Abstract: Since the late 1980s, the idea of sustainable development has been gaining widespread recognition as a guiding framework for policies on development and the environment. However, the concept of sustainable development has received a number of criticisms, including its over-emphasis on meeting human needs through economic growth, as well as its failure to recognize dynamic human–environment interactions. In response to these shortfalls, the concepts of resilience and adaptive governance have emerged as alternative perspectives for pursuing sustainable development. Resilience in social-ecological systems emphasizes the capacity of coupled human–environment systems to deal with change, while continuing to develop. Adaptive governance relies on diverse and nested institutional mechanisms for connecting actors across multiple scales to manage conflicts and uncertainties in ecosystem management processes. However, the ethical dimensions of resilience and adaptive governance have not received enough attention. A promising ethical perspective for guiding policies on human–environment interactions is the philosophy of deep ecology, which highlights the need for recognition of the intrinsic values of all living things, as well as the nurturing of ecological and cultural diversity. In this paper, I argue that an integration of the principles of deep ecology and adaptive governance provides a complementary set of ethical principles and institutional attributes that offers better prospects for pursuing sustainable development in the era of the Anthropocene. The implications of this integrative agenda include: the adoption of a holistic conception of dynamic human–environment interactions; the recognition of diverse knowledge systems through an anti-reductionist approach to knowledge; the promotion of long term sustainability through respect for ecological and cultural diversity; and embracing decentralization and local autonomy. I further illustrate this integrative agenda using the management of protected areas as a case study.

Keywords: anthropocene; resilience; social-ecological systems; sustainability; transitions; wilderness

1. Introduction

In recent years, there has been growing recognition of the emergence of the era of the Anthropocene in which humanity has acquired the capacity to mold the natural environment, thus making human activity a major driver of global environmental change, as opposed to the era in which the environmental impacts of pre-industrial societies had a relatively benign influence on earth system processes [1–3]. Moreover, there is a growing awareness that the acceleration of anthropogenic pressures on the earth system presents an increased risk of abrupt, non-linear and irreversible changes in the dynamics of the earth system, with potential adverse implications for human wellbeing and ecosystem health [4–6]. These planetary dynamics in the era of the Anthropocene can be explained from the resilience and complex social-ecological systems perspectives, which describe the dynamic and co-evolving interactions between social and ecological systems across multiple spatial and temporal scales [7,8].
In view of these insights, the concept of sustainable development as a guiding principle for the stewardship of the earth system is of relevance now more than ever [1–3,9–11].

Although the idea of sustainability has a long-standing history in the field of natural resource management [12,13], the application of the sustainability concept to the field of development planning began in the 1980s, in response to growing awareness of the neglect of environmental and social issues in conventional development practices by national governments and international development agencies [13–17]. In the report, “Our Common Future” (the Brundtland Report), the World Commission on Environment and Development (WCED) defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [18] (p. 43). The Brundtland Report identifies two key underlying components of the definition. One is the satisfaction of basic human needs and aspirations, such as food, clothing, shelter, and jobs. Consistent with the basic needs strategy of development that aims at providing opportunities for the full development of the individual [14,19], the report posits that “Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their basic aspirations for a better life” [18] (p. 44). The report argues that when basic needs are not met, poverty and inequality pose threats to the environment. It, therefore, recommends economic growth as a necessary strategy to expand society’s production capacity and to create equitable opportunities for all to meet their needs. The other component of the definition of sustainable development is the recognition of limits in the capacity of the natural environment to meet the needs of present and future generations. The Brundtland Report notes that society’s ability to meet the needs of present and future generations is compromised when resources are overexploited. For renewable resources, such as forest ecosystems, the report suggests the use of maximum sustained yield as a guiding principle to avoid exceeding resource carrying capacity. For non-renewable resources, such as fossil fuels, the report recommends the use of available technology to minimize resource depletion and to explore the availability of substitutes. While the sustainable development concept has received broad-based support over the years, it has also received sustained criticisms. These include a lack of conceptual clarity; the separation of social, ecological and economic components; inadequate recognition of the dynamic interactions between humans and nature; the lack of clear ethical foundations; an over-emphasis on human needs; and inadequate consideration of the diversity of cultures and needs [12,17,20–22].

Since the publication of the Brundtland Report, several international conferences have been held to further develop the sustainable development agenda. The UN Conference on Environment and Development (the Earth Summit), which was held in Rio de Janeiro in 1992, resulted in the adoption of a number of international conventions, including Agenda 21, which aims to promote grassroots participation and cooperation as one of the key strategies for achieving sustainable development [15]. In 2002, the World Summit on Sustainable Development, held in Johannesburg, South Africa, reaffirmed the relationship between human wellbeing and ecosystem health in the sustainable development agenda and led to the adoption of the Millennium Development Goals (MDGs), including the eradication of extreme poverty and hunger, the promotion of universal primary education, improvement in maternal health and the promotion of environmental sustainability [23,24]. During the 15-year implementation period of the MDGs, significant progress was made toward reducing hunger, poverty and disease in the developing world, although the progress was variable across goals, countries and regions [2,25]. At the UN Conference on Sustainable Development, held in Rio de Janeiro (Rio + 20) in 2012, the need for new Sustainable Development Goals to replace the MDGs was highlighted [10]. At the 2015 UN Sustainable Development Summit in New York, the Sustainable Development Goals (SDGs) were finally adopted. The 17 development goals address a range of challenges including poverty, food, energy and water security, as well as climate change [26]. However, recent analysis suggests the SDGs may have inherited some of the problems associated with the Brundtland Report, such as an over-emphasis on market-based approaches to economic growth and lack of cross-sectoral integration [22,27].

It has been posited that achieving sustainable development in the era of the Anthropocene requires the use of innovative governance mechanisms that are adaptive, multi-level and polycentric, as opposed
to the reliance on conventional top-down institutions \cite{1,28,29}. In this regard, adaptive governance of social-ecological systems is increasingly seen as a promising institutional mechanism for promoting sustainable development at the global, regional and local scales \cite{4,7,9}. Adaptive governance refers to flexible multi-level institutions that connect actors across multiple levels to facilitate ongoing learning, and responding to conflicts and uncertainties in ecosystem-based management processes \cite{30–32}. However, the ethical foundations of adaptive governance regimes have not received much attention in the resilience literature \cite{33}. With the exception of a few studies \cite{11,34–36}, ethical considerations in the broader literature on social-ecological systems research have not received adequate research focus. As such, just like adaptive co-management \cite{37}, there is no guarantee that the implementation of adaptive governance will result in just and equitable outcomes. To reduce the potential for the adaptive governance concept in particular, and complexity thinking in general, to be co-opted by decision-makers for the pursuit of unjust and unsustainable political agendas, there is the need for clear ethical guidelines for the pursuit of policies based on adaptive governance.

A promising ethical perspective that has the potential to inform current sustainability efforts at various levels from the local to the global is deep ecology \cite{38–40}. While several perspectives exist in the field of environmental ethics, such as eco-feminism and environmental pragmatism \cite{41}, this article focuses on deep ecology, due to the potential for compatibility and complementarity between the metaphysical, epistemological and institutional attributes of deep ecology, and those found in the literature on resilience and adaptive governance. Moreover, the ethical principles of deep ecology have been more widely discussed in various sustainability arenas, particularly the management of protected areas which is used as a case study in this article. Deep ecology is a philosophy that is informed by a holistic conception of human–environment relationships, and offers an ethical prescription that emphasizes the intrinsic value of all members of the biotic community, as well as the need to nurture the diversity of ecological, cultural and knowledge systems \cite{42,43}. While the deep ecology perspective offers promise as a guide for long term sustainability, the institutional mechanisms for operationalizing these ethical principles have not been well-developed \cite{42}.

In this paper, I argue that the integration of deep ecology and adaptive governance of complex social-ecological systems provides a coherent set of institutional attributes and ethical considerations, which holds promise for promoting sustainable development in the era of the Anthropocene. The integration of the principles of deep ecology and adaptive governance draws attention to a holistic conception of human–environment interactions, an anti-reductionist approach to knowledge, an emphasis on diversity of cultures and ecosystems and the promotion of decentralization and local autonomy. I illustrate this argument using the management of protected areas.

2. An Alternative Paradigm for Sustainable Development: Panarchy and Social-Ecological Resilience

In recent decades, there has been growing awareness that most of the conservation challenges facing resource managers in the field of forestry, fisheries and other resource management arenas stem from a failure to recognize the dynamic interdependence between social and ecological systems \cite{44,45}. In view of these insights on the failure of past policies, the conventional paradigm that assumed stability and predictability of ecosystems is increasingly being questioned and rejected, in favor of an alternative paradigm that posits that social and ecological systems are intricately interconnected as coupled social-ecological systems, and that it is unreasonable to try to study or manage the two as separate entities \cite{45,46}. The dynamics of coupled social-ecological systems have been described using the attributes of complex adaptive systems, such as scale, thresholds, nonlinearity, emergence, surprise, heterogeneity and path-dependency \cite{44,47–49}. These dynamics can be modeled using the concepts of adaptive cycles and panarchy \cite{50}. The concept of adaptive cycles departs from conventional assumptions on the stability and equilibrium of ecosystems by positing that dynamic social and ecological systems pass through four phases that comprise growth and exploitation, conservation, collapse and reorganization \cite{51}. Panarchy is a grand theory that depicts complex social-ecological systems as interactions among adaptive cycles that are nested across multiple scales \cite{50}. Within the
panarchy, collapses of smaller and faster adaptive cycles have the potential to trigger cascading effects across the entire panarchy. Similarly, larger and slower adaptive cycles at higher levels have a conditioning effect on the smaller and faster adaptive cycles below [52,53]. These dynamic cross-scale interactions account for the balance between change and stability in social-ecological systems [54].

