Law, Restoration and Ontologies for a More Ecologically Complex World!

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Restoration efforts can target very different outcomes. Simply put, restoration is a process, and diverse values and ontological dispositions can shape the why, what and how questions about what people do. Restorative inputs focused on adaptively adding complexity into an ecosystem commits to values that go beyond rehabilitating and just removing threats and harms that are disturbing an ecosystem. Restoring within a landscape to enhance its ecological complexity is a useful goal for adaptive governance, and one which will also enable discussions about how humans and legal and governance institutions can change and respond to managing the environment. Using two scenarios we briefly explore how governance approaches to restoration need ontological dispositions focused on ecological complexity. In particular, we argue in this article that a focus on inputs into ecological complexity creates not only opportunities for overall net gain, but also, and more critically, that it requires legal and governance changes that establish parameters for how the vision will be realised. We explore and briefly discuss four of these institutional challenges to chart further research trajectories for how restorative inputs into ecological complexity can be achieved.

I   Introduction

In a recent review of the signature conservation legislation in Australia, the *Environment Protection and Biodiversity Conservation Act 1999* (Cth), *The Independent Review of the Environment Protection and Biodiversity Conservation Act 1999* ('Interim Report') identified the thin governance framework around restoration as a major reason for the Act not having achieved its goals.[1] The report then went on to identify restoration as a necessary complement to protection and conservation strategies in order to 'enable future development to be

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[1]   See Australian Government, *The Independent Review of the Environment Protection and Biodiversity Conservation Act 1999* (2020) ch 1 <https://epbcactreview.environment.gov.au/> ('Interim Report')

sustainable'.[2] It defined restoration as improving 'the condition of the environment to a state that is required to be sustainable in the long-term, or a state that is desirable'.[3] This definition was set against an alternative, which the report identified as 'a blanket ambition for a return to a particular historic environmental condition'.[4] From this starting point, the Interim Report suggested, rather simply, that offset schemes need to be reimagined to achieve restoration.

This is a good start, given that the Interim Report was clear about the ineffectiveness of offset schemes to actually 'offset the impact of development', but it appears to reinforce a narrow approach that is usually taken to adapting and responding to damage, disturbance and degradation. While the report rejects 'historical' baselines as a measure of complexity, there is little to suggest that the changes envisioned will aim at anything beyond remediating and rehabilitating the environment so that ecosystems can sustain themselves without human input. While this review of a crucial piece of Australian legislation continues to put the attention on restoration, it also continues to situate restoration as part of a reactive strategy to manage the natural environment, once it has been damaged to a point that it matters to human beings.[5] The Interim Report went as far as suggesting that offsets in Australia need to contribute to restoring new areas, but it stopped short of pushing for deeper ecological gains that required developers to contribute to genuine gain in native ecosystems and higher levels of complexity in those systems. Given that restoration can support a range of values and ethical dispositions, there is always the risk that restoration will not get articulated as managing disturbances to recover complexity, but rather to achieve a 'desirable' future landscape.

This article seeks to describe an alternative approach to restoration governance and regulation, so as to draw attention to the value of transforming the normative and ontological foundations of environmental law. A burgeoning practice in governing restoration activities is adaptively and reflexively doing the work over a period of time. Reponses to damage and degradation, and also offsets that seek to genuinely restore a site, require the use of long-term adaptive approaches in order to ensure successful restoration outcomes, particularly at the landscape scale.[6] In this article we discuss how governance for ecological

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2   Ibid 13.
3   See ibid 86, Box 21.
4   Ibid.
5   The United Nations has declared 2021–2030 the Decade for Restoration, bringing further attention to this subject. For more information, see <https://www.decadeonrestoration.org>.
6   James Aronson, João S Pereira and Juli G Pausas (eds), *Cork Oak Woodlands on the Edge: Ecology, Adaptive Management, and Restoration* (Island Press, 2009); Standards Reference Group SERA,

restoration needs a strong value base in addition to adaptive and reflexive processes, and we propose the term 'restorative inputs' to describe the aim of building complexity through restoration as a normative goal. This approach is ultimately a surer way of ensuring long-term ecological gain. Transactional arrangements that typically exist for net-gain instruments like offsets do not always focus on restorative inputs that build complexity, as this is expensive and can take a long time to deliver.

In Parts II and III we explore how discussions of complexity can usefully inform environmental law approaches to restoration, by first pointing to its ontological frailties and problems, and practically by focusing attention on the benefits that adaptive governance brings to managing restoration processes. In Part IV we draw on two short governance scenarios within Australia to illustrate these points. In Parts V and VI we explore and discuss how 'restorative inputs' can complicate, but usefully add to, adaptive governance frameworks, and conclude by outlining governance frameworks required for an approach that seeks to add complexity to systems. While the focus on restorative inputs that add complexity to a system has already been discussed elsewhere,[7] this article brings together discussions of the institutional and governance significance and potential of these ideas, and critiques and frames important environmental law responses going into the future.

II THE ONTOLOGICAL PARADOX OF ENVIRONMENTAL LAW

It is through the instruments of law and governance that decisions are made informing land management and landscape function, as well as species conservation, ecosystem management and processes, influencing intergenerational landscapes and responses to environmental damage. Our current environmental law and governance systems are, however, failing to prevent and remediate the ecological degradation that distinguishes the

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National Standards for the Practice of Ecological Restoration in Australia (Society for Ecological Restoration Australasia, 2017); Robert J Cabin, 'Science-Driven Restoration: A Square Grid on a Round Earth?' (2007) 15(1) *Restoration Ecology* 1; Ian Hodge and William M Adams, 'Short-Term Projects versus Adaptive Governance' (2016) 5(4) *Land* 1; Mita Nagarkar and Karsten Raulund-Rasmussen, 'An Appraisal of Adaptive Management Planning and Implementation in Ecological Restoration: Case Studies from the San Francisco Bay Delta, USA' (2016) 21(2) *Ecology and Society* 43; Charles Simenstad, Denise Reed and Mark Ford, 'When Is Restoration Not?' (2006) 26(1) *Ecological Engineering* 27.

[7]   Afshin Akhtar-Khavari, 'Restoration and Cooperation for Flourishing Socio-Ecological Landscapes' (2020) 11(1–2) *Transnational Legal Theory* 62.

Anthropocene era.[8] Traditional notions of environmental governance struggle to adequately capture the complex relations between global transformations of social and natural systems,[9] and tend to approach environmental management in a predominantly efficiency-driven, transactional, command-and-control way, prioritising front-end processes to predict and assess environmental harm in a balancing act with economic growth, national interests and social stability.[10] Along with the legal illusion of control and stability that remains prominent in international and national norms,[11] environmental governance continues a single-trait, maximum-sustained yield paradigm that is top-down, bureaucratic and efficiency-driven, aiming to produce goods and services in a predictable manner.[12] This assumes that the environment is bounded and problems can be solved through linear cause-and-effect frameworks that either control the processes leading to the problem or ameliorating the problem after it occurs.[13] This governance approach, by which we mean a system where collective goals are identified and decisions and actions are undertaken to achieve these collective goals, linking the social and the ecological,[14] advances principles such as sustainable development and 'polluter-pay'. Such principles are well-suited to managing bounded environmental problems, such as point-source pollution, and maintaining the status quo by protecting private property, national statehood, risk and liability management, and fostering predictability and stability, but ill-suited to governing the omnipresent, uncertain and pervasive 'thing' that is 'the environment'.[15]

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[8]   Louis Kotzé, *Environmental Law and Governance for the Anthropocene* (Hart Publishing, 2017); Nicholas A Robinson, 'Fundamental Principles of Law for the Anthropocene?' (2014) 44(13) *Environmental Policy and Law* 15; Anna Grear and Evadne Grant (eds), *Thought, Law, Rights and Action in the Age of Environmental Crisis* (Edward Elgar Publishing, 2015).

[9]   Frank Biermann, et al. 'Transforming Governance and Institutions for Global Sustainability: Key Insights from the Earth System Governance Project' (2012) 4(1) *Current Opinion in Environmental Sustainability,* 51.

