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Article

Whose Diversity Counts? The Politics and Paradoxes of Modern Diversity

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Abstract: Is "diversity" a modern concept, like indigeneity or biodiversity, which is conceived precisely at the time that it seems to be threatened and on the verge of disappearing? In the face of perceived threats to diversity, projects and policies have been crafted to protect, promote, or conserve diversity, but in doing so they have often demonstrated a paradoxical propensity toward purity and authority in representations of diversity. Perceptions of "pure" natural diversity might represent native forests comprised solely of native species; "pure" cultural diversity might represent indigenous peoples who still speak indigenous languages and wear native dress. If purity is emblematic of diversity, what, then, is the place of hybrid landscapes and peoples? In our study, we draw on a range of examples—of agrobiodiversity conservation in Bolivia, satellite mapping initiatives in Madagascar and Ecuador, scientific authority about anthropogenic climate change, indigenous language and identity in Peru, and a comparison of the Amazon and Atlantic Forest in Brazil—to demonstrate gaps between representations of diversity, and the heterogeneous local realities they obscure. We suggest that hybridity is a form of diversity unto itself—albeit a form of diversity that is more complex, and thus harder to codify and categorize.

Keywords: diversity; modernity; purity; hybridity; mapping; scientific authority; climate change; indigenous languages; political ecology

1. Introduction

Is "diversity" a modern concept, like indigeneity or biodiversity, which is conceived precisely at the time that it seems to be threatened and on the verge of disappearing? Does diversity engender sustainability [1]? A number of scholars have analyzed the ways in which diverse local knowledges and practices enhance both biodiversity and sustainability [2–10]. Yet, the Western world is commonly understood to be driving unsustainable processes of development and globalization, thereby threatening the diversity of non-Western natures and cultures. Globalization is often portrayed as a directional force that is imposed—North to South, West to East—with adverse consequences. As this special issue asks, "to what extent does globalization hinder epistemological, cultural, and linguistic diversity?" European languages have been imposed on indigenous peoples, leading to linguistic loss. Northern transnational corporations have extended through the global South, upturning societies and environments [11]. Globalization, however, is nothing new [12,13], and the flows of globalization are multidirectional; the margins often seek the metropole [14,15]. Just as globalization may hinder some forms of knowledge, it enables others. Furthermore, processes of globalization lead to heterogeneous, multifaceted impacts in different localities [16]. These forms of heterogeneity are themselves expressions of diversity.

In the face of perceived and actual threats to biological and cultural diversity, projects and policies have been crafted to protect, promote, or conserve diversity [17]. In doing so, they have often demonstrated a paradoxical propensity: to normalize through measurement, definition, and representation a concept that encompasses heterogeneity and difference. This tension leads to gaps between the lived experiences of diversity, and the standardized measurements that seek to establish common ground across actors and between regions. In the process of creating metrics, certain forms of meaning elude measure.

Many forms of diversity are unseen by the standardized metrics of Western science. As Stephen Gudeman, an economic anthropologist, reflected back on his efforts at quantification during early fieldwork in Panama, "I wanted to quantify land tilled, labor used [...] But the rural farmers were not interested in summary calculations or even financial equivalents; they used disparate, homemade measures when quantifying work processes. Each measure had a specific use, none had a direct relation to money, and I could not correlate them under a single ruler" [18]. Such candid acknowledgement of the subjectivity and local variety of measurements illustrates the kinds of untold diversity we seek: diversity *within* systems of knowledge, and not just between them; diverse perceptions of the landscape; folk diversity; diversity of beliefs; diversity that challenges our paradigms and idealized visions.

These expressions of diversity tend to elude the standardizing metrics of surveys, censuses, and databases. In efforts to count, represent, or map people and places, there are inherent tensions as science renders diversity "legible" [19]. In the introduction to *Seeing Like A State*, James Scott

introduces the concept of legibility to describe state simplifications, finding that metrics and measures allowed states to "'translate' what it knew into a common standard necessary for a synoptic view" [19]. Similarly, we ask how diversity is "translated" or made legible.