The sustainable management of complex social-ecological systems requires building resilience to change and surprise [7,55–57]. The resilience concept has its origins in the field of ecology in the 1960s and 1970s [58]. As opposed to traditional ecological assumptions of ecosystem stability around a single equilibrium, the resilience concept explains ecosystem dynamics based on the assumption of the existence of multiple stable equilibria. Based on this assumption, resilience is the amount of disturbance a system can absorb before shifting to another state [51,58,59]. In complex social-ecological systems, the resilience concept refers to the capacity to cope, adapt and transform in response to drivers of change [55,60,61]. Coping refers to short-term responses by individuals and groups aimed at reducing the adverse impacts of drivers of change [60]. Adaptation refers to the processes by which social-ecological systems learn and adjust to external drivers and internal processes, in order to take advantage of opportunities for continued development along the current trajectory [45,60]. Transformation entails the ability to initiate change that involves crossing critical thresholds into new development trajectories when existing social, economic and ecological conditions become unsustainable [45,62,63]. All these three types of social-ecological responses appear to require various combinations of capital assets and institutions [61].

The requirements for transformational change in social-ecological systems have been receiving particular attention in the literature in recent years, as the need for such change is increasingly seen as essential for the attainment of sustainable development in the Anthropocene era [8,45,56,64]. Growing evidence suggests that critical factors influencing transformational change in social-ecological systems include crises, windows of opportunity, leadership, incentives, enabling legislation and arenas for deliberation [30,45,65–67]. Navigating change in social-ecological systems requires institutions for connecting social and ecological systems across scales.

3. Institutional Requirements: Adaptive Governance of Social-Ecological Systems

The growing knowledge of the uncertainties and conflicts resulting from the complex cross-scale interactions in social-ecological systems, and the influence of external drivers of change, present a number of challenges for the design of effective institutions for the sustainable governance of social-ecological systems [55,68,69]. One of the major challenges is the design of institutions with the capacity to provide the knowledge and incentives for learning and experimentation processes in adaptive ecosystem-based management [7,58]. Additionally, in view of the increased emphasis on transformational capacity in recent years, the design of institutions for social-ecological governance need to account for the broader processes of social-ecological change [54,70]. Moreover, the recognition of the importance of scale, and problems associated with scale mismatch in conventional resource management policies, calls for the design of multi-level institutions capable of enhancing the fit between various components of social and ecological systems across multiple scales [7,44,71]. Conventional top-down institutions that rely on reductionist scientific knowledge to achieve narrow sectoral goals, based on assumptions of stability and equilibrium, are ill-suited for meeting these challenges [9,30,72].

To address these governance challenges, adaptive governance of social-ecological systems [68,73,74] has been receiving attention among researchers and policymakers as a promising alternative to conventional resource management approaches. Adaptive governance refers to flexible and collaborative learning-based governance mechanisms that connect individuals, organizations and institutions across multiple scales in ecosystem-based management of land and water resources [31,32,75]. The focus of adaptive governance regimes goes beyond the narrow emphasis on the resource management arena toward consideration of the broader social and institutional context within which resource management occurs [73,76,77]. In this regard, Osterblom and Folke [78] build on Dietz et al. [68] to define adaptive governance as “a process of dealing with complexity and change under uncertain conditions that are difficult to control, involving diverse
interest, and reconciling conflict among people and groups who differ in values, interests, perspectives, and power, and the kinds of information they bring to situations” (p. 2). This makes adaptive governance an appropriate mechanism for managing the wicked problems that are entailed in the implementation of adaptive management and ecosystem management [49,74,79]. Adaptive governance is also seen as an effective mechanism for promoting transformational change in social-ecological systems when existing conditions become undesirable [58,75,80,81].

The key features of adaptive governance have received considerable attention in the resilience literature and they include: the recognition of change and uncertainty; the integration of diverse sources of knowledge; the promotion of integrative and adaptive management goals; and a reliance on diverse and nested institutional structures within polycentric systems [9,49,68,74,75]. These attributes of adaptive governance could help overcome the conceptual and implementation shortfalls associated with current approaches to promoting sustainable development, such as the neglect of complexity, the lack of integrated goals, the dominance of science and technology and an overreliance on top-down decision-making. In spite of its promise, a number of knowledge gaps continue to limit the widespread adoption of adaptive governance regimes. Notable among these knowledge gaps is the neglect of the ethical foundations for adaptive governance regimes [33]. Reference [11] highlighted the need for embracing attitudes and worldviews that support the active stewardship of ecosystem processes as a key component of mechanisms for realizing the sustainable development agenda. In the next section, this article seeks to contribute to the discussion on the ethical aspects of adaptive governance by drawing from insights on deep ecology.

4. Deep Ecology, Adaptive Governance, and Sustainable Development

Since the birth of the field of environmental ethics in the 1970s, several ethical perspectives have emerged to explore human–environment interactions. Among them, deep ecology is probably the most widely known [82]. The term deep ecology was coined by the late Norwegian philosopher, Arne Naess, in a paper titled “The Shallow and the Deep Long Range Ecology Movements”, published in the journal Inquiry in 1973. The idea was further developed with contributions from Bill Devall and George Sessions, among others [42]. Reference [83] made a number of distinctions between his proposed deep ecology and the conventional approach to development and the environment, which he referred to as shallow ecology. In this section, I argue for the integration of deep ecology and adaptive governance, by highlighting their shared assumptions and goals, as well as knowledge and institutional prescriptions. In doing this, I also show how these shared attributes of deep ecology and adaptive governance differ from, and offer an alternative to the conventional approach to sustainable development which exhibits the attributes of shallow ecology, such as the separation of humans from nature, the emphasis on anthropocentrism, the reliance on reductionist science and the utilization of top-down institutional mechanisms. Although deep ecology can also be described using the eight principles of the deep ecology platform [38], the focus on the distinction between deep ecology and shallow ecology in this section captures the central issues in the eight principles, while allowing for ease of comparison with the adaptive governance literature.

4.1. Assumptions about Human–Nature Relationships

At the metaphysical level, shallow ecology is based on the mechanistic view of humans as separate from their environment, and the world as composed of discrete, atomistic entities [84]. Consistent with this characterization, a major criticism of the sustainable development agenda as proposed in the Brundtland Report is its failure to fully appreciate the complexity and uncertainties that characterize human–environment relationships. Following that report, social, economic and ecological systems are conceptualized as separate but interconnected components, representing the three pillars of sustainable development [3,11]. This conceptualization has been critiqued for failing to recognize the diversity of societies, economies and ecosystems across scales, separating human activities from the natural environment, and also reinforcing a static view of the relationships between humans and nature [20,85].
In contrast with these shallow ecological assumptions that underpin the conventional approach to sustainable development, deep ecology is informed by a “rejection of the man-in-environment image in favor of the relational total-field image” [86] (p. 3). The relational, total-field holism of deep ecology posits that “there is no firm ontological divide in the field of existence. In other word, the world simply is not divided up into independently existing subjects and objects, nor is there any bifurcation in reality between the human and nonhuman realms” [84] (p. 157). From this perspective, humans are not separate from or above nature, but part of a complex web of relationships in a constant state of flux [40,43,82,87]. Following from this, deep ecology also maintains the possibility for humans to extend their self-identification to include others [43]. Such an expanded definition of the self is necessary for achieving the state of self-realization [82]. As [43] (p. 31) succinctly noted, “If everything is part of ones’ self, and one is aiming at self-realization (which deep ecologists argue to be the case) then the clear conclusion to be drawn is that the realization of all (living) organisms is necessary for one’s own full self-realization”.

In line with deep ecology’s holistic and dynamic conception of human–nature interactions, the adaptive governance approach is informed by the view of social and ecological systems as integrated complex adaptive social-ecological systems that shape each other in a co-evolutionary fashion across space and time [9,47]. Panarchy theory suggests that the dynamic cross-scale interactions among adaptive cycles in social-ecological systems give rise to periods of gradual predictable change, as well as occasional abrupt changes that are characterized by high levels of uncertainties [49,53,88]. Adaptive governance provides the mechanisms for managing gradual and abrupt change in such complex social-ecological systems [30,76,89]. Adaptive governance prepares for these uncertainties by relying on adaptive management as a mechanism for building resilience and reducing vulnerability [90]. In active adaptive management, resource management actions are implemented as experiments to test competing policy hypotheses with the aim of generating knowledge about the system [91–94]. However, because adaptive management has largely been implemented as a technical resource management approach that fails to adequately recognize social and institutional considerations [74,95–97], adaptive governance provides an appropriate institutional context for the successful implementation of adaptive management [80,94,98]. Given the reluctance of policymakers in embracing the complexity and uncertainties that characterize human–environment interactions [94,96], combining the scientific insights from the resilience and adaptive governance literature with the metaphysical assumptions of deep ecology could offer a more compelling argument for a rethinking of human–nature interactions.

4.2. Conservation and Development Goals

Ethically, shallow ecology is informed by an anthropocentric or human-centered perspective that views humans as the source of all values, and assigns instrumental values to nonhuman natural entities based on their usefulness as means to meeting the needs of humans [42,82,99]. Arne Naess used anthropocentrism to refer to “the tendency to look at nonhumans and the ecosphere in general from the point of view of narrow utilitarianism, a devaluation of anything but humans and a focus on their narrow, shallow interests, not their deep ones” [100] (p. 231). For instance, a central emphasis of the Brundtland Report is the promotion of economic growth as a strategy for meeting basic human needs and improving upon environmental conditions [12,18,101]. However, the capacity of the earth’s ecosystem to support the rate of economic growth recommended in the Brundtland Report has been questioned [101]. This over-emphasis on economic growth could be seen as one of the key problems associated with the SDGs that could potentially result in the countering of sustainability objectives [27]. As a result, the sustainable development agenda has been critiqued for adopting an anthropocentric perspective that prioritizes human needs over the value of other forms of life [20,102]. The problems associated with the lack of integrated approaches to sustainable development are best illustrated in policies on food, energy and water resource systems, where the pursuit of narrow sectoral approaches have often resulted in adverse consequences that threaten food, energy and water security [103–105].
In contrast, deep ecology is non-anthropocentric in its orientation, as it recognizes the intrinsic values or inherent worth of the nonhuman natural world and considers humans as ordinary members of the biotic community [42]. Deep ecology’s deep-seated respect for all forms of life is expressed in the principle of biospherical egalitarianism—the equal right of all to live and blossom [82,86,87]. Based on these principles, deep ecology offers a radical agenda that replaces the ideology of economic growth with ecological sustainability. The goal of long term ecological sustainability entails the protection and sustenance of the richness and diversity of life on earth [84,106]. Socially, deep ecology calls for promoting the diversity of cultures through the removal of all forms of domination, exploitation and suppression [38,86]. From a deep ecology perspective, “cultural diversity is an analogue on the human level to the biological richness and diversity of life forms” [38] (p. 267). The diversity of human cultures and non-human life forms enhances the chances of survival and also contributes to overall quality of life. Policies that erode this diversity also threaten opportunities for self-realization [86].