[10]   Andreas Philippopoulos-Mihalopoulos, 'Towards a Critical Environmental Law' in Andreas Philippopoulos-Mihalopoulos (ed), *Law and Ecology: New Environmental Foundations* (Routledge, 2011) 18; JB Ruhl, 'Panarchy and the Law' (2012) 17(3) *Ecology and Society* 31.

[11]   Philippopoulos-Mihalopoulos (n 11).

[12]   Brian C Chaffin, Hannah Gosnell and Barbara Cosens, 'A Decade of Adaptive Governance Scholarship: Synthesis and Future Directions' (2014) 19(3) *Ecology and Society* 56; CS Holling and Gary K Meffe, 'Command and Control and the Pathology of Natural Resource Management' (1996) 10(2) *Conservation Biology* 328; Ahjond S Garmestani and Melinda Harm Benson, 'A Framework for Resilience-Based Governance of Social-Ecological Systems' (2013) 18(1) *Ecology and Society* 9.

[13]   Holling and Meffe (n 12).

[14]   Chaffin, Gosnell and Cosens (n 12).

[15]   Luigi Pellizzoni, 'Responsibility and Environmental Governance' (2004) 13(3) *Environmental Politics* 541.

Environmental law is deeply informed by both the tradition of legal positivism and positivist interpretations of environmental realities continuing a particular ontological framing.[16] Environmental law continues to reinforce a constructed dichotomy between the sphere of the *anthropos* and that of the natural world. The former is viewed as operating above or outside the functions of the latter. Nature, in environmental law, is abstracted and sheared from social context (both human and more-than), becoming passive or non-agentic and, therefore, *res nullius*: a resource empty of meaning and purpose and available for annexation. It is this dichotomy that forms Western environmental law's ontological canon.[17]

While conceptualisations of 'the environment' have largely arisen through the application of an epistemology that necessitates and privileges technical scientific knowledge and a belief in control, the rise of an ecological narrative, in which humans are recognised as a part of the environment which itself has myriad forms of agency, culture and history, with complex interactions and relationships between subjects, has begun to challenge the operation of environmental law. This 'new ecology', emerging from systems-science perspectives, accepts that natural systems operate far from equilibrium and assumes the possibility of uncertainty, instability and variability in natural systems.[18] McMichael argues that this systems approach of ecological science

> embraces the complex interplay between animate and inanimate components; it studies dynamic, non-equilibrial and non-linear processes ... To an ecologist the world is neither deterministic nor randomly unpredictable; rather, it is a world of contingent probabilities within mutually adapted, self-ordering systems.[19]

Socio-ecological systems — that is, the bio-geophysical ecological unit and associated social actors and institutions — have been characterised as complex

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[16]   Nicole Graham, Margaret Davies and Lee Godden, 'Broadening Law's Context: Materiality in Socio-Legal Research' (2017) 26(4) *Griffith Law Review* 480.

[17]   Anna Grear, '"Anthropocene, Capitalocene, Chthulucene": Re-encountering Environmental Law and its "Subject" with Haraway and New Materialism' in Louis Kotzé (ed), *Environmental Law and Governance for the Anthropocene* (Hart, 2017) 77; Louis Kotzé and Duncan French, 'The Anthropocentric Ontology of International Environmental Law and the Sustainable Development Goals: Towards an Ecocentric Rule of Law in the Anthropocene' (2018) 7(1) *Global Journal of Comparative Law* 5; Saskia Vermeylen, 'Materiality and the Ontological Turn in the Anthropocene: Establishing a Dialogue Between Law, Anthropology and Eco-Philosophy', in Louis Kotzé (ed), *Environmental Law and Governance for the Anthropocene* (Hart, 2017).

[18]   Lee Godden and Jacqueline Peel, *Environmental Law: Scientific, Policy and Regulatory Dimensions* (Oxford University Press Australia & New Zealand, 2010); William L Steffen et al, *Global Change and the Earth System: A Planet Under Pressure* (Springer-Verlag, 2005).

[19]   Tony McMichael, *Human Frontiers, Environments, and Disease: Past Patterns, Uncertain Futures* (Cambridge University Press, 2001) 21–22.

adaptive systems ('CAS').[20] This means that the characteristics of such systems cannot be captured using a single perspective,[21] but are instead a set of components 'interconnected in such a way that [they] produce their own pattern of behaviour over time'.[22] Mitchell defines a CAS as 'a system in which large networks of components with no central control and simple rules of operation give rise to complex collective behaviour, sophisticated information processing, and adaptation via learning or evolution'.[23] The collective behaviour resulting from component interactions is therefore more than the sum of the behaviour expected of individual parts,[24] exhibiting non-linear relationships, unpredictability, autopoiesis, adaptation and emergent behaviour.[25] Such processes support system identity and self-organisation,[26] adapting to changes in their external environment through conditional action and anticipation[27] and exhibiting coherence under change (stable disequilibrium).[28] In contrast to the epistemic belief in objectivity within the scientific method, a systems approach does not assume that the act of observation is a neutral pre-analytical step. Rather, decisions as to what and how to observe a system become crucial analytical requirements determining the representation of the system.[29]

The complexity and uncertainty of these systems raises challenges for environmental, institutional and governance arrangements,[30] not least because uncertainty is no longer confined geographically or jurisdictionally, temporally, or by relationships of duty between those creating the harm and those who are

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[20]   Steffen et al (n 18).

[21]   Giuseppe Munda, 'Social Multi-Criteria Evaluation: Methodological Foundations and Operational Consequences' (2004) 158(3) *European Journal of Operational Research* 662.

[22]   Donella H Meadows, *Thinking in Systems: A Primer* (Chelsea Green Publishing, 2008) 2.

[23]   Melanie Mitchell, *Complexity: A Guided Tour* (Oxford University Press, 2009) 13.

[24]   MEJ Newman, 'Complex Systems: A Survey' (2011) 79(8) *American Journal of Physics* 800.

[25]   Silvio O Funtowicz and Jerome R Ravetz, 'The Worth of a Songbird: Ecological Economics as a Post-Normal Science' (1994) 10(3) *Ecological Economics* 197.

[26]   Rakhyun E Kim and Klaus Bosselmann, 'International Environmental Law in the Anthropocene: Towards a Purposive System of Multilateral Environmental Agreements' (2013) 2(2) *Transnational Environmental* 285.

[27]   Stuart Kauffman, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity* (Oxford University Press, 1995); Simon A Levin, *Fragile Dominion: Complexity and the Commons* (Perseus Books, 1999).

[28]   Per Bak, *How Nature Works: The Science of Self-Organized Criticality* (Springer, 1996); John Henry Holland, *Hidden Order: How Adaptation Builds Complexity* (Perseus Books, 1995).

[29]   Zora Kovacic, 'Investigating Science for Governance through the Lenses of Complexity' (2017) 91 *Futures* 80.

[30]   Carl Folke et al, 'Adaptive Governance of Social-Ecological Systems' (2005) 30(1) *Annual Review of Environment and Resources* 441; Oran R Young and Will Steffen, 'The Earth System: Sustaining Planetary Life-Support Systems' in Carl Folke, Gary P Kofinas and F Stuart Chapin (eds), *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World* (Springer-Verlag, 2009).

harmed. Uncertainties are recognised as not only analytical, but also normative, with traditional and reductionist approaches of prediction and control being of limited effectiveness. Uncertainty, inherent to the scientific method, lack of coherence between scientific understandings[31] and complex adaptive systems, challenges the reliability of rational decision-making processes[32] where certainty as a possibility is assumed.[33] Rational assumptions that the environment can be controlled and that certainty can be achieved, fundamentally ring false thus questioning the very ability of environmental law 'to become or even to be law'.[34] The 'unsettling internalisation of scientific uncertainty' in environmental law results in 'constant re-evaluation of already established problem-solving methodologies',[35] requiring ongoing generation and application of new knowledge.[36]

Environmental law and governance have increasingly been attempting to fill the gaps where uncertainties have emerged. Processes of prediction and control only result in incoherence and fragmentation, inadequately capturing the important, non-linear and complex interconnections between ecological and social systems.[37] Holling and Meffe have observed that traditional governance approaches reduce the natural variation of ecological systems by applying rules for fixed yields, resulting in the perverse effect of increased uncertainty as the resilience of ecosystems diminish — ecosystems being more likely to break down in response to disturbances that could have been previously absorbed.[38]

Many new governance solutions have been put forward to respond to these questions of dynamism, uncertainty and complexity in strongly coupled socio-ecological systems, as well as in response to the fundamental uncertainty created by the novel conditions of the Anthropocene.[39] In the next part, we discuss one

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[31] Daniel Sarewitz, 'How Science Makes Environmental Controversies Worse' (2004) 7(5) *Environmental Science & Policy* 385.

