

Designer Ecosystems for the Anthropocene

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Accepting that nature and culture are intricately co-evolved has profound implications for the ethical, legal, philosophical and pragmatic dimensions of social and environmental policy. The way researchers think about nature affects how they understand and manage ecosystems. While the ideals of preserving wilderness and conserving ecosystems have motivated much conservation effort to date, achieving these ideals may not be feasible under Anthropocene conditions unless communities accept custodial responsibilities for landscapes and other species.

Keywords: designer ecosystems ; ecological restoration ; environmental policy ; Anthropocene

1. Introduction

Different cultures have fundamentally different relationships with animals and the environment due to their foundational beliefs and worldviews ^[1]. These shape nature–culture relationships and underpin the way ecosystems are understood and managed ^{[1][2]}. Most contemporary ecosystem management models have their origins in the European enlightenment, embedding the Cartesian duality that separates humans from nature ^[3]. The dominant, instrumental, administratively rational models perpetuate this dualism, separating the knowing and governing of nature into science and policy domains and outsourcing environmental management to professional experts ^[1]. These models were promoted globally via colonial regimes and their attempts to “civilise” the World’s “wilderness areas” and “wild” Indigenous peoples ^[3]. The results have profound implications for the Earth’s diverse peoples and landscapes and the way ecosystems are managed ^[3]. The administrative and scientific rationalism that underpins modern environmental management grew to dominance under conditions of relative climatic stability ^[4]. However, the pressures of a new climate regime mean researchers need to critically examine and reconceive the relationships with the Earth, the biosphere and other species ^[4]. This critical examination should extend to the foundational concepts and normative values underpinning nature–culture relationships, which are often taken as givens.

The entry's origins are in the author's work with the Martuwarra Fitzroy River Council, which represents Indigenous people in Australia’s Kimberley region. These traditional owners find abhorrent the widely promoted idea of wilderness. Instead, they seek greater recognition of their relational models of cultural landscape management. For a clear articulation of these concerns, see Fletcher et al. ^[3]. This entry goes beyond these concerns about wilderness, exploring options for meeting complex sustainability challenges by drawing on literature about cultural landscapes, ecological design, agroecology and permaculture.

2. Anthromes, Anthroscapes and Cultural Landscapes

The accelerating rates of change occurring to the planet in the Anthropocene ^[5] build on twelve thousand years of deforestation and land-use change since the advent of agriculture ^[6]. Through pursuing food and fibre production using agriculture, humans have altered about two-thirds of the World’s ice free, terrestrial ecosystems, forming the extensively modified landscapes or anthropogenic biomes that Ellis ^[7] defines as anthromes. Human-dominated regions that inevitably integrate cultural and natural processes ^{[8][9]} are also known as anthroscapes ^[10] or cultural landscapes ^[11]. These, co-evolved and productive landscapes are widespread and diverse, sustaining communities from the deserts of Australia ^[3] to the rain-sodden Lake District of England ^[8].

Agricultural development simplified many landscapes, resulting in the destruction and degradation of habitats, particularly in those areas best suited to large-scale industrial farming ^{[8][7][12][13]}. While not the intent, many species have declined in extent and numbers and ecosystems functions have changed, resulting in large-scale land, water and biodiversity conservation problems ^[13]. While agriculture has had negative consequences for many species, it is worth noting that some species—known as increasers, such as crop plants, weeds, crows and rodents—have benefited, increasing in number and distribution ^[14].

Overturning land degradation problems and achieving biodiversity conservation requires the application of principles and guidelines based on ecological science, across multiple scales that range from the local to the trans-national ^[15]. These principles need refining, for example, through application in the large-scale reafforestation and land restoration programs, such as those proposed in Sub-Saharan Africa ^[16]. While many policies and programs aim to improve conservation outcomes and reduce the negative impacts of land use, these are rarely commensurate with the scale of the problems. A lack of sustained effort in mobilising governments, industries and communities in transformational landscape-scale conservation initiatives leaves many peopled and production landscapes highly degraded ^[17]. More fundamentally, there is generally a deep unwillingness to deal with the political, cultural and economic drivers of environmental degradation ^[18].