Similar to deep ecology, the adaptive governance approach addresses the need for adaptive and integrated management goals in the pursuit of sustainable development [32,107]. Adaptive governance regimes provide flexible institutional mechanisms for the implementation of integrated management goals covering the social, economic and ecological components in ecosystem-based management processes in the face of unpredictability [7,31,70,108]. Ecosystem-based management often involves actors with diverse values and interests as well as competing knowledge claims who are dispersed across various scales. Managing these differences in perspectives calls for mechanisms for conflict management, such as those entailed in adaptive governance processes [68,72].

A key requirement of adaptive governance is analytic deliberation, a process of deliberation among scientists and resource managers that is also informed by scientific analysis [68,109,110]. Analytic deliberation serves as a means of managing conflicting values and knowledge uncertainties, thus making adaptive governance a promising approach for dealing with wicked problems in ecosystem management processes [49,111]. For instance, in their analysis of three case studies on the role of adaptive governance in ecosystem management, reference [31] found that the adaptive governance approach had led to procedural benefits, such as enhanced capacity for monitoring, communication, and responding to changes, as well as substantive benefits, such as the provision of multiple ecosystem services. The authors identified the role of adaptive governance in these processes to include system-wide knowledge mobilization to create awareness, facilitation of collaboration and negotiation across scales, and the utilization of formal and informal institutional mechanisms. However, in the absence of clear ethical guidelines, there is the risk of promoting human-centered goals in the pursuit of adaptive governance and other resilience-based management approaches, thereby perpetuating the pattern of human domination over nature that is typical of the conventional management paradigm. Moreover, given the differences in knowledge, resources and political influence of stakeholders engaged in adaptive governance processes, there is the potential for adaptive governance processes to result in unjust outcomes and the perpetuation of pre-existing social inequalities. As [112] noted, the question of what constitutes “a desirable, fair and feasible future” in the process of social-ecological transformation has not yet been answered. Similarly, reference [113] highlighted the likelihood for resilience-based policies to entrench socially unjust and environmentally unsustainable conditions in their quest to maintain the status quo. Thus, it appears the focus of deep ecology on the nurturing of cultural and ecological diversity based on the principle of biocentric egalitarianism holds promise for promoting inter and intra-species equity in adaptive governance processes.

4.3. Knowledge Systems

Another distinction between deep ecology and shallow ecology could be made with regard to their epistemological positions on science and technology. Shallow ecology endorses the Cartesian view of the universe as composed of atomistic elements that could be understood through the method of reductionism. As such, shallow ecology engenders the fragmentation of knowledge [42]. The shallow ecological approach also emphasizes the training of experts in the hard sciences to manage the
environment in a way that combines economic growth with environmental health. Consistent with this approach, the adoption of Western technology is promoted without regard to differences in cultural context [38]. In the Brundtland Report, the need for technological solutions to emerging problems is strongly emphasized as a requirement for sustainability [18]. For instance, the report endorses the depletion of non-renewable natural resources where technological substitutes are available. This mainstream approach to sustainability has also been critiqued for its overreliance on science and technology, a further reflection of the enlightenment roots of the sustainable development agenda [85].

From the perspective of Enlightenment thinkers, such as Francis Bacon and Rene Descartes, the purpose of science was to serve as an instrument for the domination and exploitation of nature to ensure human progress [85,114]. The type of science that is promoted from the Enlightenment perspective is positivist science that emphasizes the use of quantifiable data to derive generalizable explanations about objective realities [115]. The dominance of positivism has contributed to the fragmentation of disciplines and the marginalization of other ways of knowing [85,115]. For instance, policies on climate change mitigation and adaptation have continued to emphasize the search for engineering solutions, thus, limiting opportunities for the utilization of the social sciences, as well as local and traditional knowledge [116–118].

In view of these shortfalls, recent years have seen a growing appreciation of the knowledge systems of non-Western societies [119]. In line with these trends, deep ecology embraces epistemological pluralism that accommodates scientific and non-scientific ways of knowing as a means of achieving broader social ideals, such as freedom and quality of life [120,121]. From this perspective, the promotion of cognitive diversity is seen as an integral part of efforts to enhance cultural diversity [120,122]. In this regard, deep ecology endorses a shift from the hard sciences to the soft sciences in a way that advances local and global cultures, promotes a critical analysis of Western technology by non-industrial societies to inform adoption decisions and promotes culturally-sensitive local soft technologies [38].

Consistent with the deep ecology perspective, there is growing awareness that realization of the SDGs for global sustainability will require the mobilization of knowledge across scales and sectors through collaboration across disciplines, as well as between academics and non-academics [2,123]. In this regard, the adaptive governance approach promotes the integration of diverse sources and types of knowledge, including scientific and local knowledge [68,72,98]. The adaptive governance approach also provides institutional mechanisms for connecting actors within and across scales in promoting knowledge mobilization through social learning and knowledge co-production processes [9,30,32,77]. For instance, in their analysis of three successful case studies on ecosystem-based management, reference [31] identified the broad mobilization of various types of knowledge among diverse actors, including scientists, farmers and conservationists through adaptive governance mechanisms as a key ingredient in generating awareness and support for collective responses to the perceived crises in each of the cases. However, success in building integrated knowledge about social-ecological systems has not been widespread. Knowledge integration across disciplines, including the natural and social sciences, is often constrained by differences in metaphysical assumptions about the world, explanatory models, as well as methods and criteria for knowledge validation [124–127]. Similarly, the integration of science and traditional knowledge, as well as knowledge co-production through co-management and other participatory processes, is frequently thwarted by lack of trust among participants, as well as differences in power and worldviews [37,128]. Breaking away from the pattern of marginalization of the social sciences and traditional knowledge [127,129] through adaptive governance calls for an explicit emphasis on deep ecology’s principle of epistemological pluralism.

4.4. Institutional Mechanisms

The institutional dimensions of the sustainable development agenda have also received some criticism. Reference [85] describes the emergence of a global “green diplomacy” since the 1972 Stockholm Conference as a mechanism for the implementation of the sustainable development agenda. The author defines green diplomacy as “a way of seeing the world from a managerial perspective:
a style of negotiating a solution to the problems facing the world that takes as its starting point a view of nature solidly based in Enlightenment thought” (p. x). Green diplomacy represents a top-down institutional mechanism that involves negotiations by government representatives and representatives of international organizations, through which agreements are reached on how to address global conservation and development challenges. Global efforts on climate change illustrate the shortfalls of the top-down managerial approach of green diplomacy. Until recently, global efforts to negotiate an international agreement on the mitigation of anthropogenic climate change under the United Nations Framework Convention on Climate Change had gone on for over two decades, without resulting in an effective treaty [116,130,131].

Politically, deep ecology recognizes the need for transformative changes in existing social and political institutions in order to achieve the goal of long term sustainability [38,132]. As [86] (p. 5) noted, “The vulnerability of a form of life is roughly proportional to the weight of influences from afar, from outside the local region in which that form has achieved an ecological equilibrium.” In this regard, deep ecology rejects the paternalistic and imperialistic relationships between industrialized societies and less powerful nonindustrial cultures that characterize current approaches to pursuing sustainable development. Rather, deep ecology embraces local autonomy and decentralization as governance mechanisms for promoting local self-sufficiency and self-determination [38,42,43,86]. One way to promote such decentralized forms of governance is to replace nation-states with bioregions as governance units [42]. Such bioregional communities could provide opportunities for the emergence of sense of place, the development of local ecological knowledge and the expression of local culture [122]. Beyond the local level, deep ecology also recognizes the need for coordinated action at the global level in order to effect the needed changes [38]. However, more clarity is needed on the political and institutional agenda of deep ecology [42].

In view of the shortfalls associated with the top-down approach to addressing global climate change and other sustainability challenges [116,133], increased attention is being paid to the search for governance mechanisms that coordinate the role of governments and the private sector across multiple levels, in the mobilization and sharing of information and resources for realizing the SDGs [2]. Consistent with the focus of deep ecology on decentralized governance and local autonomy, the adaptive governance approach emphasizes the use of polycentric systems as a response to the shortfalls of conventional governance mechanisms [75,90,134]. Unlike monocentric systems in which decision-making authority is centered at one level, polycentric systems comprise multiple governing units at multiple levels, with some degree of autonomy at each level [130]. Within polycentric systems, responsibilities among the governing units are allocated at the lowest most appropriate level according to the principle of subsidiarity [131]. Polycentric institutions are also characterized by an overlap and redundancy in functions among governing units at the various levels [90,134]. Polycentric governance systems offer several potential benefits, such as enhanced opportunities for experimentation and learning, enhanced trust and cooperation through opportunities for communication and interaction, as well as enhanced resilience and reduced vulnerability [130,131,134]. Thus, it appears the relatively well-developed institutional attributes of adaptive governance could potentially serve as a framework for the operationalization of the deep ecology agenda. Although the emerging literature on polycentric systems highlight several challenges, including high transaction costs, inadequate consideration of power dynamics and the potential for undesirable outcomes [29,134,135], it appears that a commitment to decentralization and local autonomy from a deep ecology perspective could help overcome some of these institutional challenges in adaptive governance.