[32] Mariachiara Tallacchini, 'Before and Beyond the Precautionary Principle: Epistemology of Uncertainty in Science and Law' (2005) 207(2) *Toxicology and Applied Pharmacology* 645, 648.

[33] Åsa Knaggård, 'What Do Policy-Makers Do with Scientific Uncertainty? The Incremental Character of Swedish Climate Change Policy-Making' (2014) 35(1) *Policy Studies* 22.

[34] Philippopoulos-Mihalopoulos (n 10) 22.

[35] Philippopoulos-Mihalopoulos (n 10) 21.

[36] Adan Tarlock, 'Is There a There There in Environmental Law?' (2004) 19(2) *Journal of Land Use & Environmental Law* 213.

[37] Ruhl (n 10); Rak Kim, 'Unravelling the Maze of Multilateral Environmental Agreements: A Macroscopic Analysis of International Environmental Law and Governance for the Anthropocene' (PhD Thesis, Australian National University, 2013).

[38] Holling and Meffe (n 12). See also Simon Levin et al, 'Social-ecological systems as complex adaptive systems: modelling and policy implications' (2012) 18(2) *Environment and Development Economics* 111.

[39] Bradley Karkkainen, 'Marine Ecosystem Management and a Post-Sovereign Transboundary Governance' (2004) 6(1) *San Diego International Law Journal* 113; Judith E Koons, 'Key Principles to

such response, namely, adaptive governance in the context of a complex socioecological process: ecological restoration.

III   ADAPTATION AND ECOLOGICAL RESTORATION

Legal systems have a key role in responding and adapting to questions of dynamism, uncertainty and complexity inherent to socio-ecological systems.[40] The environmental governance challenge of our time is the development of governance systems that can respond to, adapt to, manage, and recognise the inherent uncertainty, interdependencies and dynamic conditions of these systems in which we live, in order to restore and maintain life-sustaining earth processes.[41] Ecological restoration is an example of a complex, systems process.[42] Ecological restoration refers to the process of assisting the recovery of a damaged ecosystem to restore ecological structure, complexity and integrity so that the system is self-supporting, resilient and displays a level of historical continuity and fidelity.[43] The practice of ecological restoration does not assume restoration to a replica environment, as landscapes are dynamic, but rather envisions an ecological system that is self-sustaining, historically informed, with ranges of variability and multiple potential ecological trajectories.[44] As ecosystems can take decades or centuries to restore, evaluation is therefore a necessary tool in avoiding costly mistakes.[45]

Transform Law for the Health of the Planet' in Peter Burdon (ed), *Exploring Wild Law: The Philosophy of Earth Jurisprudence* (Wakefield Press, 2011) 45; Ruhl (n 10).

[40]   Jan McDonald, 'The Role of Law in Adapting to Climate Change' (2011) 2(2) *Wiley Interdisciplinary Reviews: Climate Change* 283; Kotzé (n 8).

[41]   Louis Kotzé, 'Earth System Law for the Anthropocene: Rethinking Environmental Law Alongside the Earth System Metaphor' (2020) 11(1–2) *Transnational Legal Theory* 75; Andreas Philippopoulos-Mihalopoulos, 'Critical Environmental Law as Method in the Anthropocene' in Andreas Philippopoulos-Mihalopoulos and Victoria Brooks (eds), *Research Methods in Environmental Law: A Handbook* (Elgar, 2017) 131.

[42]   Michael P Weinstein, Steven Y Litvin and Justin M Krebs, 'Restoration Ecology: Ecological Fidelity, Restoration Metrics, and a Systems Perspective' (2014) 65 *Ecological Engineering* 71.

[43]   Eric Higgs, *Nature by Design: People, Natural Process, and Ecological Restoration* (MIT Press, 2003); Standards Reference Group SERA (n 6); Katharine Suding et al, 'Committing to Ecological Restoration' (2015) 348(6235) *Science* 638; Anastasia Telesetsky, 'Ecoscapes: The Future of Place-Based Ecological Restoration Laws' (2013) 14(4) *Vermont Journal of Environmental Law* 493.

[44]   Luis Balaguer et al, 'The Historical Reference in Restoration Ecology: Re-Defining a Cornerstone Concept' (2014) 176 *Biological Conservation* 12; Eric Higgs et al, 'The Changing Role of History in Restoration Ecology' (2014) 12(9) *Frontiers in Ecology and the Environment* 499; Margaret A Palmer and JB Ruhl, 'Aligning Restoration Science and the Law to Sustain Ecological Infrastructure for the Future' (2015) 13(9) *Frontiers in Ecology and the Environment* 512; Suding et al (n 43).

[45]   Christer Nilsson et al, 'Evaluating the Process of Ecological Restoration' (2016) 21(1) *Ecology and Society* 41.

The National Standards for the Practice of Ecological Restoration developed for Australia note that restoration is an adaptive, reflexive and systemic practice guided by site characteristics and the relationship of the site with socio-ecological systems, including climate, landscape function and community.[46] Ecological restoration therefore requires long-term conservation management, review processes and changes in direction in order to correct for unexpected ecosystem responses — conditions requiring flexible and adaptive governance regimes to account for high levels of uncertainty and imperfect understandings of ecosystem interrelationships and feedback.[47] As such, adaptive approaches, such as adaptive management and adaptive governance, have been widely recommended to govern ecological restoration,[48] particularly landscape scale projects.[49]

Adaptive approaches shift environmental law's focus to the back-end of governance processes, requiring continuous monitoring, evaluation and adjustment in achieving an optimal socio-ecological system. Adaptive governance, for example, is defined as the social conditions and context that mediate human interactions with ecosystems, resulting in a 'range of interactions between actors, networks, organizations, and institutions emerging in pursuit of a desired state for social-ecological systems'.[50] It attempts a paradigmatic shift from a singular reductionist approach governing singular parts of an ecosystem, to one that seeks to understand and respond to the dynamism and uncertainty of the whole socio-ecological system.[51] This approach recognises that top-down, centralised state-based environmental governance approaches generally do not match ecological complexity or provide effective solutions.[52] Adaptive governance responses to these challenges therefore often emerge through community-led, bottom-up initiatives.[53] Ongoing explorations of adaptive governance strategies in law and decision-making have shown it to be a relatively

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[46]   Standards Reference Group SERA (n 6).

[47]   Hodge and Adams (n 6); Weinstein, Litvin and Krebs (n 42).

[48]   Aronson et al (n 6); Standards Reference Group SERA (n 6).

[49]   Cabin (n 6); Hodge and Adams (n 6); Nagarkar and Raulund-Rasmussen (n 6); Simenstad, Reed and Ford (n 6).

[50]   Chaffin, Gosnell and Cosens (n 12) 61.

[51]   Ibid.

[52]   Oran R Young, *The Institutional Dimensions of Environmental Change: Fit, Interplay, and Scale* (MIT Press, 2002); Graeme S Cumming, David HM Cumming and Charles L Redman, 'Scale Mismatches in Social-Ecological Systems: Causes, Consequences, and Solutions' (2006) 11(1) *Ecology and Society* 14.