Overcoming global-scale problems, such as land degradation and biodiversity loss, requires a multitude of solutions that recognise the cultural and economic dimensions of the people and politics involved in land management ^{[17][19]}. Effective nature conservation must involve the people who manage landscapes and cannot only be left to national parks and reserves ^[17] because nature persists in and through cities ^[20] and other anthrosapes ^[13] such as agricultural and pastoral lands ^[21]. Conservation across all land tenures, beyond traditional parks and nature reserves, requires institutional, policy and practical reforms that mobilise communities and political leaders ^[17]. These co-evolved cultural landscapes need the care and custodianship provided by communities with their intricate understanding, histories, beliefs, language, experience and governance regimes ^{[3][21][8]}. When functional, these normative and cultural frameworks provide capacity for determining that landscapes are managed and governed and can limit the exploitation that drives degradation.

The governance and management processes that shape and reshape landscapes can be seen as a form of ecosystem design ^[22]. If the shaping and reshaping of landscapes are processes of design, then let us acknowledge humans as the custodians of designer ecosystems. Before elaborating on designer ecosystems, the following section outlines the relevance of Australia's co-evolved cultural landscapes to this idea.

3. Learning from Australia's Landscapes Co-Evolved Cultural Landscapes

Australia's co-evolved cultural landscapes provide important lessons for thinking and managing ecosystems in the Anthropocene. There is now a general acceptance that thousands of generations of human use and occupation shaped Australian ecosystems, over periods that spanned several major climatic transitions ^[23]. Australia's landscapes co-evolved through the iterative and skilful management of Indigenous peoples, including their deliberate and systematic use of fire in ways that determine landscape patterns, species communities and vegetation features ^{[24][25]}. In addition, Indigenous peoples extensively modified rivers, wetlands and waterways to form fish traps and freshwater aquaculture systems ^{[26][27]} and translocated numerous plant species, including through ceremonial gifting practice ^[28]. Australia's Indigenous peoples also have deep totemic connections to places and animals ^[1] and custodial responsibilities for the care of land, water, plants and animals, through first, or natural law, which codified responsibilities for stewarding environmental resources ^{[3][24][29]}.

The studies outlined above portray cultural governance practices that shaped and nurtured landscapes—including economically, culturally and symbolically important plant and animal species. The attempted silencing and erasure of the evidence of this ecosystem stewardship is part of settler Australia's colonial dispossession of Indigenous peoples that disrupted the practice of natural law and ecosystem stewardship ^{[29][30]}. Promoting ideas about preserving "natural" landscapes or "wilderness" areas, free of human influences, reinforces this colonial lineage, furthering the dispossession ^[31] through what Fletcher et al. ^[3] call the shackles of wilderness. Claims that only endemic species should be replanted are underpinned by these naturalistic values ^[32]. However, these nativist approaches ignore the deliberate translocation of plant and animal species by Indigenous peoples over millennia ^{[27][28]}. Despite the attempted silencing, evidence of the continuing heritage values of these cultural landscapes is compelling ^{[23][33]}, and the continent's profound human history challenges the ideal of "wilderness" based on notions of "natural" ecosystems free of human influence ^{[3][31]}. Further, it challenges "wilderness" concepts, which perpetuate the nature–culture dichotomy ^[3].

In contrast to wilderness, the term country is all encompassing, covering a people's territory, and their relationships to land, water, animal and vegetation resources. It is increasingly commonly used in Australia, to denote the holistic concept of country used by Indigenous Australians ^[3]. The idea of caring for country is central to many contemporary Australian interactions with the landscape, including under the broad banner of Landcare ^[17]. For several decades, Australia's governments have actively supported communities' care for the land through policies and programs known generically as Landcare ^[17]. Landcare programs empower local collaborations in agricultural, coastal and urban areas enabling social, technological and environmental innovations ^[17]. While Landcare has supported contemporary explorations about living well in this continent, the practice of communities caring for country is at least 60,000 years old and involved laws and

practices that stewarded environmental resources ^{[3][24][29][33][34]}. Landcare brings together this timeless ethos while fostering innovative and regenerative agriculture and landscape management that integrates the needs of humans and other species ^[17]. Landcare legitimises diverse relationships with country, promoting creative explorations, innovative practices and new enterprises ^[17], the need for which is more pressing than ever, given the challenges of climate adaptation ^[35].

Country is a broad concept that includes the waters and waterways, which have deep cultural, material and spiritual significance ^[33]. Rivers and their floodplains, not only have high cultural heritage values but also have high biodiversity conservation and material values. Water is central to Indigenous peoples' materiality, sociality and spirituality with increasing claims for the right to govern rivers in ways that recognise water as more than a simple natural resource available for exploitation ^{[33][34][36]}. Instead, there are calls to legally recognise rivers as environmental resources and ancestral beings, with cultural identities and legal rights ^[33].