5. Case Study: Management of Protected Areas

The establishment of protected areas has been gaining increased recognition as a key component of global conservation strategies aimed at addressing the loss of biodiversity [13–138]. Protected areas refer to “clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services
and cultural values” [138] (p. 5). The conventional approach to managing protected areas, known as the “Yellowstone model” has been characterized by the reliance on government representatives as resource owners and decision-makers. This model of protected areas management typically employs expert-driven rational-comprehensive planning processes aimed at achieving a narrow range of goals, particularly nature preservation and provision of opportunities for recreation and tourism [139,140]. While this conventional approach has been largely successful in the United States [141], its application in the developing world has received several criticisms, including the separation of humans from nature, the neglect of local socio-economic concerns, the abuse of human rights through forced displacement and the failure to achieve biodiversity goals [137,142–145]. In recent decades, alternative approaches to protected areas management, such as co-management and community-based conservation have emerged in response to the shortfalls of the conventional model [139,144,146,147]. Nonetheless, the conventional approach to protected areas management continues to receive support [148]. Ongoing work on principles for good governance of protected areas suggest the need for governance mechanisms for promoting integrative goals and inclusive decision-making processes, as well as addressing uncertainties and ethical considerations [138,149,150]. Here, I offer a brief overview of the history and key features of the conventional Yellowstone model of protected areas management, following which, I identify its key shortfalls and discuss how they could be addressed using ideas from adaptive governance and deep ecology.

The establishment of Yellowstone National Park in the USA in 1872 as the world’s first national park ushered in the role of national governments in the ownership and management of protected areas [151]. Yellowstone National Park was established to be managed as a “public park or pleasuring ground for the benefit and enjoyment of the people” [152] (p. 37). Following the establishment of Yellowstone National Park, the role of national parks as places for the recreational enjoyment of the American public became entrenched in early US national park policy, notably the National Park Service Organic Act of 1916, which states the purpose of the parks as “to conserve the scenery and the natural and historic objects and the wild life therein . . . unimpaired for the enjoyment of future generations” [153] (p. 12). Early preservationists, notably John Muir, supported the promotion of mass tourism in US national parks as it was seen as an important strategy to create awareness and political support for the National Park System [152,154]. Under the first director of the National Park Service, Stephen Mather, recreation and tourism became entrenched as the primary focus of national parks in the US [155]. However, far from being a benign land use, the adverse impacts of mass tourism on ecosystems and recreational experience became clearer over time. Through the works of Aldo Leopold, Arthur Carhart and Robert Marshall, among others, the wilderness values of national parks gained popularity and policy attention over the years, eventually culminating in the adoption of the Wilderness Act of 1964, which provided a legal mandate for the designation of wilderness areas on public lands managed by federal land management agencies [152]. The Wilderness Act states that “A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain” [152] (p. 4). What has come to be commonly known as the Yellowstone model of protected areas management represents the management of protected areas by government representatives for ecosystem preservation and the provision of opportunities for nature-based recreation and tourism [139]. In this model, the resource is typically owned by a government agency that also has the authority and responsibility for managing the resource to achieve specific goals [138,156]. Over the years, several criticisms have been levelled against the application of the Yellowstone model in the management of protected areas in the developing world.

First, the Yellowstone model has been critiqued for its flawed ecological assumptions. The primary management approach of drawing legal boundaries around parks and protecting them from natural and anthropogenic disturbances as a means of preserving their naturalness [157] has been linked to the outdated balance of nature paradigm and its associated climax theory [153]. The balance of nature paradigm depicted ecosystems as closed, self-regulating systems, separate from nature,
and possessing a single equilibrium state that was reached through a linear, predictable development trajectory [158,159]. Based on these assumptions, climax theory posited that “all vegetation was at, or was returning to, a fully developed climax stage of succession that was natural and characteristic of the region” [153] (p. 15). However, the emergence of new ecological insights on the dynamic and complex nature of ecosystems has challenged the assumption of stable ecosystems fluctuating predictably around a single equilibrium [140,160,161]. Additionally, new evidence on the role of Native Americans in shaping the landscape prior to European settlement has challenged the idea of naturalness [142,153,162].

In view of these insights, building the resilience of park ecosystems to uncertainties and change is beginning to receive attention as a useful goal in the management of protected areas [160,163]. Although these emerging perspectives offer promise for the sustainable management of protected areas, much of the discussion has largely focused on the ecological component of protected areas [157]. An application of deep ecology and adaptive governance to protected areas management promises to advance a truly holistic perspective on the complex and evolving relationships between social and ecological systems across space and time. Such a holistic approach broadens the aspirations of protected areas managers from building the resilience of park ecosystems against uncertainties, to building social-ecological resilience in protected areas as integrated systems of humans and nature [161] using adaptive management and other planning approaches for managing uncertainty [70].

Second, the Yellowstone model of protected areas has also been critiqued for its narrow focus on nature preservation and nature-based tourism [139]. As has been noted previously, the establishment of Yellowstone National Park in the US began the tradition of managing protected areas for the purpose of recreation and tourism [151,152]. Following the adoption of the Wilderness Act in 1964, the management of protected areas shifted from its previous anthropocentric focus on recreational enjoyment toward an ecocentric or biocentric focus, which emphasized managing to preserve naturalness and solitude in protected areas [152]. In spite of the changing management philosophies, a common feature of the Yellowstone model of protected areas is its focus on park ecosystems to the neglect of local socio-cultural concerns [145]. The increased adoption of this model of protected areas management in the developing world has generated major adverse consequences. Reference [164] argued that tropical regions in the developing world that are considered biodiversity hotspots, where protected areas are needed are also social hotbeds, characterized by various socio-economic and political challenges that are neglected in the management of protected areas. The establishment of protected areas in these regions is often characterized by forced evictions that lead to physical, economic and cultural displacement [137,165–167]. This authoritarian approach to managing protected areas also leads to social conflicts that threaten biodiversity conservation [139,143,168]. Finally, established protected areas in the developing world tend to be poorly managed, with most of them existing as paper parks [148].

In view of these shortfalls, people-centered conservation approaches, such as community-based conservation (CBC) and integrated conservation and development projects (ICDPs) have emerged to address the need for community involvement and access to conservation benefits [137,164,169]. ICDPs aim to reduce local pressures on protected areas, by providing various incentives through the integration of local development needs with park management goals, particularly in the buffer zones of protected areas [137,170]. While ICDPs and CBC are often treated synonymously in the literature, reference [137] notes that CBC goes beyond ICDPs by emphasizing local community involvement in park management as a means of achieving conservation and local development goals. In all, the implementation of people-centered conservation initiatives has been critiqued for promoting socio-economic goals, such as sustainable livelihoods and poverty reduction, at the expense of biodiversity conservation [143,146,170]. The focus of ICDPs on the buffer zones of individual protected areas has been critiqued for failing to account for external forces stemming from the broader political economy [164]. Other shortfalls associated with people-centered conservation initiatives include a lack of recognition of community complexity [171], and poor design and implementation mechanisms [170,172]. In view of these shortfalls, a resurgence of interest in the protectionist
Yellowstone model of protected areas has been occurring [143,148,169,173]. This pattern of narrow sectoral approaches to protected areas management highlights the need for ethical guidelines that simultaneously account for the social and ecological dimensions of protected areas [169,174].

Managing protected areas to achieve long term sustainability and resilience requires consideration of ecological, economic, cultural and community issues in a broader regional context [161]. This goal could be realized using the focus of adaptive governance on the integration of multiple values [68,72] and the ethical guidelines of deep ecology on the promotion of biological and cultural diversity [38,106]. The deep ecology principles also provide ethical foundations in support of the call for greater social justice, human dignity and cultural integrity in protected areas management [144,169,175].

Third, a defining feature of the Yellowstone model of protected areas management is its reliance on government representatives as owners and managers of protected areas [139,156]. Consistent with its reliance on centralized institutions, decision-making also follows the rational-comprehensive model [140], a planning approach that aims at choosing the best means for maximizing the common interest, based on the assumption of the availability of comprehensive data on planning problems and societal values [176]. The reliance on centralized institutions and expert-driven planning processes in the Yellowstone model offers limited opportunities for community participation [175], and often leads to the marginalization of local knowledge and local institutions in protected areas management [141]. For instance, decisions on the legal designation of protected areas often occur without the input of the communities that will be impacted by these decisions [144,175]. The widespread existence of paper parks in the developing world also reflects the limited capacity and interest of governments in the developing world in the implementation of the Yellowstone model [148,177]. The legitimacy of conservation decisions based on the authoritarian approach of the Yellowstone model has also been questioned [137,169].

In response to the shortfalls of the Yellowstone model, a shift has been occurring from an emphasis on the role of government to a focus on the governance requirements for protected areas management [136,140,150]. Governance refers to the interactions among the structures, processes and traditions that shape how power is exercised, how collective decisions are made and how stakeholders have a say in the decision-making process [178]. There appears to be a growing consensus on the principles for the good governance of protected areas and they include legitimacy, transparency, accountability, inclusiveness, fairness, policy connectivity within and across sectors and resilience to uncertainties [150]. Of particular interest is the need for governance mechanisms that advance human dignity and social justice by safeguarding the right to self-determination, local autonomy and the right to participate as equal partners in all levels of decision-making [169]. To address these governance concerns, alternative governance mechanisms for protected areas that have been receiving attention include co-managed protected areas, private protected areas and community conserved areas [137,138,156]. Of all the alternative institutional arrangements, co-management, which refers to the sharing of power and responsibilities between government representatives and local resource users [179], appears to offer the most promise for meeting these governance requirements [139]. However, neither co-management nor the other institutional mechanisms explicitly address the need for building resilience to change in protected areas management [37,180].

More recently, the search for appropriate institutions for protected areas management has broadened to include adaptive co-management [140,181,182], and adaptive governance [183]. The key features of adaptive governance, such as analytic deliberation, nesting and institutional variety provide mechanisms for meeting the attributes of good governance, including building resilience against surprises [76]. For instance, in their analysis of local sustainability initiatives in English National Parks, the authors of reference [183] concluded that a positive correlation existed between the attainment of local sustainability and the attributes of adaptive governance, such as cross-scale interactions, bridging organizations, and shared understandings. Similarly, the authors of reference [181] found, in their analysis of adaptive co-management in Biosphere Reserves around the world, that the practice of adaptive co-management led to higher levels of effectiveness in the attainment of sustainable management.
development goals without compromising biodiversity conservation. Hence, protected areas policies based on the integration of deep ecology and adaptive governance could advance an agenda for social and ecological justice [174] by promoting decentralization, local autonomy and diversity of institutions across levels, as well as enhancing opportunities for the utilization of local ecological knowledge in protected areas management. Such an approach would embrace the use of informal institutional mechanisms, such as taboos on the management of sacred groves and other protected areas in traditional societies [184].