[53]   Peter J Brosius, Anna Lowenhaupt Tsing and Charles Zerner (eds), *Communities and Conservation: Histories and Politics of Community-Based Natural Resource Management* (AltaMira Press, 2005); Edward P Weber, *Bringing Society Back In: Grassroots Ecosystem Management, Accountability, and Sustainable Communities* (MIT Press, 2003).

successful environmental governance response,[54] and it has been applied to studies of watershed management,[55] management of desert areas,[56] regional drought management,[57] the Great Barrier Reef,[58] and urban sustainability,[59] as well as some ecological restoration sites.[60]

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[54]   See (2013) 18(3) *Ecology and Society* ('Law and Social-Ecological Resilience, Part II: Contributions from Law for Social-Ecological Resilience Symposium', Jonas Ebbesson and Ellen Hey (eds)); Ahjond S Garmestani and Craig R Allen (eds), *Social-Ecological Resilience and Law* (Columbia University Press, 2014); (2013) 18(2) *Ecology and Society* ('Law and Social-Ecological Resilience, Part I: Contributions from Resilience 2011', Ahjond S Garmestani, Craig R Allen and Melinda Harm Benson (eds)); Lisa Sharma-Wallace, Sandra J Velarde and Anita Wreford, 'Adaptive Governance Good Practice: Show Me the Evidence!' (2018) 222 *Journal of Environmental Management* 74.

[55]   Barbara Cosens, Lance Gundersonnd Brian C Chaffin, 'Introduction to the Special Feature Practicing Panarchy: Assessing Legal Flexibility, Ecological Resilience, and Adaptive Governance in Regional Water Systems Experiencing Rapid Environmental Change' (2018) 23(1) *Ecology and Society* 4; Barbara Cosens, Lance Gunderson, Craig Allen and Melinda Benson, 'Identifying Legal, Ecological and Governance Obstacles, and Opportunities for Adapting to Climate Change' (2014) 6(4) *Sustainability* 2338; Dave Huitema et al, 'Adaptive Water Governance: Assessing the Institutional Prescriptions of Adaptive (Co-)Management from a Governance Perspective and Defining a Research Agenda' (2009) 14(1) *Ecology and Society* 26; Patrick Huntjens et al, 'Institutional Design Propositions for the Governance of Adaptation to Climate Change in the Water Sector' (2012) 22(1) *Global Environmental Change* 67; Giorgos Kallis, Michael Kiparsky and Richard Norgaard, 'Collaborative Governance and Adaptive Management: Lessons from California's CALFED Water Program' (2009) 12(6) *Environmental Science & Policy* 631; John T Scholz and Bruce Stiftel (eds), *Adaptive Governance and Water Conflict: New Institutions for Collaborative Planning* (Routledge, 2005).

[56]   Donald R Nelson, W Neil Adger and Katrina Brown, 'Adaptation to Environmental Change: Contributions of a Resilience Framework' (2007) 32(1) *Annual Review of Environment and Resources* 395.

[57]   Rohan Nelson, Mark Howden and Mark Stafford Smith, 'Using Adaptive Governance to Rethink the Way Science Supports Australian Drought Policy' (2008) 11(7) *Environmental Science & Policy* 588.

[58]   Terence P Hughes et al, 'Adaptive Management of the Great Barrier Reef and the Grand Canyon World Heritage Areas' (2007) 36(7) *AMBIO: A Journal of the Human Environment* 586; Per Olsson, Carl Folke and Terry P Hughes, 'Navigating the Transition to Ecosystem-Based Management of the Great Barrier Reef, Australia' (2008) 105(28) *Proceedings of the National Academy of Sciences* 9489; Lisen Schultz et al, 'Adaptive Governance, Ecosystem Management, and Natural Capital' (2015) 112(24) *Proceedings of the National Academy of Sciences* 7369.

[59]   Paula Vandergert et al, 'Blending Adaptive Governance and Institutional Theory to Explore Urban Resilience and Sustainability Strategies in the Rome Metropolitan Area, Italy' (2016) 8(2) *International Journal of Urban Sustainable Development* 126; Tahmina Yasmin, Megan Farrelly and BC Rogers, 'Adaptive Governance: A Catalyst for Advancing Sustainable Urban Transformation in the Global South' (2019) 36(5) *International Journal of Water Resources Development* 1.

[60]   William H Butler, Ashley Monroe and Sarah McCaffrey, 'Collaborative Implementation for Ecological Restoration on US Public Lands: Implications for Legal Context, Accountability, and Adaptive Management' (2015) 55 *Environmental Management* 564; Lance Gunderson and Stephen S Light, 'Adaptive Management and Adaptive Governance in the Everglades Ecosystem' (2006) 39 *Policy Sciences* 323.

IV ILLUSTRATING THE CHALLENGE WITH LAW
AND ECOLOGICAL RESTORATION

Despite ecological restoration being a current global priority,[61] the law and governance arrangements for ecological restoration are still emerging as states grapple with post-extractive landscapes and liabilities.[62] To investigate the governance of ecological restoration, we discuss two governance case studies from Australia to illustrate the ideas discussed above in Parts II and III.

Land development, particularly through resource extraction, is considered a highly appropriate use of land in Australia. The resource industry in particular has made significant efforts to brand activities in language that associates extraction with 'frontier development', 'prosperity' and 'nation-building', with mining equated with bringing wealth and civilisation to the outback.[63] In this discourse, resource extraction is thus a moral imperative.[64] With the rise of environmentalism in the 1970s and 1980s, a growing recognition emerged that development- and growth-focused industries had serious environmental and social consequences resulting in attempts to bring 'sustainable development' to mining and other industries.[65] Resource-rich states began to consider the impact

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[61]   For example, the United Nations General Assembly declared 2021–2030 the decade of ecosystem restoration. See <https://www.decadeonrestoration.org>.

[62]   James Aronson and Sasha Alexander, 'Ecosystem Restoration Is Now a Global Priority: Time to Roll Up Our Sleeves: News Report from CBDCOP11' (2013) 21(3) *Restoration Ecology* 293; Palmer and Ruhl (n 44); Telesetsky (n 43); Anastasia Telesetsky, An Cliquet and Afshin Akhtar-Khavari, *Ecological Restoration in International Environmental Law* (Routledge, 2016).

[63]   David S Trigger, 'Mining, Landscape and the Culture of Development Ideology in Australia' (1997) 4(2) *Ecumene* 161 ('Mining, Landscape and the Culture'); David S Trigger, 'Citizenship and Indigenous Responses to Mining in the Gulf Country' in Nicolas Peterson, Will Sanders Geoffrey Brennan (eds), *Citizenship and Indigenous Australians: Changing Conceptions and Possibilities* (Cambridge University Press, 1998) ('Citizenship and Indigenous Responses').

[64]   Trigger, 'Mining, Landscape and the Culture' (n 64); Trigger, ('Citizenship and Indigenous Responses' (n 64).

[65]   See Brian F Chase, 'Tropical Forests and Trade Policy: The Legality of Unilateral Attempts to Promote Sustainable Development under the GATT' (1994) 17(2) *Hastings International and Comparative Law Review* 349; International Council on Mining and Metals, *Planning for Integrated Mine Closure: Toolki*t (Report, 2008); International Council on Mining and Metals, *Sustainable Development Framework: ICMM Principles* (Report, 2015); J S Maini, 'Sustainable Development of Forests' (1992) 43(169) *Unasylva* 3; K Freerk Wiersum, '200 Years of Sustainability in Forestry: Lessons from History' (1995) 19 *Environmental Management* 321; World Bank Group and International Finance Corporation, *It's Not Over When It's Over: Mine Closure Around the World* (World Bank Group's Mining Department, Global Mining, 2002).

of industry on landscapes and the cost that closure and rehabilitation has upon future land-use activities.[66]

Mine sites across Australia have become major environmental risks after closure, with an estimated 60,000 abandoned mines.[67] Environmental risk remains an ongoing concern' with '[m]ine closure, complete rehabilitation and relinquishment of the former mine site [being] almost unknown' in Australia.[68] As a result, more stringent government policies and the adoption of sustainable development practices have materialised across many industries in an attempt to reduce the environmental risk and costs of post-extractive landscapes.

Regulation to date, however, has been largely concerned with the rehabilitation of discrete geographical areas — for example, the rehabilitation of a mine site, remediation for pollution or other environmental disasters, or the conservation of a particular species.[69] Such governance approaches are often limited in scope and ambition. We provide two examples of restoration governance within Australia: mine restoration in Queensland, and forest restoration in Tasmania.