The critical lesson from examining Australia's cultural landscapes is that landscapes and their components, such as plants, animals and waters, need recognition as co-evolving with people, who have distinct relationships and responsibilities to a territory. In these cultural–natural assemblages, cultural knowledge, laws and governance regimes and material and spiritual connections are intrinsically interwoven with how ecosystems are understood and governed ^[33]. Recognising these relational dimensions can enable theories and practices of environmental management that better integrate humans and nature. This integration changes the way researchers understand and govern human–ecosystem relationships and how they define and use natural resources ^{[1][3][33]}.

4. Ecological Restoration under Climate Change?

In this section, researchers ask whether ecological restoration is relevant under Anthropocene conditions, including climate change. Restoration ecology initially focused on restoring a pre-existing assemblage of species that occupied a site ^{[37][38]}. This form of restoration can drive backwards-looking approaches: by definition, the act of restoring implies seeking to re-establish a prior state ^[37]. Ross et al. ^[22] outline how recreating past ecosystems was the driving idea behind the formation of the Society for Ecological Restoration, which initially defined ecological restoration as “the process of intentionally altering a site to establish a defined, indigenous, historic ecosystem. The goal of this process is to emulate the structure, function, diversity, and dynamics of the specified ecosystem.” The society subsequently altered its purpose, adopting the definition that “ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.” This conceptual shift acknowledges the impossibility of “recreating historic ecosystems in a world dominated by novel species interactions in a historical climate, biogeochemical, and hydrological regimes” and that, therefore, global-scale Anthropogenic influences, including climate change, may make some restoration goals unachievable ^[22].

Ecosystem management in the face of these Anthropocene forces demands flexible and adaptive approaches that can handle the complex multi-scaled and non-linear feedbacks between social, ecological and climatic systems ^[22]. Hobbs and Harris ^[38] claim that setting realistic and clear objectives for ecosystem restoration projects is necessary, particularly when working to recover degraded ecosystems (or particular functions of degraded ecosystems).

However, setting clear and feasible objectives may become increasingly difficult due to compounding Anthropogenic drivers of change. These changes can make static conservation paradigms and stationary hydrological models inaccurate or redundant guides to environmental management ^[22]. These complexities and uncertainties mean that past ways of understanding the world have less utility, and new post-natural or post-normal paradigms are needed ^[39]. Three examples support the argument that post-natural models of ecosystem management are needed.

Firstly, water resource management and aquatic ecosystem conservation must adjust to the “death of stationarity” which undermines the foundations of hydrology, making past ways of knowing less reliable ^[40], especially in large river basins affected by climate change ^[41]. Secondly, pre-development benchmarks used for planning the conservation estate are challenged by climate change altering ecosystems and the distribution of species ^[42]. Thirdly, climate and land use change is altering wildfire dynamics. The increasing scale, intensity and impacts of wildfires in many parts of the world have profound implications for disaster management, conservation and land-use planning ^[43]. Many of the world's forests and woodlands appear to be at fire-driven “tipping points” that could change species distribution, vegetation types and ecosystem dynamics ^[44]. The intensification of wildfires is due to multiple, compounding human causal agents including climate, land use and ecosystem change ^[44], indicating caution is needed about simplistically and deterministically reducing the future to climate ^[45].

Given these compounding change drivers, linear projections or static views of “nature”, “natural” systems or “natural” regimes for fire, water or biodiversity have limited utility. Theoretical models that can accommodate the increasingly dynamic nature of ecosystems are needed and governance regimes of socio-ecological systems need to recognise the potential for profound shifts to radically altered states ^[46]. Evidence of this potential for radical shifts in ecosystems can be found in many parts of Australia, where colonial-settler disruptions have fundamentally and dramatically altered much of the country’s terrestrial and aquatic ecosystems ^[47]. Risks of further major shift are intensifying due to compounding anthropogenic influences, including climate change, ^{[22][39]} which is profoundly affecting major river systems ^{[41][48]}. The scale of change occurring in Australia’s Murray–Darling Basin is leading to fundamental questions about ecological “restoration” as an explicit policy or implicit normative goal ^{[48][49]}. For example, Harris ^[49] argues that many restoration goals are unrealistic and that more critical examinations are needed of the failures to restore riverine ecosystems, despite the decades of work and billions of dollars expended ^[49].

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