Forms of measurement are not necessarily objective. In this study, we collectively examine the consequences of standardizing perceptions of diversity when applied to fields, forests, people, and the norms of science itself. What validates diversity? We consider the implications of norms for characterizing agrobiodiversity, the creation of maps from satellite imagery, the proliferation of folk denial of the reality of climate change, the tendency to use language as indispensable requirement for indigenous identity, and archetypal visions of tropical forests. By examining perceptions of diversity in landscapes, scientific discourses, and peoples, it is not our assumption that biological and cultural diversity are one and the same. Rather, through comparative case studies it is our intention to demonstrate and problematize the similar tendencies that undergird ways that diversity is understood in both cultures and landscapes—namely, a bias towards 'pure' and more measurable expressions of diversity. Implicit in these cases are questions of inclusion and exclusion: what falls within or outside of diversity's purview? We demonstrate gaps between remote visualizations and representations of diversity, and the heterogeneous local realities they obscure. Diversity itself is a form of knowledge that travels across scales, yet it is also a lived experience.

While some forms of diversity are made visible, others are hidden. We ask what drives these disjunctures: why are some forms of diversity valued, and others unseen or ignored? To what extent does diversity entail notions of "purity" and authenticity? Is that which is classified and categorized more likely to be protected? Perceptions of "pure" natural diversity might represent forests comprised of native or endemic species; "pure" cultural diversity might represent indigenous peoples who still speak indigenous languages, wear native dress and maintain distinctive traditions. If purity is emblematic of diversity, what, then, is the place of hybrid landscapes and peoples? What is the role of disturbance in modern diversity? Whose diversity counts? This question is inspired by Robert Chambers' 1997 book, *Whose Reality Counts? Putting the First Last* [20]. Like Chambers, we argue that, in order to make progress in thinking about sustainability, we must problematize orthodox frameworks in conservation and development and consider alternative realities and epistemologies.

As Latour hypothesized in *We Have Never Been Modern*, "the word 'modern' designates two sets of entirely different practices […]. The first set of practices, by 'translation', creates mixtures between entirely new types of beings, hybrids of nature and culture. The second, by 'purification', creates two entirely distinct ontological zones: that of human beings on the one hand; that of nonhumans on the other. Without the first set, the practices of purification would be fruitless or pointless. Without the second, the world of translation would be slowed down, limited, or even ruled out" [21].

While Latour distinguishes between the creation of new hybrids and the process of "purification", he also describes a mutual relationship between these processes. Similarly, we understand modern diversity to constitute a relationship between the hybrid and the pure. Conditions of modernity both create forms of hybridity, and promote standardizing metrics that are biased towards purity. Purity not only separates nature from culture, but creates an entity that is more rare, bounded, and measurable—such as the idea of intact forest, untouched by humans. In contemporary environmental discourse, when hybridity is read into the landscape, it tends to be associated with degradation: people are present in nature, rendering it common. Forests become patchworks, or disappear. Drawing from the insights of political

ecologists who have debunked assumptions of local peoples' actions degrading the environment [9,22], we propose that hybridity is a form of diversity unto itself—albeit a form of diversity that is more complex, and thus harder to codify and categorize. This mirrors a movement in the ecological sciences, geography, and history to reassess hybrid, seemingly "impure" landscapes as places of diversity rather than degradation [10,23–25]. For example, following Latour, Robbins [23] designates "impure" land-cover as hybrids of the natural and social in a study of India. Evoking the paradoxical relationship between modernity, purity, and diversity, Robbins argues that "all efforts to fit landscapes into abstract and purified modern categories actually increase the proliferation of hybrid and impure landforms". Furthermore, recent emphasis on "novel ecosystems" [26] that blend invasive and native species has driven reflexive debate within the ecological community [27]. The idea that non-native species and novel ecosystems should not necessarily be rejected, but "embrace[d]" [28] expresses a contemporary revaluation of associations between hybridity and diversity. While some meanings are neatly encoded in "pure" forms of diversity, the meanings of hybrid diversities are harder to pin down. It is to these messier forms of diversity that we turn: diversities of beliefs within scientific discourse, diversity created by globalization, and the diversity of complex spaces where nature and culture intersect.