A   *Mine Restoration in Queensland*

In Queensland, the Department of Natural Resources and Mines and Energy ('DNRME') is responsible for mine compliance, land access and abandoned mines. The Department of Environment and Science ('DES') is responsible for the environmental management of operating mines and overseeing mine site rehabilitation, which is required under the *Environmental Protection Act 1994* (Qld) ('EP Act Qld'). Rehabilitation is required to reduce disturbance caused by authorised mining activities and to minimise future potential environmental harm. Mining proponents must apply for an environmental authority in order to conduct mine activities, with the application detailing the proposed rehabilitation of the site post operation.[70] This is detailed in a rehabilitation management plan

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66   Australian Government, *Leading Practice Sustainable Development Program: Mine Closure and Completion* (2006); Australian Government, *Leading Practice Sustainable Development Program: Mine Rehabilitation* (2006).

67   Alex Mark Lechner et al, 'Mapping and Prioritising Rehabilitation of Abandoned Mines in Australia' (Conference Paper, Life-of-Mine Conference, AusIMM, 10–12 July 2012).

68   Rod Campbell et al, 'Dark Side of the Boom; What We Do and Don't Know about Mines, Closures and Rehabilitation' (Discussion Paper, The Australia Institute, 2017) 2.

69   Benjamin J Richardson, 'Restoring Layered Geographies: Ecology, Society and Time' (2017) 26(2) *Griffith Law Review* 154.

70   EP Act (Qld) s 125(1).

('RMP'). The DES assesses the RMP and also assesses rehabilitation for part of,[71] or the part or whole of, a mining project being surrendered.[72]

RMPs are informed by departmental guidelines that establish a rehabilitation hierarchy: the top requires the avoidance of disturbance that will require rehabilitation or the reinstatement of a 'natural' analogous ecosystem, through to lower levels that seek to provide rehabilitated land to allow for land use that accords with previous or lower value or, at the most undesirable, leaving the site in an unusable condition or with the potential to generate future pollution or adversely affect environmental values.[73] Mine operators are required to achieve the highest practicable rehabilitation level and identify post-mining land uses that are acceptable to the community, local government and other relevant stakeholders. General rehabilitation goals, that can ensure the safety of humans and wildlife through non-polluting and stable landforms sustaining an agreed post-mining land use, must also be met. Site-specific goals may be applied in relation to endangered species, water, registered heritage, or regional or local planning.

Despite this regulatory framework, the Queensland Audit Office's review of Queensland's environmental regulation found the environmental remediation of mines was 'an unrealised aspiration'.[74] The review found there were serious mine legacy concerns, with the state being left with an increasing number of abandoned mines, with mining bonds often inadequate to meet the cost of rehabilitation.[75] As a result, the government introduced the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (Qld), amending the EP Act (Qld) to incorporate Progressive Rehabilitation and Closure ('PRC') Plans into the environmental authority process for both new and existing mines. The PRC Plans include an approved schedule containing completion dates for achieving progressive rehabilitation of mine sites. This step-by-step approach aims to achieve a level of adaptive management throughout the restoration process and limit the risk of state liability for abandoned mines.[76]

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[71]   Ibid s 318Z.
[72]   Ibid s 264.
[73]   Department of Environment and Science, 'Rehabilitation Requirements for Mining Resource Activities' (2014) <https://environment.des.qld.gov.au/___data/assets/pdf_file/0022/100975/rs-gl-rehabilitation-requirements-mining.pdf.>.
[74]   Queensland Audit Office, *Environmental Regulation of the Resources and Waste Industries* (Report, 2013) 15.
[75]   Ibid.
[76]   State of Queensland, 'Achieving Improved Rehabilitation for Queensland: Other Associated Risks and Proposed Solutions' (Discussion Paper, 2018).

B *Forest Restoration Tasmania*

Tasmania's forest management system is largely regulated under the *Forest Practices Act 1985* (Tas). The Act seeks to 'achieve sustainable management of Crown and private forests with due care for the environment and taking into account social, economic and environmental outcomes'.[77] The forest practices system establishes a tenure-blind approach, regulated by the Forest Practices Code ('FPC'), forest practices plans ('FPPs'), forest practices officers ('FPOs') with independent oversight and reporting by the regulator, and the Forest Practices Authority ('FPA'). The FPA notes that the 'Tasmanian forest practices system is based on an adaptive management approach where results from research and monitoring lead to continuing improvement of the system',[78] with the FPC aiming to provide 'reasonable protection' for the environment.

Under both the FPC and the *Forest Practices Act 1985*, restoration is not a required part of forest activities, but it does occur through the 'best practice' of forest companies or under their FPPs, particularly as all plantation companies operating in Tasmania are certified to either the Australian Forestry Standard and/or the Forest Stewardship Council. Forest restoration is recognised under both of these certification standards, and Tasmanian forestry companies have an economic incentive to meet those standards.[79]

In addition, while not mandatory under the FPC, the FPC does influence forest restoration by setting out requirements in relation to the retention of existing native forest streamside reserves, conservation of riparian values, establishment of native vegetation, and constraints on harvesting.[80] If a forest company intends to undertake restoration, an FPP is required, resulting in a protocol for planning, implementation and compliance reporting. FPPs are generally implemented by FPOs and forest contractors familiar with the requirements of the FPC and technically capable. The desired reforestation standard is generally expressed as stems/ha of eucalypt seedlings 12–24 months after treatment and inevitable mortality in FPPs.[81]

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[77]   *Forest Practices Act 1985* (Tas) sch 7.
[78]   Graham Wilkinson, 'A Proposed New Format for the Forest Practices Code' (2008) 9(1) *Forest Practices News* 1.
[79]   Michael Schofield, 'A Review of Forest Restoration Projects in Tasmania' (Gottstein Fellowship Report, 2017).
[80]   Forest Practices Authority, 'Forest Practices Code' (2015) 78.
[81]   Schofield (n 79).

C *Analysis*

Law is never simply a collection of inviolable rules and processes. Laws and governance regimes reflect narratives, stories and worldviews; they are fundamentally the expression of a lifeworld.[82] Therefore, it is not enough to update environmental law's anthropocentric narrative of reason and liberalism by supplementing it with 'scientific description'.[83] Overcoming the alienation of earth systems present in environmental law requires knowledge of alternative ways of being and existing in the world in a way that supports an ecological logic. This knowledge should not be reduced to empirical description[84] or a process of adaptation and learning. Such approaches are at risk of being simply technical and rules-based responses to a much broader ontological concern.

This is demonstrated in the governance case studies above. In both jurisdictions, we can observe a continuing conceptualisation of ecosystems as 'resources', defined by their use value. Rehabilitation governance is largely concerned with future use of the land (particularly in the mining example) or maintaining access to markets through certification (forestry practices in Tasmania). Standards are limited to metrics of disaggregated ecosystem aspects, that is, soil or water quality and stable landforms in the case of mining restoration in Queensland, or single species coverage in the case of forest restoration in Tasmania. Adaptive approaches are included in both of the governance frameworks, but appear to have been largely implemented to facilitate processes that limit state liability in the case of the progressive rehabilitation in Queensland, and to allow for an agile organisation in the case of the independent regulator in forest management in Tasmania. While these are certainly important goals, adaptive management in the case studies did not seek to improve ecological complexity. The complexity inherent in the relationships between the social and ecological components of these systems is assumed to develop on its own over a period of time.

Adaptive approaches have been criticised for their failure to attend sufficiently to questions of agency, power, culture and history.[85] And it is in this

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82   Aaron Mills, 'The Lifeworlds of Law: On Revitalizing Indigenous Legal Orders Today' (2016) 61(4) *McGill Law Journal* 847.

83   Kirsten Anker, 'Law As ... Forest: Eco-Logic, Stories and Spirits in Indigenous Jurisprudence' (2017) 21 *Law Text Culture* 191, 198.