6. Conclusions

In recent decades, the idea of sustainable development has received significant attention from scientists and policymakers as a framework for enhancing harmonious human–environment interactions. However, in response to the social and ecological threats presented by climate change and other grand sustainability challenges, in recent years there has been a turn toward resilience and adaptive governance of social-ecological systems as more useful frameworks. Yet, the ethical implications of these emerging concepts have not received adequate attention. In the absence of such ethical principles, there is the risk that the implementation of adaptive governance and other resilience-based management approaches could be co-opted for the pursuit of political agendas that perpetuate unjust and unsustainable conditions. In this paper, I have argued for the integration of deep ecology and adaptive governance as a means of addressing the institutional and ethical challenges entailed in the promotion of sustainable development in the Anthropocene era. Using the management of protected areas as a case study, I have illustrated that the integration of deep ecology and adaptive governance could inform the assumptions, goals, knowledge and institutional mechanisms that underpin conservation and development efforts. It must, however, be noted that deep ecology is not without its critics [185]. For instance, reference [186] highlights the potential for the application of deep ecology in the management of protected areas in the developing world to prioritize biodiversity preservation over human wellbeing. Additionally, the application of deep ecology by radical environmental groups in the US has been critiqued. Moreover, some eco-feminists have raised concerns that deep ecology’s holism could mask important differences within and among species [82,185]. In view of these concerns, other researchers are invited to interrogate the integrative agenda proposed in this article and to explore its implications for the management of various resource systems in various parts of the world. Given that the interpretation and application of the principles of deep ecology may vary among supporters of the deep ecology movement based on their religious affiliations, philosophical perspectives and other background factors [38], it is to be expected that the integrative agenda for social and ecological justice that has been proposed in this manuscript may not be supported by everyone. Following suggestions from [140], a comparative analysis of the utility of various ethical perspectives, therefore, promises to be a fruitful research venture in the search for an appropriate ethical foundation for the implementation of adaptive governance processes.

Funding: This research was funded by the USDA National Institute of Food and Agriculture McIntire Stennis project, grant number 1020037.

Acknowledgments: I would like to thank the editor and the two anonymous reviewers for their insightful comments and suggestions that have contributed to enhancing the clarity and rigor of the manuscript.

Conflicts of Interest: The author declares no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Steffen, W.; Persson, A.; Deutsch, L.; Zalasiewicz, J.; Williams, M.; Richardson, K.; Crumley, C.; Crutzen, P.; Folke, C.; Gordon, L.; et al. The Anthropocene: From global change to planetary stewardship. AMBI O 2011, 40, 739–761. [CrossRef] [PubMed]
2. Sachs, J.D. From millennium development goals to sustainable development goals. *Lancet* 2012, 379, 2206–2211. [CrossRef]
3. Griggs, D.; Stafford-Smith, M.; Gaffrey, O.; Rockström, J.; Ohman, M.C.; Shyamsundar, P.; Noble, I. Sustainable development goals for people and planet. *Nature* 2013, 495, 305–307. [CrossRef]
4. Rockström, J.; Steffen, W.; Noone, K.; Persson, A.; Chapin, F.S., III; Lambin, E.; Lenton, T.M.; Scheffer, M.; Folke, C.; Schellnhuber, H.J.; et al. Planetary boundaries: Exploring the safe operating space for humanity. *Ecol. Soc.* 2009, 14, 32. [CrossRef]
5. Hughes, T.P.; Carpenter, S.; Rockström, J.; Scheffer, M.; Walker, B. Multiscale regime shifts and planetary boundaries. *Trends Ecol. Ecol.* 2013, 28, 389–395. [CrossRef] [PubMed]
6. Steffen, W.; Richardson, K.; Rockström, J.; Cornell, S.E.; Fetzer, I.; Bennett, E.M.; Biggs, R.; Carpenter, S.R.; de Vries, W.; de Wit, C.A.; et al. Planetary boundaries: Guiding human development on a changing planet. *Science* 2015, 347, 1259855. [CrossRef] [PubMed]
7. Folke, C.; Jansson, A.; Rockström, J.; Olsson, P.; Carpenter, S.R.; Chapin, F.S., III; Crepin, A.-S.; Daily, G.; Danell, K.; Ebbesson, J.; et al. Reconnecting to the biosphere. *AMBIO* 2011, 40, 719–738. [CrossRef]
8. Westley, F.; Olsson, P.; Folke, C.; Homer-Dixon, T.; Vredenburg, H.; Loorbach, D.; Thompson, J.; Nilsson, M.; Lambin, E.; Sendzimir, J.; et al. Tipping toward sustainability: Emerging pathways of transformation. *AMBIO* 2011, 40, 762–780. [CrossRef]
9. Berkes, F. Environmental governance for the Anthropocene? Social-ecological systems, resilience and collaborative learning. *Sustainability* 2017, 9, 1232. [CrossRef]
10. Holden, E.; Linnerud, K.; Banister, D. Sustainable development: Our common future revisited. *Glob. Environ. Chang.* 2014, 26, 130–139. [CrossRef]
11. Folke, C.; Biggs, R.; Norström, A.; Reyers, B.; Rockström, J. Social-Ecological resilience and biosphere-based sustainability science. *Ecol. Soc.* 2016, 21, 41. [CrossRef]
12. Lele, S.M. Sustainable development: A critical review. *World Dev.* 1991, 19, 607–621. [CrossRef]
13. Wheeler, S.M. Planning for Sustainability: Creating Livable, Equitable, and Ecological Communities; Routledge: New York, NY, USA, 2004.
14. Barbier, E.B. The concept of sustainable economic development. *Environ. Conserv.* 1987, 14, 101–110. [CrossRef]
15. Portney, K.E. *Taking Sustainable Cities Seriously: Economic Development, the Environment, and Quality of Life in American Cities*; The MIT Press: Cambridge, MA, USA, 2003.
16. Kates, R.W.; Parris, T.M.; Leiserowitz, A.A. What is sustainable development? Goals, indicators, values, and practice. *Environ. Sci. Policy Sustain. Dev.* 2005, 47, 3–21.
17. Kemp, R.; Parto, S.; Gibson, R.B. Governance for sustainable development: Moving from theory to practice. *Int. J. Sustain. Dev.* 2005, 8, 12–30. [CrossRef]
18. WCED. *Our Common Future*; Oxford University Press: New York, NY, USA, 1987.
19. Streeten, P.P. Basic needs: Premises and promises. *J. Policy Modeling* 1979, 1, 136–146. [CrossRef]
20. Giddings, B.; Hopwood, B.; O’Brien, G. Environment, economy and society: Fitting them together into sustainable development. *Sustain. Dev.* 2002, 10, 187–196. [CrossRef]
21. Burns, T.R.; Witoszek, N. Brundtland report revisited: Toward a new humanist agenda. *J. Hum. Ecol.* 2012, 39, 155–170. [CrossRef]
22. Stafford-Smith, M.; Griggs, D.; Gaffney, O.; Ullah, F.; Reyers, B.; Kane, N.; Stigson, B.; Shrivastava, P.; Leach, M.; O’Connell, D.; Integration: The key to implementing the sustainable development goals. *Sustain. Sci.* 2017, 12, 911–919. [CrossRef]
23. Sachs, J.D.; Reid, W.V. Investments toward sustainable development. *Science* 2006, 312, 1002. [CrossRef]
24. Robertson, M. *Sustainability: Principles and Practice*, 2nd ed.; Routledge: New York, NY, USA, 2017.
25. United Nations. *The Millennium Development Goals Report*; United Nations: New York, NY, USA, 2015.
26. World Bank. *Atlas of Sustainable Development Goals*; The World Bank: Washington, DC, USA, 2018.
27. Frey, D.F.; MacNaughton, G. A human rights lense on full employment and decent work in the 2030 sustainable development agenda. *SAGE Open* 2016, 6, 1–13. [CrossRef]
28. Burch, S.; Gupta, A.; Inoue, C.Y.A.; Kalfagianni, A.; Persson, A.; Gerlak, A.K.; Ishii, A.; Patterson, J.; Peckering, J.; Scobie, M.; et al. New directions in earth system governance research. *Earth Syst. Gov.* 2019, 1, 10006. [CrossRef]
29. Morrison, T.H.; Adger, W.N.; Brown, K.; Lemos, M.C.; Huijtena, D.; Phelps, J.; Evans, L.; Cohen, P.; Song, A.M.; Turner, R.; et al. The black box of power in polycntric environmental governance. *Glob. Environ. Chang.* 2019, 57, 101934. [CrossRef]

30. Olsson, P.; Folke, C.; Galaz, V.; Hahn, T.; Schultz, L. Enhancing the fit through adaptive co-management: Creating and maintaining bridging functions for matching scales in the kristianstads vattenrike biosphere reserve Sweden. *Ecol. Soc.* 2007, 12, 28. [CrossRef]

31. Schultz, L.; Folke, C.; Österblom, H.; Olsson, P. Adaptive governance, ecosystem management, and natural capital. *Proc. Natl. Acad. Sci. USA* 2015, 112, 7369–7374. [CrossRef] [PubMed]

32. Akamani, K. Adaptive water governance: Integrating the human dimensions into water resource governance. *J. Contemp. Water Res. Educ.* 2016, 158, 2–18. [CrossRef]

33. Larsen, R.K.; Calgaro, E.; Thomalla, F. Governing resilience building in Thailand’s tourism-dependent coastal communities: Conceptualizing stakeholder agency in social-ecological systems. *Glob. Environ. Chang.* 2011, 21, 481–491. [CrossRef]

34. Fennell, D.; Plummer, R.; Marschke, M. Is adaptive co-management ethical? *J. Environ. Manag.* 2008, 88, 62–75. [CrossRef]

35. Berkes, F.; Doubleday, N.C.; Cumming, G.S. Aldo Leopold’s land health from a resilience point of view: Self-Renewal capacity of social-ecological systems. *EcoHealth* 2012, 9, 278–287. [CrossRef] [PubMed]

36. Stokols, D.; Lejano, R.P.; Hipp, J. Enhancing the resilience of human-environment systems: A social ecology perspective. *Ecol. Soc.* 2013, 18, 7. [CrossRef]

37. Berkes, F. Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *J. Environ. Manag.* 2009, 90, 1692–1702. [CrossRef] [PubMed]

38. Naess, A. The deep ecological movement: Some philosophical aspects. In *Environmental Ethics: An Anthology*; Light, A., Rolston, H. III, Eds.; Blackwell Publishing: Oxford, UK, 2003; pp. 262–274.