2. Whose Diversity Counts? Six Examples that Interrogate the Politics and Paradoxes of Modern Diversity

We utilize a comparative anthropological and political ecology approach to analyze the consequences and limitations of common approaches by conservation professionals and others to measure and represent diversity. A political ecology approach entails examining the politics of environmental use and management, as well as representations of the environment, which are themselves imbued with power relations and shape the very environments they represent [29–31]. In this regard, our analyses are intimately related to the practice of conservation and sustainable development. Environmental and conservation practice is driven by visions of value and degradation—promoting and protecting valued landscapes and limiting degradation. The propagation and imposition of one set of values, such as the idea that "pristine nature" is free of people, has significant consequences for landscapes and lives [32,33]. Like other political ecologists, we unpack assumptions about the environment and the interventions they justify [9,34–36], in this case having to do with diversity. We examine a range of projects and metrics that are intended to define and protect diversity, and find a common trend among scientific authorities and others to draw on archetypal concepts of diversity and, paradoxically, to favor purity over alternative and hybrid forms of diversity.

All told, we use six examples to interrogate the politics and paradoxes of modern diversity, which are in turn broken up into three sections—the first and second sections have to do with mapping and metrics, respectively, and our third section focuses on diversity in beliefs having to do with environmental problems (in particular, climate change) and valued landscapes. Throughout our examples, we call for reflection, and in many cases, reconsideration, about the ways in which diversity is considered and valorized.

2.1. Mapping Diversity: Prized Purity, Derided Degradation, and Hidden Hybridity

In this section, we question the seeming objectivity and neutrality of maps of forest-cover, which in turn weave narratives about forest health or degradation. Drawing on previous scholarship by authors like Fairhead and Leach [9], Bruce Braun [37] and Paul Robbins [23], and ethnographic fieldwork in Madagascar and Ecuador, we reveal the values and biases embedded in these mapping projects, and point to the hybrid landscapes and histories that are themselves valid expressions of diversity, yet are decried or obscured through these efforts to map and represent diversity.

2.1.1. In Search of "Real" Forest: Agroforestry & Diversity in Madagascar

Our first example examines and critiques a frequently utilized standardizing tool—a map of forest types, in this case one that was developed and utilized in Madagascar. While the mapping project may seem like a neutral way to represent the rich diversity of this country, the practice reflects the values of the mapmakers: in this case the emphasis on purity and distinguishability of forest types.

The island of Madagascar, with its unique ecosystems, charismatic species, and high degree of endemism, has become nearly synonymous with the ideals of global biodiversity. Environmental researchers and practitioners have become increasingly concerned with preserving this diversity, warning that many of the unique species of Madagascar are currently facing the imminent threat of extinction [38].

It is within the context of seeking to understand, monitor, and manage the island's biodiversity that the "Mapping the Vegetation of Madagascar" project developed. This project, which began in 2003, is a collaboration between the Critical Ecosystem Partnership Fund, the Kew Royal Botanic Gardens, the Missouri Botanical Garden, and Conservation International. The partnership's goal was to create an updated vegetative map of Madagascar, drawing from satellite images and GPS data. The resulting map, now completed, offers impressive and detailed distribution data for fifteen different types of vegetative cover found across the island. It also, however, has certain limitations, which result in various types of diversity being rendered invisible.

In the course of the project, the researchers became puzzled by the satellite photos from the Mananara Nord region of Madagascar, located within the rainforest corridor of the Eastern coast. The photos showed the area as a green mosaic of tree cover that looked very much like "real" forest—or, under the category of the map—humid forest. Yet, the project researchers knew that Mananara was known for large-scale clove production, and thus concluded that many of the trees they were seeing from the air were most likely clove trees. Such systems would not be considered "real" humid forest under the map's classification, but would instead be considered degraded humid forests. As a result, the project personnel looked for individuals who could travel to Mananara with a GPS device to record the specific trees they observed at various points throughout the area, to determine if they indicated humid forest or degraded forest.

This dilemma of categorization, along with the larger quest to categorize and color-code Madagascar's ecosystems, reveals interesting dimensions of how the international environmental community measures and values biological diversity. Looking at the final map, one can read the particular narrative that the project is circulating. The area around Mananara, for example, emerges as a patchwork of primarily pink (cultivated vegetation) and light green (degraded humid forest) areas,

with a slight splattering of dark green (humid forest). Reading this map as a conventional conservation narrative, one will likely conclude that the original, primary humid forests of Mananara are shrinking, and that biodiversity is subsequently being lost [9].