84   Ibid.

85   Muriel Cote and Andrea J Nightingale, 'Resilience Thinking Meets Social Theory: Situating Social Change in Socio-Ecological Systems (SES) Research' (2012) 36(4) *Progress in Human Geography* 475; Debra J Davidson, 'The Applicability of the Concept of Resilience to Social Systems: Some Sources of Optimism and Nagging Doubts' (2010) 23(12) *Society & Natural Resources* 1135; Michael Fabinyi, Louisa Evans and Simon J Foale, 'Social-Ecological Systems, Social Diversity, and Power:

criticism that we can observe a failure to truly break the anthropocentrism of environmental law. Adaptive management and governance, despite their attempts to recognise the sociality of natural systems, still continue a particular worldview in which ecological systems are often framed as a legal 'object' or resource. Agency within these systems is largely limited to the 'human', and questions of diversity, equity and power relations, when raised, are primarily concerned with an environmental justice that centres on the human.[86]

This means that in doing the restoration work, landscapes remain at risk of continuing to be a commodity, or recovery efforts are simply a required intervention for maintaining the use value of private property. Critically, it means that restoration efforts do not add as much to the structural and trophic complexity that is needed in the system, so that at some point human being decisions are not central to sustaining the system. According to the five-star recovery system used in the recent ecological restoration standards of the International Society of Ecological Restoration, ecosystems can accumulate complexity to the point that it is naturally regenerating itself. Using this system, for instance, restoration efforts can help achieve sustainability, but not necessarily complexity for the system under consideration.[87] This distinction is illustrative simply of the opportunities for adaptive governance, and the importance of having substantive goals, as well as process goals for restoration efforts. The mining and forestry examples highlight the lack of this ambition in achieving complexity.

Insights from Anthropology and Political Ecology' (2014) 19(4) *Ecology and Society* 28; Marc Welsh, 'Resilience and Responsibility: Governing Uncertainty in a Complex World: Resilience and Responsibility' (2014) 180(1) *Geographical Journal* 15.

[86]   Chaffin, Gosnell and Cosens (n 12).

[87]   See Tein McDonald, Justin Jonson and Kingsley W Dixon, 'National Standards for the Practice of Ecological Restoration in Australia' (2016) 24(S1) *Restoration Ecology* S4 for a discussion of the five-star system that seeks to explain the levels of complexity that a system can achieve, with the highest level being one where there are very high similarities between it and the reference ecosystem. This five-star system was adopted by the 2019 2nd edition of the Society for Ecological Restoration as part of its *International Principles and Standards for the Practice of Ecological Restoration.* See also Tein McDonald and Kingsley Dixon, 'National Standards: Reasserting the Ecological Restoration Framework in Uncertain Times" (2018) (19)(S1) *Ecological Management & Restoration* 79.

V BUILDING COMPLEXITY: CHALLENGING LAW'S ANTHROPOCENTRISM WITH RESTORATIVE INPUTS

To help achieve greater ecological complexity through a legal system conducive to a 'future that has a future',[88] we want to explore in this part how the idea of 'restorative inputs' can shape values differently and contribute substantively to law and governance, shifting its ontological commitments. Conceptually, restorative inputs are similar to other innovative ideas, like net-gain, no-net-loss, half-Earth,[89] and a host of others that set abstract limits and conditions on activities so that performance can be measured against them. The idea of restorative inputs is to go beyond technical solutions and reorient the ontological frames of ecological restoration law and governance and move beyond technical solutions and a largely extractive and property-based relationship with the more-than-human world. Restorative inputs aims to create social institutions that reorient ontologies towards more cooperative relationships between human beings and the natural world. The aim, therefore, is not to create more stringent rules to manage the transactional and competitive access arrangements between human beings, but rather to enable cooperative acts and initiatives that can build new ontologically significant social and cultural institutions.

Ecological restoration is not concerned simply with remediating and rehabilitating an ecosystem; it can also shape how humans conceive of and relate to the natural environment by actively working on inputs into achieving greater complexity.[90] By focusing on complexity and native systems, it is a practice that can facilitate the development of a partnership ethic between 'the human' and 'the more-than-human', envisioning 'a better relationship between humans and the rest of the world'.[91] Undertaken with broad stakeholder and community involvement and engagement, ecological restoration can ground and attach people to places in which they live with deep metaphysical or emotional connections, motivating people to care for ecosystems beyond the services they provide or their aesthetics,[92] even instilling a sense of stewardship or

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[88]   Arturo Escobar, *Designs for the Pluriverse* (Duke University Press, 2018) 9.

[89]   Edward O Wilson, *Half-Earth: Our Planet's Fight for Life* (Liveright Publishing Corporation, 2016).

[90]   William R Jordan, *The Sunflower Forest: Ecological Restoration and the New Communion with Nature* (University of California Press, 2003). This book is increasingly recognised as one of the first monograph-length discussions of the significance and benefit of restoration for changing the human–nature relationship.

[91]   Dave Egan, Evan E Hjerpe and Jesse Abrams, *Human Dimensions of Ecological Restoration: Integrating Science, Nature, and Culture* (Island Press, 2011); Carolyn Merchant, *Reinventing Eden: The Fate of Nature in Western Culture* (Routledge, 2003).

[92]   Afshin Akhtar-Khavari and Benjamin J Richardson, 'Ecological Restoration and the Anthropocene' in Afshin Akhtar-Khavari and Benjamin J Richardson (eds), *Ecological Restoration Law: Concepts and*

responsibility with respect to land and property.[93] In this, restorative inputs into the complexity of a system is similar to terms such as landscape restoration, eco-cultural restoration, focal restoration and reciprocal restoration. Such terms define practices concerned not only with scientific value but also aesthetic, historical and traditional landscape values, reflecting an understanding that the presence of humans can be an integral part of thriving, resilient landscapes.[94] Reciprocal restoration, for example, as Kimmerer explains, is 'the mutually reinforcing restoration of land and culture such that the repair of ecosystem services contributes to cultural revitalization and renewal of culture promotes restoration of ecological integrity'.[95] Restorative inputs build on these concepts, framed by a commitment to socio-ecological complexity.

A *Restorative Inputs and Complexity*

As we have identified, ecological restoration is both a complex, systems process, and also an ambition to achieve more than just rehabilitation and remediation.[96] Ecosystems and socio-ecological systems can be considered complex adaptive systems. Markets, regulations and institutions, however, have a tendency to break down landscapes, ecosystems and bioregions into smaller units for the purposes of trade, markets and regulation of rights. Ecosystems are reduced to their components, such as taxonomic richness, water and soil quality, undermining the appreciation of the overall complexity of these systems.[97] Regulation, therefore, does not generally define restoration as a self-sustaining system focused on function and process, but rather promotes an 'undue

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Case Studies (Routledge, 2019) 1; Robyn Bartel and Nicole Graham, 'Ecological Reconciliation on Private Agricultural Land: Moving Beyond the Human–Nature Binary in Property–Environment Contests' in Afshin Akhtar-Khavari and Benjamin J Richardson (eds), *Ecological Restoration Law: Concepts and Case Studies* (Routledge, 2019) 93; Gretel Van Wieren, 'Ecological Restoration as Public Spiritual Practice' (2008) 12(2–3) *Worldviews: Global Religions, Culture, and Ecology* 237.

[93]   Emily Barritt, 'The Story of Stewardship and Ecological Restoration' in Akhtar-Khavari and Richardson (n 92) 72; Bartel and Graham (n 92).

[94]   Wayne Barbour and Christine Schlesinger, 'Who's the Boss? Post-Colonialism, Ecological Research and Conservation Management on Australian Indigenous Lands' (2012) 13(1) *Ecological Management & Restoration* 36; Egan, Hjerpe and Abrams (n 91); Francisco Moreira, Isabel Queiroz and James Aronson, 'Restoration Principles Applied to Cultural Landscapes' (2006) 14(3–4) *Journal for Nature Conservation* 217; Z Naveh, 'Epilogue: Toward a Transdisciplinary Science of Ecological and Cultural Landscape Restoration' (2005) 13(1) *Restoration Ecology* 228.

[95]   Robin Kimmerer, 'Restoration and Reciprocity: The Contributions of Traditional Ecological Knowledge' in Egan, Hjerpe and Abrams (n 91) 258.

[96]   Weinstein, Litvin and Krebs (n 42); Palmer and Ruhl (n 44).