39. Witoszek, N. The death of a philosopher king and the crisis of our time. *Environ. Values* 2010, 19, 1–6. [CrossRef]

40. Kopnina, H. Future scenarios and environmental education. *J. Environ. Educ.* 2014, 45, 217–231. [CrossRef]

41. Light, A.; Rolston, H. *Environmental Ethics: An Anthology*; Blackwell: Oxford, UK, 2003.

42. Fox, W. Deep ecology: A new philosophy of our time? In *Environmental Ethics: An Anthology*; Light, A., Rolston, H., III, Eds.; Blackwell Publishing: Oxford, UK, 2003; pp. 252–261.

43. Palmer, C. An overview of environmental ethics. In *Environmental Ethics: An Anthology*; Light, A., Rolston, H., III, Eds.; Blackwell Publishing: Oxford, UK, 2003; pp. 15–37.

44. Hughes, T.P.; Bellwood, D.R.; Folke, C.; Steneck, R.S.; Wilson, J. New paradigms for supporting the resilience of marine ecosystems. *Trends Ecol. Evol.* 2005, 20, 380–386. [CrossRef] [PubMed]

45. Folke, C.; Carpenter, S.R.; Walker, B.; Scheffer, M.; Chapin, T.; Rockström, J. Resilience thinking: Integrating resilience, adaptability and transformability. *Ecol. Soc.* 2010, 15, 20. [CrossRef]

46. Redman, C.L.; Grove, J.M.; Kuby, L.H. Integrating social science into the long-term ecological research (LTER) network: Social dimensions of ecological change and ecological dimensions of social change. *Ecosystems* 2004, 7, 161–171. [CrossRef]

47. Folke, C. Social-Ecological systems and adaptive governance of the commons. *Ecol. Res.* 2007, 22, 14–15. [CrossRef]

48. Liu, J.; Dietz, T.; Carpenter, S.R.; Alberti, M.; Folke, C.; Moran, E.; Pell, A.N.; Deadman, P.; Kratz, T.; Lubchenco, J.; et al. Complexity of coupled human and natural systems. *Science* 2007, 317, 1513–1516. [CrossRef]

49. Akamani, K.; Holzmueller, E.J.; Groninger, J.W. Managing wicked environmental problems as complex social-ecological systems: The promise of adaptive governance. In *Landscape Dynamics, Soils and Hydrological Processes in Varied Climates*; Melesse, A., Abtew, W., Eds.; Springer: New York, NY, USA, 2016; pp. 741–762.

50. Holling, C.S. Understanding the complexity of economic, ecological, and social systems. *Ecosystems* 2001, 4, 390–405. [CrossRef]

51. Carpenter, S.R.; Walker, B.; Anderies, M.J.; Abel, N. From metaphor to measurement: Resilience of what to what. *Ecosystems* 2001, 4, 765–781. [CrossRef]

52. Gunderson, L.H.; Holling, C.S. *Panarchy: Understanding Transformations in Human and Natural Systems*; Island Press: Washington, DC, USA, 2001.
53. Angeler, D.G.; Allen, C.R.; Garmestani, A.S.; Gunderson, L.; Linkov, I. Panarchy use in environmental science for risk and resilience planning. *Environ. Syst. Decis.* 2016, 36, 225–228. [CrossRef]

54. Folke, C.; Chapin, F.S., III; Olsson, P. Transformations in ecosystem stewardship. In *Principles of Ecosystem Stewardship: Resilience-Based Natural Resource Management in a Changing World*; Chapin, F.S., III, Kofinas, G.P., Folke, C., Eds.; Springer: New York, NY, USA, 2009.

55. Olsson, P.; Galaz, V. Transitions to adaptive approaches to water management and governance in Sweden. *Environ. Manag.* 2003, 34, 75–90. [CrossRef] [PubMed]

56. Gunderson, L.H.; Carpenter, S.R.; Kinzig, A. Ecosystem stewardship: Building adaptive capacity in a world of transformations. *AMBIO* 2002, 31, 437–440. [CrossRef]

57. Olsson, P.; Galaz, V. Transitions to adaptive approaches to water management and governance in Sweden. *Environ. Manag.* 2003, 34, 75–90. [CrossRef] [PubMed]

58. Dietz, T.; Ostrom, E.; Stern, P.C. The struggle to govern the commons. *Science* 2003, 323–334. [CrossRef] [PubMed]

59. Arrow, K.; Bolin, B.; Costanza, R.; Dasgupta, P.; Folke, C.; Holling, C.S.; Jansson, B.-O.; Levin, S.; Maler, K.-G.; Perrings, C.; et al. Economic growth, carrying capacity, and the environment. *Science* 1995, 268, 520–521. [CrossRef] [PubMed]

60. Nelson, R.; Howden, M.; Smith, M.S. Using adaptive governance to rethink the way science supports Australian drought policy. *Environ. Sci. Policy* 2008, 11, 588–601. [CrossRef]

61. Nelson, D.R.; Adger, W.N.; Brown, K. Adaptation to environmental change: Contributions of resilience framework. *Annu. Rev. Environ. Resour.* 2007, 32, 395. [CrossRef]

62. Walker, B.; Carpenter, S.R.; Kinzig, A. A community resilience model for understanding and assessing the sustainability of forest-dependent communities. *Hum. Ecol. Rev.* 2012, 19, 99–109.

63. Nelson, D.R.; Adger, W.N.; Brown, K. Adaptation to environmental change: Contributions of resilience framework. *Annu. Rev. Environ. Resour.* 2007, 32, 395. [CrossRef]

64. Ostrom, E. A general framework for analyzing sustainability in social-ecological systems. *Science* 2009, 325, 419–422. [CrossRef] [PubMed]

65. Olsson, P.; Galaz, V. Transitions to adaptive approaches to water management and governance in Sweden. In *Water Policy Entrepreneurs: A Research Companion to Water Transitions around the Globe*; Huitema, D., Meijerink, S., Eds.; Edward Elgar: Northampton, MA, USA, 2009; pp. 304–324.

66. Karpouzoglou, T.; Dewulf, A.; Clark, J. Advancing adaptive governance of social-ecological systems through theoretical multiplicity. *Environ. Sci. Policy* 2016, 57, 1–9. [CrossRef]
78. Österblom, H.; Folke, C. Emergence of global adaptive governance for stewardship of regional marine resources. *Ecol. Soc.* 2013, 18, 4. [CrossRef]

79. Allen, C.R.; Fontaine, J.J.; Pope, K.L.; Garmestani, A.S. Adaptive management for a turbulent future. *J. Environ. Manag.* 2011, 92, 1339–1345. [CrossRef] [PubMed]

80. Walker, B. A commentary on “Resilience and water governance: Adaptive governance in the Columbia River Basin”. *Ecol. Soc.* 2012, 17, 29. [CrossRef]

81. Olsson, P.; Galaz, V.; Boonstra, W.J. Sustainability transformations: A resilience perspective. *Ecol. Soc.* 2014, 19, 1. [CrossRef]

82. Warren, K. Ecofeminist philosophy and deep ecology. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 255–269.

83. Naess, A. The shallow and the deep, long-range ecology movement: A summary. *Inquiry* 1973, 16, 95–100. [CrossRef]

84. Fox, W. Deep ecology: A new philisophy of our time? In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 153–165.

85. Broadhead, L.-A. *International Environmental Politics: The Limits of Green Diplomacy*; Lynne Rienner Publishers: Boulder, CO, USA, 2002.

86. Naess, A. The shallow and the deep, long-range ecology movements: A summary. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 3–7.

87. Brennan, A. Comment: Pluralism and deep ecology. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 175–180.

88. Gunderson, L.; Cosens, B.A.; Chaffin, B.C.; Arnold, C.A.; Fremier, A.K.; Garmestani, A.S.; Craig, R.K.; Gosnell, H.; Birge, H.E.; Allen, C.R.; et al. Regime shifts and panarchies in regional scale social-ecological water systems. *Ecol. Soc.* 2017, 22, 31. [CrossRef]

89. Craig, R.K.; Garmestani, A.S.; Allen, C.R.; Arnold, C.A.; Birge, H.; DeCaro, D.A.; Fremier, A.K.; Gosnell, H.; Schlager, E. Balancing stability and flexibility in adaptive governance: An analysis of tools available in US environmental law. *Ecol. Soc.* 2017, 22, 3. [CrossRef]

90. Chaffin, B.C.; Gosnell, H.; Cosens, B. A decade of adaptive governance scholarship: Synthesis and future directions. *Ecol. Soc.* 2014, 19, 56. [CrossRef]

91. Holling, C.S. *Adaptive Environmental Assessment and Management*; John Wiley and Sons: New York, NY, USA, 1978.

92. Walters, C. *Adaptive Management of Renewable Resources*; McMillan: New York, NY, USA, 1986.

93. Lee, K.N. Appraising adaptive management. *Conserv. Ecol.* 1999, 3, 3. [CrossRef]

94. Allen, C.R.; Gunderson, L.H. Pathology and failure in the design and implementation of adaptive management. *J. Environ. Manag.* 2011, 92, 1379–1384. [CrossRef] [PubMed]

95. McLain, R.J.; Lee, R.G. Adaptive management: Promises and pitfalls. *Environ. Manag.* 1996, 20, 437–448. [CrossRef] [PubMed]

96. Walters, C.J. Is adaptive management helping to solve fisheries problems? *AMBIO* 2007, 36, 304–307. [CrossRef]

97. Cosens, B.; Williams, M.K. Resilience and water governance: Adaptive governance in the Columbia River Basin. *Ecol. Soc.* 2012, 17, 3. [CrossRef]

98. West, S.P.; Schultz, L. Learning for resilience in the European Court of Human Rights: Adjudication as an adaptive governance practice. *Ecol. Soc.* 2015, 20, 31. [CrossRef]

99. Watson, R.A. A critique of anti-anthropocentric biocentrism. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 109–120.