While the categorization of vegetative data is described by the project as being "objective," there are in fact many subjective values contained within the map's classification system and the narrative it circulates. First, the choice of the categories themselves reflects subjective ideals of environmental landscapes. For instance, the map classifies land as being either under forest cover or under cultivation. It thus does not include any designation for agroforestry landscapes, which combine elements from natural forests, managed forests, and cultivated landscapes. This omission is particularly striking in regards to Mananara, as agroforestry cultivation represents the majority of vegetative cover in this region [39]. In lieu of having its own designation, agroforestry land is instead coded as "degraded humid forest".

The mapping project thus reflects the persistent epistemological divide in the environmental community that separates agricultural landscapes from forest landscapes [40,41]. Such a separation differs from the conception of landscapes often adopted by small-scale farmers in the global South, who are more likely to regard natural forest, secondary forest, and agricultural fields as complimentary stages in larger cycles of cultivation, reciprocity, and regeneration [42–44]. The fact that the experts of the project could not themselves distinguish clove forests from "real" forests suggests the artificiality of strictly separating cultivation, "primary" forest, and degraded forest.

In erasing agroforestry landscapes from its view of Madagascar, the mapping project subsequently misses the many types of diversity that these spaces contain—diversity, in fact, fostered by the introduction of economically important clove trees, which in turn has encouraged farmers to keep land under tree cover [28]. This diversity includes an impressive number of tree species: botanical surveys conducted in seven vanilla and clove agroforestry parcels, for example, catalogued ninety-seven different tree species representing thirty-nine families; approximately 35 percent of these tree species were native or endemic. Clove forests also support a variety of bird and animal species, including lemurs. As others have illustrated, agroforestry systems often foster vital ecological services that increase the environmental sustainability of landscapes, including promoting healthy soils, hydrological cycles, and corridor habitat for endemic or endangered species [45].

In addition to these more "orthodox" forms of diversity, the clove forests of Mananara contain a plethora of other types of diversities. Within these managed forests, for example, individuals cultivate a variety of subsistence crops as well as cash crops. This mixture represents species from across the world, with vanilla vines from Mexico cultivated alongside Indonesian clove trees, African coffee plants, New World root crops, and native and non-native fruit and palm trees. These crops also represent a diversity of market linkages: fruits are traded in local markets, coffee in national markets, and cloves and vanilla in international markets. Finally, agroforestry landscapes also support a diversity of cultural practices, serving as symbolic spaces for families who deliberately encode these fields with memories and meanings [46]. Indeed, farmers in the region regard their agroforestry fields with pride. Far from considering such landscapes as "degraded" humid forest, Mananara farmers would be much more likely to describe them as "improved" humid forest.

Thus, by coding agroforestry spaces as "degraded," the Vegetative Map of Madagascar ascribes a negative connotation to landscapes that, in fact, produce and preserve a great deal of diversity. This

diversity, however, tends to be the messier hybrid form of diversity, created by cycles, intersections, overlaps, and lived experiences. Instead of grappling with such messy forms of diversity, the mapping project focuses on the "pure" forms of diversity found in "real" humid forests with "real" trees. Such a framework does not regard Mananara, with its colorful mosaic of greens and pinks, as actively creating diversity, but as fundamentally threatening to it. Overall, while the singular views of diversity advocated by the Vegetative Map of Madagascar contribute important perspectives to on-going environmental conversations, they should not overwhelm other equally compelling, though more difficult to locate, types of diversity.

2.1.2. Camera Obscura: Satellite Imagery and Illegible Landscapes in Ecuador

In our second example, we further explore the epistemological divide between agriculture and forest in contemporary practices of remote sensing. This case, however, considers a more overt ideological project tied to the interests of a mining company in Ecuador. Nevertheless, like the case in Madagascar, it reveals how diverse and culturally meaningful landscapes remain obscured when forest biodiversity becomes the central optic of landscape measurement and valuation.