[97]   Richard B Norgaard, 'Ecosystem Services: From Eye-Opening Metaphor to Complexity Blinder' (2010) 69(6) *Ecological Economics* 1219.

emphasis' on physical habitat.[98] This can also result in the prioritisation of certain restoration goals, such as carbon sequestration, over others, resulting in unintended circumstances for objectives such as biodiversity.[99] This can result in the recovery of only part of an ecosystems ecological function, process and socio-ecological benefits.[100] It also risks what Higgs calls *technological restoration* — a scientific-technical practice dominated by elite experts and technicians, concerned with efficiency and uniformity, resulting in restoration as commodity.[101] The practices of rehabilitation and reclamation often used in mine closures and other extractive practices, concerned with ensuring the reparation of ecosystem components, provides an example. The ecosystem services narrative provides another example of where restoration governance and policy internationally is at risk of continuing the ongoing commodification of ecological systems and the reduction of ecosystems into component functions.[102] This has troubling connotations for the governance of ecological restoration:

> [E]nvironmental governance can no more succeed around the metaphor of ecosystem services apart from the richness of ecological thinking than mortgage markets can succeed on the myth that housing prices will always rise … Somehow, we need to make a significant transition toward richer ways of understanding and governing.[103]

A governance framework built around restorative inputs is therefore an attempt to contribute to a deeper articulation of a restorative law and governance framework for ecological restoration, anticipating, fostering and conscientiously defending restoration governance from the ontological and epistemological frameworks of traditional forms of environmental law and governance that continue to disaggregate and commodify the 'natural' world.[104]

A restorative input approach aims to recognise the significance of the whole and the complexity of all the entanglements that come together within a landscape. Scientific knowledge and decision-making is therefore but one part of the process for making good decisions, as historical, cultural and emotional

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[98]   Palmer and Ruhl (n 44) 514.
[99]   Mark Buckley and Ernie Niemi, 'Climate Change Implications for Ecological Restoration Planning' in Egan, Hjerpe and Abrams (n 91) 177.
[100]   David Moreno-Mateos et al, 'The Long-Term Restoration of Ecosystem Complexity' (2020) 4(5) *Nature Ecology & Evolution* 676.
[101]   Higgs (n 43).
[102]   Higgs et al (n 44); Telesetsky (n 43).
[103]   Norgaard (n 97) 1225.
[104]   Emille Boulot, 'Restoring Land, Restoring Law: Theorizing Ecological Law with Ecological Restoration' in Geoffrey Garver et al (eds), *From Environmental to Ecological Law* (Routledge, forthcoming).

connections continue to be integral to understanding the natural world.[105] Governance of such landscape-based approaches would necessarily require an orientation to considering ecosystem function, dispersal, stochastic disturbance, self-organisation, trophic complexity and ecological resilience, which mark successful, systems-based ecological restoration.[106] Such an approach focuses on the interactions between ecological system components rather than simply just the components themselves.[107] In addition, the complexity of such landscapes cannot be maintained and realised without meaningfully acknowledging and entrenching *relational* dimensions of the entangled and connected parts of the world into governance decisions and frameworks. How this will translate to governance is the question we explore next, setting out some initial theorisation as to governance tools and mechanisms that would support and foster complexity, rather than reducing and disaggregating it.

VI RESTORATIVE GOVERNANCE

In this part, we explore key parameters for a governance framework committed to restorative inputs and building complexity through adaptation-oriented approaches. We identify four particular elements. First, the governance of complex systems requires a governance approach that is systems-based, reflexive and responsive to the inherent uncertainty of these systems. Second, governance must ensure that restoration is integrated across the landscape, both spatio-temporally and jurisdictionally. Third, restorative input governance requires a long-term approach, recognising that successful restoration with self-supporting complexity may take centuries or millennia, thus challenging the temporality of traditional environmental law.[108] Finally, as many scholars have identified, there is no one governance solution to questions of complexity. Governance must be heuristic, recognising and responding to the very place-specific nature of complex systems management.

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[105]   This theme comes up in this article a fair bit: Andrew Campbell, Jason Alexandra and David Curtis, 'Reflections on Four Decades of Land Restoration in Australia' (2017) 39(5) *Rangeland Journal* 405.

[106]   Moreno-Mateos et al (n 100); Andrea Perino et al, 'Rewilding Complex Ecosystems' (2019) 364(6438) *Science* 351; Weinstein, Litvin and Krebs (n 42).

[107]   Moreno-Mateos et al (n 100).

[108]   See Richardson (n 69).

A *Systems Thinking and Law*

As noted above, socio-ecological systems are inherently dynamic, exhibiting non-linearities, no central control and behavioural surprise. This means that predicting and managing restoration trajectories 'has been particularly vexing'.[109] Legal systems have a key role in responding and adapting to these questions of dynamism, uncertainty and complexity in strongly coupled socio-ecological systems,[110] with ecologists arguing that governance should be adaptive, long-term and implemented through networks of stakeholders.[111]

Systems theory, however, has not only been applied just to the physical sciences (although there is significant work done in this space).[112] It has also been applied across the social sciences, including environmental law,[113] policy[114] and management.[115] It has been adopted as a framework for addressing social-ecological issues by environmental governance scholars from around the world, including the Stockholm Resilience Centre,[116] the Resilience Alliance[117] and the

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[109]   Weinstein, Litvin and Krebs (n 42) 72; Madhur Anand and Rachelle E Desrochers, 'Quantification of Restoration Success Using Complex Systems Concepts and Models' (2004) 12(1) *Restoration Ecology* 117; William J Mitsch et al, 'Creating and Restoring Wetlands' (1998) 48(12) *BioScience* 1019; Maria C Ruiz-Kaen and T Mitchell Aide, 'Restoration Success: How Is It being Measured?' (2005) 12(3) *Restoration Ecology* 569.

[110]   Kotzé (n 8).

[111]   Hodge and Adams (n 6).

[112]   Murray Gell-Mann, *The Quark and the Jaguar: Adventures in the Simple and the Complex* (H Holt, 1994); John H Holland, 'Studying Complex Adaptive Systems' (2006) 19(1) *Journal of Systems Science and Complexity* 1; John H Holland, *Complexity: A Very Short Introduction* (Oxford University Press, 1995); Kauffman (n 27); Levin (n 27); Mitchell (n 23).

[113]   Kim (n 37); Kim and Bosselmann (n 26); JB Ruhl, 'Law's Complexity: A Primer' (2008) 24(4) *Georgia State University Law Review* 29 ('Law's Complexity'); JB Ruhl, 'Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law' (1997) 34(4) *Houston Law Review* 933 ('Thinking of Environmental Law').

[114]   Gerald Andrews Emison, 'The Potential for Unconventional Progress: Complex Adaptive Systems and Environmental Quality Policy' (1996) 7 (Fall) *Duke Environmental Law & Policy Forum* 167.

[115]   Elinor Ostrom, 'Coping with Tragedies of the Commons' (1999) 2(1) *Annual Review of Political Science* 493; Christian Rammel, Sigrid Stagl and Harald Wilfing, 'Managing Complex Adaptive Systems — A Co-Evolutionary Perspective on Natural Resource Management' (2007) 63(1) *Ecological Economics* 9; Thomas Dietz, Elinor Ostrom and Paul C Stern, 'The Struggle to Govern the Commons' (2003) 302(5652) *Science* 1907.

[116]   Folke et al (n 30); Carl Folke et al, 'The Problem of Fit between Ecosystems and Institutions: Ten Years Later' (2007) 12(1) *Ecology and Society* 30; Andreas Duit et al, 'Governance, Complexity, and Resilience' (2010) 20(3) *Global Environmental Change* 363.

[117]   Bobbie Low et al, 'Redundancy and Diversity: Do They Influence Optimal Management?' in Fikret Berkes, Johan Colding and Carl Folke (eds), *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change* (Cambridge University Press, 2003) 83.