100. Naess, A. Letter to Dave Foreman, 23 June 1988. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 227–231.

101. Daly, H.E. Toward some operational principles of sustainable development. *Ecol. Econ.* 1990, 2, 1–6. [CrossRef]
102. Kopnina, H. The victims of unsustainability: A challenge to sustainable development goals. *Int. J. Sustain. Dev. World Ecol.* 2016, 23, 113–121. [CrossRef]

103. Bazilian, M.; Rogner, H.; Howells, M.; Hermann, S.; Arent, D.; Gienel, D.; Steduto, P.; Mueller, A.; Komor, P.; Tol, R.S.J.; et al. Considering the energy, water and food nexus: Towards an integrated modelling approach. *Energy Policy* 2011, 39, 7896–7906. [CrossRef]

104. Biggs, E.M.; Bruce, E.; Boruff, B.; Duncan, J.M.; Horsley, J.; Pauli, N.; McNeill, K.; Neef, A.; Ogrop, F.V.; Curnow, J.; et al. Sustainable development and the water-energy-food nexus: A perspective on livelihoods. *Environ. Sci. Policy* 2015, 54, 389–397. [CrossRef]

105. Weitz, N.; Strambo, C.; Kemp-Benedict, E.; Nilsen. Closing the governance gaps in the water-energy-food nexus: Insights from integrative governance. *Glob. Environ. Chang.* 2017, 45, 165–173. [CrossRef]

106. Naess, A. Is the deep ecology vision a green vision or is it multicoloured like the rainbow? An answer to Nina Witoszek. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 466–472.

107. Pahl-Wostl, C.; Lebel, L.; Knieper, C.; Nikitina, E. From applying panaceas to mastering complexity: Toward adaptive water governance in river basins. *Environ. Sci. Policy* 2012, 23, 24–34. [CrossRef]

108. Akamani, K.; Holzmueller, E.J. Socioeconomic and policy considerations in the adoption of agroforestry systems: An ecosystem-based adaptive governance approach. In *Agroforestry: Anecdotal to Modern Science*; Dagar, J.C., Tewari, V.P., Eds.; Springer Nature: Singapore, 2017; pp. 833–855.

109. Dietz, T.; Stern, P.C. Science, values, and biodiversity. *BioScience* 1998, 48, 441–444. [CrossRef]

110. Dietz, T. Bringing values and deliberation to science communication. *Proc. Natl. Acad. Sci. USA* 2013, 110, 14081–14087. [CrossRef] [PubMed]

111. Scholz, J.T.; Stiftel, B. *Adaptive Governance and Water Conflict: New Institutions for Collaborative Planning; Resources for the Future*: New York, NY, USA, 2005.

112. Gög, C.; Brand, U.; Haberl, H.; Hummel, D.; Jahn, T.; Liehr, S. Challenges for social-ecological transformations: Contributions from social and political ecology. *Sustainability* 2017, 9, 1045. [CrossRef]

113. Devulf, A.; Karpouzoglou, T.; Warner, J.; Wesselink, A.; Mao, F.; Vos, J.; Tamas, P.; Groot, A.E.; Heijmans, A.; Ahmed, F.; et al. The power to define resilience in social–hydrological systems: Toward a power-sensitive resilience framework. *Wiley Interdiscip. Rev. Water* 2019, 6, e1377. [CrossRef]

114. Bourdeau, P. The man-nature relationship and environmental ethics. *J. Environ. Radioact.* 2004, 72, 9–15. [CrossRef]

115. Cortner, H.; Moote, M.A. *The Politics of Ecosystem Management*; Island Press: Washington, DC, USA, 1999.

116. Eriksen, S.; Aldunce, P.; Bahinipati, C.S.; Martins, R.D.A.; Molefe, J.I.; Nhemachena, C.; O’Brien, K.; Olorunfemi, F.; Park, J.; Sygna, L.; et al. When not every response to climate change is a good one: Identifying principles for sustainable adaptation. *Clim. Dev.* 2011, 3, 7–20. [CrossRef]

117. Adger, W.N.; Barnett, J.; Brown, K.; Marshall, N.; O’Brien, K. Cultural dimensions of climate change impacts and adaptation. *Nat. Clim. Chang.* 2013, 3, 112–117. [CrossRef]

118. Akamani, K. Toward ecosystem-based adaptation to climate change in West Africa: The potential contributions of non-governmental organizations. In *Adaptation to Climate Change and Variability in Rural West Africa*; Yaro, J.A., Hesselberg, J., Eds.; Springer International Publishing: Cham, Switzerland, 2016; pp. 191–213.

119. Washington, H.; Taylor, B.; Kopnina, H.; Cryer, P.; Piccolo, J.J. Why ecocentrism is the key pathway to sustainability. *Ecol. Citiz.* 2017, 1, 35–41.

120. Naess, A. Paul Feyerabend: A green hero? In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 57–68.

121. Naess, A. Reply to Bill Devall. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 71–72.

122. Devall, B. Comment: Naess and Feyerabend on science. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 69–70.

123. Irwin, E.G.; Culligan, P.J.; Fischer-Kowalski, M.; Law, K.L.; Murtugudde, R. Bridging barriers to advance global sustainability. *Nat. Sustain.* 2018, 1, 324–326. [CrossRef]

124. Lélé, S.; Norgaard, R.B. Practicing interdisciplinarity. *BioScience* 2005, 55, 967–975. [CrossRef]
125. Eigenbrode, S.D.; O’rourke, M.; Wulffhorst, J.D.; Althoff, D.M.; Goldberg, C.S.; Merrill, K.; Morse, W.; Nielsen-Pincus, M.; Stephens, J.; Winowiecki, L.; et al. Employing philosophical dialogue in collaborative science. *BioScience* **2007**, *57*, 55–64. [CrossRef]  
126. Olsson, L.; Jerneck, A.; Thoren, H.; Persson, J.; O’Byrne, D. Why resilience is unappealing to social science: Theoretical and empirical investigations of the scientific use of resilience. *Sci. Adv.* **2015**, *1*, e1400217. [CrossRef]  
127. Kelly, R.; Mackay, M.; Nash, K.L.; Cvitanovic, C.; Allison, E.H.; Armitage, D.; Bonn, A.; Cooke, S.J.; Frusher, S.; Fulton, E.A.; et al. Ten tips for developing interdisciplinary socio-ecological researchers. *Soc. Ecol. Pract. Res.* **2019**, *1*, 149–161. [CrossRef]  
128. Houde, N. The six faces of traditional ecological knowledge: Challenges and opportunities for Canadian co-management arrangements. *Ecol. Soc.* **2007**, *12*, 34. [CrossRef]  
129. Tengö, M.; Brondizio, E.S.; Elmqvist, T.; Malmer, P.; Spierenburg, M. Connecting diverse knowledge systems for enhanced ecosystem governance: The multiple evidence base approach. *AMBIO* **2014**, *43*, 579–591. [CrossRef]  
130. Ostrom, E. Polycentric systems for coping with collective action and global environmental change. *Glob. Environ. Chang.* **2010**, *20*, 550–557. [CrossRef]  
131. Cole, D.H. Advantages of a polycentric approach to climate change policy. *Nat. Clim. Chang.* **2015**, *5*, 114–118. [CrossRef]  
132. McLaughlin, A. Comment: Deep ecology and social ecology. In *Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy*; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 310–312.  
133. Adger, W.N.; Brown, K.; Nelson, D.R.; Berkes, F.; Eakin, H.; Folke, C.; Galvin, K.; Gunderson, L.; Goulsen, M.; O’Brien, K.; et al. Resilience implications of policy responses to climate change. *Wiley Interdiscip. Rev. Clim. Chang.* **2011**, *2*, 757–766. [CrossRef]  
134. Koontz, T.M.; Gupta, D.; Mudliar, P.; Ranjan, P. Adaptive institutions in social-ecological systems governance: A synthesis framework. *Environ. Sci. Policy* **2015**, *53*, 139–151. [CrossRef]  
135. Carlisle, K.; Gruby, R.L. Polycentric systems of governance: A theoretical model for the commons. *Policy Stud. J.* **2019**, *47*, 927–952. [CrossRef]  
136. Dearden, P.; Bennett, M.; Johnston, J. Trends in global protected areas governance, 1992–2002. *Environ. Manag.* **2005**, *36*, 89–100. [CrossRef]  
137. Lele, S.; Wilshusen, P.R.; Brockington, D.; Seidler, R.; Bawa, K. Beyond exclusion: Alternative approaches to biodiversity conservation in the developing tropics. *Curr. Opin. Environ. Sustain.* **2010**, *2*, 1–7. [CrossRef]  
138. Borrini-Feyerabend, G.; Dudley, N.; Jaeger, T.; Lassen, B.; Broome, N.P.; Phillips, A.; Sandwith, T. *Governance of Protected Areas: From Understanding to Action. Best Practice Protected Area Guidelines*; Series No. 20; IUCN: Gland, Switzerland, 2013.  
139. Lane, M.B. Affirming new directions in planning theory: Comanagement of protected areas. *Soc. Nat. Resour.* **2001**, *14*, 657–671. [CrossRef]  
140. Plummer, R.; Fennell, D.A. Managing protected areas for sustainable tourism: Prospects for adaptive co-management. *J. Sustain. Tour.* **2009**, *17*, 149–168. [CrossRef]  
141. Schelhas, J. The US national parks in international perspective: The Yellowstone model or consent syncretism? In *National Parks: Vegetation, Wildlife and Threats*; Polisciano, G., Farina, O., Eds.; Nova Science Publishers, Inc.: Hauppauge, NY, USA, 2009; pp. 83–103.  
142. Callicott, B.J. Contemporary criticisms of the received wilderness idea. In *Wilderness Science in a Time of Change Conference—Volume 1: Changing Perspectives and Future Directions*; Cole, D.N., McCool, S.F., Wayne, A., O’Laughlin, J., Eds.; USDA Forest Service, Rocky Mountain Research Station: Missoula, MT, USA, 2000; pp. 24–31.  
143. Wilshusen, P.R.; Brechin, S.R.; Fortwangler, C.L.; West, P.C. Reinventing a square wheel: Critique of a resurgent “Protection Paradigm” in international biodiversity conservation. *Soc. Nat. Resour.* **2002**, *15*, 17–40. [CrossRef]  
144. Brechin, S.R.; Wilshusen, P.R.; Fortwangler, C.L.; West, P.C. *Contested Nature: Promoting International Biodiversity with Social Justice in the Twenty-First Century*; State University of New York Press: Albany, NY, USA, 2003.
145. Callicott, J.B. A critique of and an alternative to the wilderness idea. In *Environmental Ethics: An Anthology*; Light, A., Rolston, H., III, Eds.; Blackwell Publishing Ltd.: Oxford, UK, 2003; pp. 437–443.