Satellite imagery is a fundamental element in the visualization of terrestrial forest systems and their decline [47]. Satellite imagery not only gives meaning to overall rates of deforestation, but paired images of "forest cover then" *versus* "forest cover now" have been influential in environmental campaigns for forest conservation [37]. With greater precision, alongside programs like Google Earth that make remote sensing more accessible and widespread [48], satellite imagery has become a ubiquitous feature within the "visual culture" of tropical deforestation [49]. Despite its appearance as a detached and objective perspective on tropical forests, however, satellite imagery is itself a form of knowledge that privileges certain types of measurement and categories, while occluding other variables [23,50]. This underlying subjectivity is particularly evident in cases where proponents of extractive industry employ satellite imagery to dampen and counter environmental arguments against their projects.

In a 1992 essay, geographer John Pickles analyzed various forms of propaganda maps to illustrate that even overt ideological cartography draws on and reproduces a shared lexicon of mapping with all cartographic projections. The extreme case of propaganda maps, Pickles argues, "shows that the traditional theories of maps fail in dealing with all maps" [51]. This section makes a parallel argument about satellite imagery through an analogous case of visual propaganda: the use of remote sensing by a mining company in Ecuador to cast itself as a savior of biological diversity and portray the local population opposed to the mine as the real threat to region's tropical nature. In scrutinizing the politically subjective perspective of the mining company, this analysis raises questions about the underlying epistemological frameworks embedded within all satellite images of tropical deforestation.

From 2004 to 2008, a junior mining company called Ascendant Copper held the rights to a mineral concession in Intag, a cloud forest frontier region on the northwestern slopes of the Ecuadorian Andes. As part of its efforts to undermine environmental narratives against mining, Ascendant argued that the Intag region was not a pristine cloud forest as many environmental groups had argued, but an already degraded and threatened landscape. In company webpages and publications, Ascendant paired images of deforested hillsides in Intag with captions like: "Intag's forests: going, going, gone" and "Complete

deforestation, mining was not the cause!" In one publication, Ascendant used images from "the prestigious program Google Earth" to show the "actual advance of deforestation" near the mining concession. Drawing on common narratives of tropical deforestation, Ascendant argued that farmers in Intag who opposed mining were not native inhabitants protecting sacred land, but "only mestizo colonos who practice slash and burn agriculture." Against the common image of non-native land colonists slashing and burning their way through biodiverse cloud forests, Ascendant portrayed itself as a steward of "environmental management" and large-scale mining as "perhaps the best solution to save the region's biodiversity."

All of Ascendant's images of deforestation were carefully framed and cropped to highlight agrarian landscapes, especially pastures, and to exclude the large extensions of forest within Intag. In dividing the region between forest and non-forest, Ascendant not only assumed a uniform expansion of an agrarian frontier, but obfuscated local practices of forest conservation. Ascendant's equation of large-scale mining with biodiversity conservation strikes an obvious note of absurdity and explicit subjectivity. Equally political, albeit less obvious, is Ascendant's narrative of poor local farmers and their agriculture. Indeed, Ascendant's account of mestizo colonists, "who practice slash and burn agriculture," is a discourse of blame common within most environmental narratives and images of tropical deforestation.

A number of scholars have highlighted how forms of satellite imagery often misread the cultural practices within seemingly natural forested landscapes [9,52,53]. This is important work that reveals the extent to which satellite imagery actually obscures the very sorts of non-western epistemologies and cultural practices that such imagery often purports to show as threatened. Many critiques of satellite imagery, however, tend themselves to emphasize forested landscapes, a process that not only makes diversity and value contingent upon arboreal motifs, but reinforces the image of agrarian terrains as inherently lacking. In appreciating the promise and limitations of satellite imagery, it is important to recognize linkages between forests and agriculture, as well as the varied epistemologies, histories, and political perspectives that are contained within seemingly simplified tropical agrarian landscapes [54,55].

A rugged terrain accessed through most of the 20th century by one or two mule trails, Intag came to be seen as a backwoods frontier that constituted a space apart from the rest of the Ecuadorian nation. The region's inaccessibility, abundant land, and productive sugar cane farms attracted not only mestizo farmers, but also Afro-Ecuadorians and, from the 1940s, Colombian migrants. At the same time, much like frontier myths in the United States, Ecuadorian rulers through the 20th century lionized Intag as a space that embodied national ideals of agricultural settlement. Many of these accounts, in fact, specifically emphasized Intag's diverse agrarian lands. A 1956 chronicle, for example, portrayed Intag, with its "diversity of climates and altitude," as "capable of developing, like perhaps no other region in the country, a varied and complete agriculture" [56]. Ascendant's visual narrative of "slash and burn" obfuscates this cultural history of Intag as diverse and exceptional territory. At the time, countering Ascendant's argument with satellite imagery of Intag's intact forests itself belies the rich and varied history through which farmers in the region have produced and maintained unique and culturally meaningful landscapes.