Complex Adaptive Systems Initiative.[118] The literature shares a common premise that the command-and-control approach to natural resource management has inherent limitations[119] and there is no one-size-fits-all solution;[120] rather, responses need to be context-specific, with institutional diversity,[121] redundancy[122] and self-organisation[123] in a polycentric,[124] nested[125] or network organisational setting.[126] Law itself is a complex adaptive system, with Ruhl arguing we should be 'adaptively managing the complex adaptive legal system to adaptively manage other complex adaptive natural and social systems'.[127]

In our thinking with restorative inputs, we agree with Conant and Ashby that 'every good regulator of a system must be a model of that system'.[128] According to Duit et al's diversity hypothesis, efficacious adaptiveness is achieved when the variety of environmental law's internal order or complexity matches its external order, that is, the variety of the environmental constraints.[129] There are, of course, many approaches to the inherent uncertainty in socio-ecological systems, but adaptive and precautionary approaches would appear to be necessary policy structures.[130] Truly restorative governance requires a systems approach to support the establishment and development of complexity across landscapes, and it is here that the learning processes of adaptive governance can be well applied.

[118]   Marco Janssen, 'Use of Complex Adaptive Systems for Modeling Global Change' (1998) 1(5) *Ecosystems* 457.
[119]   Holling and Meffe (n 12).
[120]   Elinor Ostrom, Marco A Janssen and John M Anderies, 'Going beyond Panaceas' (2007) 104(39) *Proceedings of the National Academy of Sciences* 15176.
[121]   Elinor Ostrom, *Understanding Institutional Diversity* (Princeton University Press, 2005).
[122]   Low et al (n 117).
[123]   Dietz, Ostrom and Stern (n 115); Folke et al, 'Adaptive Governance of Social-Ecological Systems' (n 30); Per Olsson et al, 'Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems' (2006) 11(1) *Ecology and Society* 18.
[124]   Elinor Ostrom, 'Polycentric Systems for Coping with Collective Action and Global Environmental Change' (2010) 20(4) *Global Environmental Change* 550.
[125]   Dietz, Ostrom and Stern (n 115).
[126]   Marco A Janssen et al, 'Toward a Network Perspective of the Study of Resilience in Social-Ecological Systems' (2006) 11(1) *Ecology and Society* 15.
[127]   Ruhl (n 10).
[128]   Roger C Conant and W Ross Ashby, 'Every Good Regulator of a System Must Be a Model of That System' (1970) 1(2) *International Journal of Systems Science* 89, 89.
[129]   Duit et al (n 115); Ruhl, 'Thinking of Environmental Law' (n 112); Ruhl, 'Law's Complexity' (n 113).
[130]   Ruhl (n 10); Lance H Gunderson and CS Holling (eds), *Panarchy: Understanding Transformations in Human and Natural Systems* (Island Press, 2002).

B *Landscape Integration*

A landscape approach recognises that ecosystems are interconnected, and their ecological processes are inherently complex.[131] Ecological restoration should therefore consider the variety of scales with cross-habitat linkages and energy fluxes that exist across the landscape.[132] Decisions regarding restoration would need to consider the natural environment in the context of its restorative conditions. Principle 7 of the second Primer of the International Society for Ecological Restoration contains the idea that restoration efforts can accumulate across a landscape.[133] On this Principle the Primer encourages planning at the landscape level to achieve complexity as it accumulates across the area over time and connects restored areas with one another. More importantly, 'landscape' incorporates both ecological and social elements, addressing spatial and temporal scales.[134] It is the scale at which 'identity to place' emerges.[135] Not only does this require the application of landscape ecology, recognising that ecosystem sustainability varies across spatio-temporal scales, it also requires a recognition that governance will be need to be integrated across multi-level jurisdictional boundaries. Governance that can support partnerships, remove regulatory barriers and coordinate across bioregional scales will be required.

C *Long-Term Approach*

One of the significant benefits of having a vision for restorative inputs built around complexity and relationality is that it positions governance approaches on a long-term trajectory. Initiatives that are designed to help restore native ecosystems can take decades, centuries or millennia of inputs.[136] Whatever the motivation or strategy, the challenge for governance in relation to long-term initiatives for building complexity will be monitoring, evaluation and adaptation to changing circumstances. Further, integrated schemes that continue to support and sustain one another without affecting the cumulative value of what is being achieved is critical.

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[131]   Erica A Newman et al, 'Scaling and Complexity in Landscape Ecology' (2019) 7 *Frontiers in Ecology and Evolution* 293.

[132]   Weinstein, Litvin and Krebs (n 42).

[133]   See Principle 8 of Society for Ecological Restoration International Science and Policy Working Group, *International Principles and Standards for the Practice of Ecological Restoration* (2nd ed, 2019) <http://ser.org/page/SERStandards>.

[134]   Jianguo Wu and R Hobbs, 'Landscape Ecology: The-State-of-the-Science' in Jianguo Wu and R Hobbs (eds), *Key Topics in Landscape Ecology* (Cambridge University Press, 2007) 271.

[135]   Jianguo Wu, 'A Landscape Approach for Sustainability Science' in MP Weinstein and RE Turner (eds), *Sustainability Science: The Emerging Paradigm and the Urban Environment* (Springer, 2012) 441.

[136]   Moreno-Mateos et al (n 100).

Instruments found in most current legislation focus more on short-term agendas and transactional opportunities and less on learning how to pass on knowledge and undertake effective succession-planning for the next generation. Funding that recognises the multi-generational nature of ecological restoration becomes a key requirement and can sustain effective restoration over the time that is required.

D *Multitude of Governance Responses*

As has been eluded to throughout this article, ecological restoration is place- and context-specific. Governance that seeks to incorporate social and ecological system complexity must recognise that universal frameworks do not exist;[137] rather, a suite of policy responses will inevitably be required.[138] As Campbell, Alexandra and Curtis note:

> Over the past four decades, we have learnt that land restoration demands long-term approaches, durable policy settings and continuity of resourcing, of both social and biophysical interventions capable of using a full suite of policy instruments — educative, informative, inventive, market and regulatory.[139]

Restorative input governance therefore requires a heuristic framework for the design and operationalisation of regulation acknowledging that governance in this space will be difficult to measure, maintain and replicate under ongoing ecological change.[140] While bottom-up place-specific approaches are certainly effective for adaptive governance implementation, support from higher levels, with cross-scale connections and nesting will be necessary for operationalisation.[141]

Restorative inputs could take many forms and shapes, and its significance would be in terms of facilitating deeper engagement with the impacts and influences that we have on one another and, more importantly, nature. Ontological change is challenging, and disruptive technologies and ideas are needed to help us shift from competitive to cooperative relationships that can enable a different evolutionary socio-ecological platform.

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[137]   Ostrom, Janssen and Anderies (n 120).
[138]   Garmestani and Benson (n 12).
[139]   Campbell, Alexandra and Curtis (n 105) 410.
[140]   Sharma-Wallace, Velarde and Wreford (n 54).
[141]   Garmestani and Benson (n 12).

VII CONCLUSION

Without attending to the ontological foundations of law, adaptive governance for restoration will continue to replicate its presuppositions regarding the human–nature binary[142] as demonstrated by the governance frameworks for mine and forest restoration in Queensland and Tasmania. But when practiced with a governance approach that recognises the human as a part of, and dependent upon, the natural world,[143] restoration has the potential to enable what Van Wieren calls a 'de-centering' of the liberal subject of environmental law, thus eroding human–nature dichotomies.[144] Decentring the human subject, however, requires a commitment to building on the complexity that is inherent in the ecological systems of which human beings are a part. We have sought to argue that governance approaches to restoration that support human goals and ambitions are not as concerned with building and adding complexity into a system.

By initiating a discussion on a values-led restoration governance, we have outlined a framework for using restorative inputs to bring an additional dimension to adaptive governance processes. Restorative inputs into 'ecological restoration' make explicit the need to focus primarily upon the development of complexity, that is, processes including ecosystem function and process. In this we can observe a shift away from solely human agency, to a whole-of-landscape consideration of agency. Restorative inputs are therefore an example of an earth-sustaining ontology, where there is active engagement in the consideration of a mutually beneficial relationship between humans and nature.

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[142]   See a similar critique with respect to ecological economics: Vijay Kolinjivadi, 'Avoiding Dualisms in Ecological Economics: Towards a Dialectically-Informed Understanding of Co-Produced Socionatures' (2019) 163 *Ecological Economics* 32.

[143]   Higgs (n 43).

[144]   Van Wieren (n 92). See also Barritt (n 93); Kimmerer (n 97); Higgs (n 43).