, V. W., and Patterson, T. (2015). Ecosystem services or services to ecosystems? Valuing cultivation and reciprocal relationships between humans and ecosystems. *Global Environmental Change*, 34, 247-262.
- Consorte-McCrea, A. and Bath, A. (2020) IUCN-SSC/CTSG Human-Wildlife Interactions Working Group report: Working with people toward conservation solutions. Available from: https://www.researchgate.net/publication/344520938_IUCN-SSCCTSG_Human-Wildlife_Interactions_Working_Group_report_Working_with_people_toward_conservation_solutions[accessed Feb 15 2021].
- Deng, X., Li, Z. and Gibson, J. (2016). A review on trade-off analysis of ecosystem services for sustainable land-use management. *Journal of Geographical Sciences*, 26(7), 953-968.
- Hoag, C., (2014). Dereliction at the South African Department of Home Affairs: time for the anthropology of bureaucracy. *Critique in Anthropology* 34(4), 410-428.
- Díaz, S., Pascual, U., Stenseke, M., Martín-López, B., Watson, R. T., Molnár, Z., ... and Shirayama, Y. (2018). Assessing nature's contributions to people. *Science*, 359(6373), 270-272.
- Furnham, A., & Marks, J. (2013). Tolerance of ambiguity: A review of the recent literature. *Psychology*, 4(09), 717-728.
- Friis, C., and Nielsen, J. Ø. (Eds.). (2019). *Telecoupling: Exploring land-use change in a globalised world*. Springer.
- Garmestani, A., Twidwell, D., Angeler, D. G., Sundstrom, S., Barichievy, C., Chaffin, B. C., ... and Allen, C. R. (2020). Panarchy: opportunities and challenges for ecosystem management. *Frontiers in Ecology and the Environment*, 18(10), 576-583.
- Gogoi, M. (2018). Emotional coping among communities affected by wildlife-caused damage in north-east India: opportunities for building tolerance and improving conservation outcomes. *Oryx*, 52(2), 214-219.
- Goulden, S., Erell, E., Garb, Y., and Pearlmutter, D. (2017). Green building standards as socio-questions. *Perspectives in Ecology and Conservation* 15(4), 271-281.
- Greenberg, J., & Cohen, R. L. (Eds.). (2014). *Equity and justice in social behavior*. Academic Press.
- Heinich, N. (2017). *Des valeurs: une approche sociologique*. Paris: Éditions Gallimard.
- Holling, C. S., and Gunderson, L. H. (2002). *Panarchy: understanding transformations in human and natural systems*. Washington, DC: Island Press.
- IUCN. (2019). Rewilding Principles. Available at https://www.iucn.org/sites/dev/files/content/documents/principles_of_rewilding_cem_rtg.pdf
- Laspidou, C. S., Mellios, N. K., Spyropoulou, A. E., Kofinas, D. T., and Papadopoulou, M. P. (2020). Systems thinking on the resource nexus: Modeling and visualisation tools to identify critical interlinkages for resilient and sustainable societies and institutions. *Science of the Total Environment*, 717, 137264.
- Liu, J., Herzberger, A., Kapsar, K., Carlson, A. K., & Connor, T. (2019). What is telecoupling?. In *Telecoupling* (pp. 19-48). Palgrave Macmillan, Cham.

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- Root-Bernstein, M., Gooden, J., and Boyes, A. (2018). Rewilding in practice and in policy. *Geoforum* 97, 292-304.
- Root-Bernstein, M., and Ladle, R. (2019). Ecology of a widespread large omnivore, *Homo sapiens*, and its impacts on ecosystem processes. *Ecology and evolution*, 9(19), 10874-10894.
- Sayles, J. S., Garcia, M. M., Hamilton, M., Alexander, S. M., Baggio, J. A., Fischer, A. P., ... and Pittman, J. (2019). Social-ecological network analysis for sustainability sciences: a systematic review and innovative research agenda for the future. *Environmental Research Letters*, 14(9), 093003.
- Osborne, T., Brock, S., Chazdon, R., Chomba, S., Garen, E., Gutierrez, V., ... & Sundberg, J. (2021). The political ecology playbook for ecosystem restoration: Principles for effective, equitable, and transformative landscapes. *Global Environmental Change*, 70, 102320.
- Paton, D., Smith, L., Daly, M., and Johnston, D. (2008). Risk perception and volcanic hazard mitigation: Individual and social perspectives. *Journal of Volcanology and Geothermal Research*, 172(3-4), 179-188.
- Rubenstein, D. R., and Rubenstein, D. I. (2016). From Pleistocene to trophic rewilding: A wolf in sheep's clothing. *Proceedings of the National Academy of Sciences*, 113(1), E1-E1.
- Skrimizea, E., Lecuye, L., Bunnefeld, N., Butler, J. R., Fickel, T., Hodgson, I., ... & Young, J. C. (2020). Sustainable agriculture: Recognizing the potential of conflict as a positive driver for transformative change. *Advances in Ecological Research*, 255-311.
- Thiruchelvi, A., and Supriya, M. V. (2012). An investigation on the mediating role of coping strategies on locus of control-wellbeing relationship. *The Spanish journal of psychology*, 15(1), 156.
- Turnhout, E., Metz, T., Wyborn, C., Klenk, N., and Louder, E. (2020). The politics of co-production: participation, power, and transformation. *Current Opinion in Environmental Sustainability*, 42, 15-21.
- Webber, S., 2015. Mobile adaptation and sticky experiments: circulating best practices and lessons learned in climate change adaptation. *Geographical Res.* 53 (1), 26–38.
- Whyte K.P., Brewer J.P., and Johnson J.T. 2016. Weaving Indigenous science, protocols and sustainability science. *Sustainability Science* 11(1): 25-32.
- Willerslev, R. (2007). *Soul hunters: hunting, animism, and personhood among the Siberian Yukaghirs*. Univ of California Press.
- Zamboni, T., Di Martino, S., and Jiménez-Pérez, I. (2017). A review of a multispecies reintroduction to restore a large ecosystem: the Iberá Rewilding Program (Argentina). *Perspectives in ecology and conservation*, 15(4), 248-256.