An over-emphasis on Intag's forests reduces the question of mining to one of biological diversity. Like the epistemological perspective of satellite imagery, a strict optics of biodiversity empowers decision-making to authorities exterior to the region. Threatened landscapes of biodiversity emerge

most clearly through satellite imagery. This sort of image, however, in positing clear divides between western and non-western, forest and non-forest, fails to acknowledge the types of varied cultural relations, practices, and perspectives within Intag's agrarian terrains that inform local opposition to mining. Though the region's history and on-going patterns of settlement fit awkwardly within pure categories of indigenous knowledge and pristine nature, Intag's hybrid landscapes do speak to other issues of fostering more sustainable livelihoods, from opposition to large-scale extractive industry to balancing agricultural production and forest conservation within culturally significant boundaries of place.

2.2. Metrics and Indicators for "High" or "Real" Diversity, and the Biological and Cultural Diversity They Overlook

In our second section we continue to examine standardizing practices for measuring and representing diversity, in this case metrics and indicators for biodiversity and cultural diversity. We identify the inability of such limited tools to capture the lived experiences of diversity, and we highlight new projects and proposals that are being designed with the goal to promote broader visions of diversity, such as use-values of agrobiodiversity or hybrid cultural diversity.

2.2.1. Abstract and Concrete Concepts of Diversity: Examples from on-farm Agrobiodiversity Conservation in The Andes

Our first example of our second section considers tensions between the scientific concept of "biodiversity" and the practices of biodiversity conservation. This section draws on academic and applied work in the *in-situ* conservation of agrobiodiversity—the on-farm conservation of native and traditional crop species and varieties.

The idea of diversity, as developed in biology and ecology, effectively refers to some imagined or measured universe of variation. Whether this universe consists of species, languages, or cultures, no single thing within it is assigned stand-alone importance. Rather, the importance of any given thing is judged in relationship to the broader group, particularly in the extent to which it is similar to or different from other things of its kind. This perspective is built into the statistical tools that ecologists have used to measure diversity (e.g., the Shannon-Weaver Index, or the Simpson Index) [57]. It is also evident in prominent analyses of the economic value of biodiversity, which emphasize the marginal value of any nth additional quantity of the diversity in question, rather than the observed value [58].

The limitation of this perspective, when applied to conservation activities, lies in its potential to trivialize any individual, concrete example of diversity. Such measurements define diversity on a relational scale of abstract values, but leave little room for acknowledging the stand-alone use-values or social meanings of the entities such a scale comprises. Omitted, for example, are culturally situated understandings of language, landscapes, plants, or practices, which may offer indicators of importance more relevant to the human experience of diversity than are mathematical assessments of "uniqueness" or "marginal value." Place-based understandings and uses are sometimes acknowledged in studies of biodiversity (as, for example, in the field of ethnobotany). However, in the implementation of conservation programming, such understandings are generally consigned to the category of "local" or "folk knowledge." These categories, by definition, deny such knowledge the universality ascribed to academic science, thereby assigning a position of lesser authority to them.

Examples from research and applied work in the conservation of native potato varieties in the Bolivian Andes illustrate the complexities arising from the disconnect between scientific measurements of crop diversity and locally relevant use-values. In this context, the locally relevant units of diversity are individual varieties, or varietal categories designated in local languages, which may roughly—but not precisely—correlate with botanical species definitions [59]. Some varieties (e.g., *papa wayk'u, papa holandesa*) are important because they are staple foods, or have reliable market outlets. Others underpin constant food supply, like those varieties amenable to long-term storage (as *chuño* or *tunta*) following Andean freeze-drying processes, or short-cycle varieties, called *purejas*, which may be planted and harvested three to four times per year. Still other varieties are valued for their unique flavors or shapes (*papa pintaboca, papa ñoj'cha*).