146. Kellert, S.R.; Mehta, J.N.; Ebbin, S.A.; Lichtenfeld, I.L. Community natural resource management: Promise, rhetoric, and reality. *Soc. Nat. Resour.* 2000, 13, 705–715.

147. Brooks, J.S. Design features and project age contribute to joint success in social, ecological, and economic outcomes of community-based conservation projects. *Conserv. Lett.* 2017, 10, 23–32. [CrossRef]

148. Terborgh, J.; Van Schaik, C. Why the world needs parks. In *Making Parks Work: Strategies for Preserving Tropical Nature*; Terbough, J., van Schaik, C., Davenport, L., Rao, M., Eds.; Island Press: London, UK, 2002; pp. 3–14.

149. Brown, K. Integrating conservation and development: A case of institutional misfit. *Front. Ecol. Environ.* 2003, 1, 479–487. [CrossRef]

150. Lockwood, M. Good governance for terrestrial protected areas: A framework, principles and performance outcomes. *J. Environ. Manag.* 2010, 91, 754–766. [CrossRef]

151. Meyer, J.L. Withstanding the test of time: Yellowstone and sustainable tourism. In *Tourism, Recreation and Sustainability: Linking Culture & the Environment*, 2nd ed.; McCool, S.F., Moisey, N.R., Eds.; CABI: Cambridge, MA, USA, 2009; pp. 142–157.

152. Dawson, C.P.; Hendee, J.C. *Wilderness Management: Stewardship and Protection of Resources and Values*, 4th ed.; Falcurn Publishing: Golden, CO, USA, 2009.

153. Aplet, G.H.; Cole, D.N. The trouble with Naturalness: Rethinking Park and wilderness goals. In *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*; Cole, D.N., Yung, L., Eds.; Island Press: London, UK, 2010; pp. 12–29.

154. Strong, D.H. *Dreamers and Defenders: American Conservationists*; Nebraska Printing Press: Lincoln, NE, USA, 1988.

155. Davenport, L.; Rao, M. The history of protection: Paradoxes of the past and challenges for the future. In *Making Parks Work: Strategies for Preserving Tropical Nature*; Terbough, J., van Schaik, C., Davenport, L., Rao, M., Eds.; Island Press: London, UK, 2002; pp. 30–50.

156. Borrini-Feyerabend, G. Governance of protected areas—Innovation in the air. *Soc. Nat. Resour.* 2009, 22, 565–577. [CrossRef]

157. Cole, D.N.; Yung, L. *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*; Island Press: Washington, DC, USA, 2010.

158. Pickett, S.T.; O’stfeld, R.S. The shifting paradigm in ecology. In *A New Century for Natural Resources Management*; Knight, R.L., Bates, S., Eds.; Island Press: Washington, DC, USA, 1995; pp. 261–277.

159. Hobb, R.J.; Cole, D.N.; Young, L.; Zavaleta, E.S.; Aplet, G.H.; Chapin, F.S., III; Landres, P.B.; Parsons, D.J.; Stephenson, N.L.; White, P.S.; et al. Guiding concepts for park and wilderness stewardship in an era of global environmental change. *Front. Ecol. Environ.* 2010, 8, 483–490. [CrossRef]

160. Hobb, R.J.; Zavaleta, E.S.; Cole, D.N.; White, P.S. Evolving ecological understandings: The implications of ecosystem dynamics. In *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*; Cole, D.N., Yung, L., Eds.; Island Press: London, UK, 2010.

161. Zavaleta, E.S.; Chapin, F.S., III. Resilience frameworks: Enhancing the capacity to adapt to change. In *Beyond Naturalness: Rethinking Park and Wilderness Stewardship in an Era of Rapid Change*; Cole, D.N., Yung, L., Eds.; Island Press: London, UK, 2010; pp. 142–158.

162. Denevan, W. The pristine myth: The landscape of the Americas in 1492. *Ann. Assoc. Am. Geogr.* 1992, 82, 369–385. [CrossRef]

163. Colwell, R.; Avery, S.; Berger, J.; Davis, G.E.; Hamilton, H.; Lovejoy, T.; Malcom, S.; McMullen, A.; Novacek, M.; Roberts, R.J.; et al. Revisiting Leopold: Resource stewardship in the national parks. *Parks* 2014, 20, 15–24. [CrossRef]

164. Wilshusen, P.; Brechin, S.R.; Fortwangler, C.L.; West, P.C. Contested nature: Conservation and development at the turn of the twenty-first century. In *Contested Nature: Promoting International Biodiversity with Social Justice in the Twenty-First Century*; Brechin, S.R., Wilshusen, P.R., Fortwangler, C.L., West, P.C., Eds.; State University of New York Press: Albany, NY, USA, 2003; pp. 1–22.

165. Ghimire, K.B.; Pimbert, M.P. *Social Change and Conservation: Environmental Politics and Impacts of National Parks and Protected Areas*; Earthscan: London, UK, 1997.

166. Brockington, D.; Igoe, J. Eviction for conservation: A global overview. *Conserv. Soc.* 2006, 4, 424–470.

167. Agrawal, A.; Redford, K. Place, conservation, and development. *Conserv. Soc.* 2009, 7, 56–58. [CrossRef]

168. Adams, W.M.; Hutton, J. People, parks and poverty: Political ecology and biodiversity conservation. *Conserv. Soc.* 2007, 5, 147–183.
169. Brechin, S.R.; Wilshusen, P.R.; Fortwangler, C.L.; West, P.C. Beyond the square wheel: Toward a more comprehensive understanding of biodiversity conservation as social and political processes. Soc. Nat. Resour. 2002, 15, 41–64. [CrossRef]

170. Van Schaik, C.; Rijksen, H.D. Integrated conservation and development projects: Problems and potential. In Making Parks Work: Strategies for Preserving Tropical Nature; Terbough, J., van Schaik, C., Davenport, L., Rao, M., Eds.; Island Press: London, UK, 2002; pp. 15–29.

171. Agrawal, A.; Gibson, C.C. Enchantment and disenchantment: The role of community in natural resource conservation. World Dev. 1999, 27, 629–649. [CrossRef]

172. Belsky, J.M. Unmasking the “local”: Gender, community, and the politics of community-based rural ecotourism in Belize. In Contested Nature: Promoting International Biodiversity with Social Justice in the Twenty-First Century; Brechin, S.R., Wilshusen, P.R., Fortwangler, C.L., West, P.C., Eds.; State University of New York Press: Albany, NY, USA, 2003; pp. 89–101.

173. Cafaro, P. For a grounded conception of wilderness and more wilderness on the ground. Ethics Environ. 2001, 6, 1–17. [CrossRef]

174. Schoreman-Ouimet, E.; Kopnina, H. Reconciling ecological and social justice to promote biodiversity conservation. Biol. Conserv. 2015, 184, 320–326. [CrossRef]

175. Fortwangler, C.L. Incorporating social justice and human rights into protected area policies. In Contested Nature: Promoting International Biodiversity with Social Justice in the Twenty-First Century; Brechin, S.R., Wilshusen, P.R., Fortwangler, C.L., West, P.C., Eds.; State University of New York Press: Albany, NY, USA, 2003; pp. 25–40.

176. Brooks, M.P. Planning Theory for Practitioners; Planners Press: Washington, DC, USA, 2003.

177. Langholz, J.A.; Lassoie, J.P. Perils and promise of privately owned protected areas. BioScience 2001, 51, 1079–1085. [CrossRef]

178. Graham, J.; Amos, B.; Plumptre, T. Governance Principles for Protected Areas in the 21st Century (Policy Brief No. 15); Institute on Governance: Ottawa, ON, Canada, 2003.

179. Carlsson, L.; Berkes, F. Co-Management: Concepts and methodological implications. J. Environ. Manag. 2005, 75, 65–76. [CrossRef] [PubMed]

180. Akamani, K.; Wilson, P.I.; Hall, T.E. Barriers to collaborative forest management and implications for building the resilience of forest-dependent communities in the Ashanti region of Ghana. J. Environ. Manag. 2015, 151, 11–21. [CrossRef]

181. Schultz, L.; Duit, A.; Folke, C. Participation, adaptive co-management, and management performance in the world network of Biosphere Reserves. World Dev. 2010, 39, 662–671. [CrossRef]

182. Plummer, R.; Baird, J.; Dzyundzyak, A.; Armitage, D.; Bodin, O.; Schultz, L. Is adaptive co-management delivering? Examining relationships between collaboration, learning and outcomes in UNESCO Biosphere Reserves. Ecol. Econ. 2017, 140, 79–88. [CrossRef]

183. Clark, J.R.A.; Clarke, R. Local sustainability initiatives in English National Parks: What role for adaptive governance? Land Use Policy 2011, 28, 314–324. [CrossRef]

184. Colding, J.; Folke, C. Social taboos: “Invisible” systems of local resource management and biological conservation. Ecol. Appl. 2001, 11, 584–600.

185. Hawkins, R. Why deep ecology had to die. Trumpeter 2014, 30, 206–230.

186. Guha, R. Radical American environmentalism and wilderness preservation: A third world critique. In Philosophical Dialogues: Arne Naess and the Progress of Ecophilosophy; Witoszek, N., Brennan, A., Eds.; Rowman & Littlefield Publishers, Inc.: Oxford, UK, 1999; pp. 313–324.

© 2020 by the author. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).