Although the differences among these varieties may map onto some level of genetic variation, it is not the genetic variation itself that defines how, when, or whether these differences take on importance for farmers and consumers. Varietal names or categories may show a rough correlation with the fine-grained genetic and morphological patterns that a botanist or evolutionary geneticist might examine to assess a variety's "value" on a relational spectrum, but this correlation is not intrinsic. The differences that a geneticist finds important might be trivial in the eyes of a household food-preparer, and vice-versa.

This disjuncture generates tensions in the practice of agrobiodiversity conservation. In theory, to conserve "diversity," practitioners should conserve as broad a spectrum as possible of crops and crop varieties. However, placing value on the spectrum itself, rather than on individual varieties, may obscure the more concrete values that make native and traditional crops important to the people who farm and consume them.

For example, such measurements may have an uneasy fit with local meanings, epistemologies, and value systems. Scholars of Andean agroecology emphasize that farmers have historically treated their seeds and fields as living beings, with whom they may have ongoing conversations and relationships of reciprocity [60,61]. As such, native and traditional varieties are not seen as examples of a universe of possibility, but rather as individual and living resources. To the extent that this worldview is common among the small-scale Andean farmers who maintain native and traditional crop varieties, the language of "agrobiodiversity conservation" effectively talks past what is locally relevant. The difference between the two perspectives might be somewhat akin to asking individuals to assess the value of their neighbors based on how unique they are to one another, rather than how close and enduring their relationships are.

The disconnect between conserving a full spectrum of varieties and prioritizing conservation based on local use-values is not limited to the sphere of cosmology and ethics; it also extends to market-based conservation initiatives.

The ongoing work of *Fundación Proinpa*, a Bolivian agricultural research NGO, illustrates the challenges of balancing concrete use-values and relational, scientific values in conserving a spectrum of crop varieties. *Proinpa* has recently undertaken a project to connect farmers growing native potato varieties with the Bolivian potato chip market. This project has required facilitation and education efforts, targeting not only farmers and consumers, but also the potato chip processor who buys raw material. Initially, it was necessary to convince the buyer to purchase not just the highest-yielding or easiest-to-process variety, as an industrial logic might dictate. Rather, the buyer was persuaded to

include multiple varieties, with the explicit goal of supporting the conservation of a cross-section of local diversity.

Achieving this outcome required *Proinpa* not only to invest in education and outreach, but also to devote human and institutional resources to food processing research. Although the household uses of native varieties were well established, when these varieties were processed using large volume techniques designed for producing chips from improved potato varieties, the outcome was a substandard product. In response, *Proinpa* developed processing procedures better suited to native potato varieties. Additionally, *Proinpa* has directly facilitated the regular supply of high-quality raw material, acting as an "honest broker" between the processor and farmers' groups.

Among projects aiming to increase farmers' market access, this effort stands out for its intentional avoidance of tactics that would winnow or standardize diversity. Often, native and traditional varieties are at a disadvantage in industrial markets, because they fail to meet the standards of uniformity, consistency of supply, and sheer volume that industrial-scale processing requires [62]. Consequently, projects seeking to enhance the market value of native and traditional crops often take the approach of selecting "high potential" varieties from the array of options available, adding value through breeding or other techniques, and subsequently promoting their wider dissemination. The implications of such strategies vary, but in principle, they may promote the perpetuation of specific traits, rather than the maintenance of on-farm systems which generate and maintain genetic diversity [63].

In this case, to support the conservation of varieties spanning a wider swathe of the spectrum of potato diversity, it was necessary for *Proinpa's* project to demonstrate the concrete use-values of each individual variety to the buyer. In other words, to support conservation of a spectrum of varieties, it was necessary to demonstrate not these varieties' uniqueness, or marginal value for conservation purposes, but rather the concrete (in this case, economic and culinary) values that these varieties would offer to the buyer.

The activities necessary to walk the delicate line between conservation-through-use, and "diversity for diversity's sake," have implications for biodiversity conservation more broadly. Programs emphasizing "diversity" in the abstract may fail to prioritize the human interests that might make conservation projects feasible. A counter-critique, meanwhile, might raise the concern that use-value-driven programs run the risk of prioritizing what matters to people or markets without considering a broader spectrum of genetic or ecological values. While these problems are not insurmountable, they deserve more focused attention. As recent initiatives to facilitate market-driven agrobiodiversity conservation [64–66] develop over time, they stand to offer important insights on both the tensions and points of synergy between abstract, relational conceptions of diversity and the concrete use-values this diversity underpins.

2.2.2. Cultural Diversity and Language: Expectations for "Authentic" Indigenous Peoples in Peru

We now turn to an examination of cultural diversity in Peru. This example demonstrates how narrow indicators are (problematically) utilized as proxies for cultural diversity and how degradation narratives and expectations of purity are applied not only to landscapes but also to people—in this case expectations that indigenous people are only authentic if they continue to speak their own indigenous language. This example finds that indigenous people can still be "authentic" even if they adopt hybrid elements to their cultures.

In Peru, it is common for government officials as well as others from the general populace to consider the use of indigenous language as a minimum requirement for indigenous identity. Put another way, if a person claiming to be indigenous does not speak an indigenous language many people in Peru assume that he or she is not *really* indigenous. This assumption is not just cultural—it is written into policies and has material implications. For example, in 2012 the National Institute for the Development of Andean, Amazonian and Afro-Peruvian People (INDEPA) was tasked to develop an official database of indigenous people (*Base de Datos Oficial de Pueblos Indígenas u Originarios*). The creation of this database was mandated by the Consultation Law passed in September 2011 and will be used to identify which communities will (or will not) be consulted about legislative or administrative measures that could affect them.

In developing the database, INDEPA identified two "objective elements" for the recognition of indigenous people: (1) indigenous language, and (2) communal lands—which together are considered to demonstrate "historical continuity" from before the establishment of the State [67]. While these objective elements may be combined and complemented with "subjective criteria," such as self-identification, many indigenous people, anthropologists, and lawyers raised concerns with the emphasis on language as one of just two primary criteria for the recognition of indigenous people. For example, Ramon Rivero, a lawyer from the non-governmental organization *Instituto del Bien Común*, noted that the use of language as an "indispensable requirement" has been "considered by many to be discriminatory" and is not otherwise a requirement in national or international law [68]. Anthropologist Alberto Chirif also expressed in an interview that considering indigenous language as "an indispensable element in defining who is and is not indigenous" is a cause for concern since "language is just one element of identity." He went on to express hopes that the indigenous movement would organize to contest the use of language as a requirement for identity, possibly taking a case to the international level (to the Inter-American Commission on Human Rights or the International Labor Organization). Indigenous leaders, like Alfonso Lopez Tejada, President of the Cocama Association for Development and Conservation San Pablo de Tipishca (ACODECOSPAT), also have repeatedly said that they, the Cocamas, keep their culture in the face of language loss—"even if we are losing our language, it doesn't signify that we are losing our culture."

In essence, there are many questions and tensions as to whether language should be considered indispensable when recognizing indigenous identity. Many people push back on this tendency, saying that language should not be a requirement and that even in the face of language loss indigenous peoples are still able to maintain their indigeneity. For example, a priest who has worked for many years with Cocama indigenous communities in the northeast Peruvian Amazon noted that while many Cocamas no longer speak the Cocama language they have maintained many of their practices and beliefs, especially when it comes to beliefs about spirits and their role in influencing sickness, pregnancies, and interactions with the farm and forest. For this priest, the best way to understand Cocama culture was captured by the analysis of Eduardo Viveiros de Castro—that just as was the case in the days of cannibalism for the Tupinambá, who belong to the same ethnolinguistic family as the Cocamas, the driving force of interacting with outsiders was "to absorb the other, and in the process, to change oneself" [69]. In this formulation, adopting certain practices from Europeans, including language, was a way to appropriate from outside cultures (*"aproprian lo extraño"*), while maintaining

their own culture as well. Hence, language loss in this case does not represent a loss of culture and identity, but rather a change in culture (or perhaps even an expansion of cultural diversity).

The above perspectives indicate that language and culture may not be as closely correlated as is frequently assumed: cultures and cultural diversity may persist and thrive even in the face of language loss. But if this is the case, then why would there be a strong lobby for bilingual education among indigenous leaders in Peru, as is currently the case? The push for bilingual education is related in part to a concern with the detrimental effects of traditional Spanish-language education on the culture and cultural identity of their children. This has to less to do with the language itself, however, and more to do with pedagogy and discrimination—their children have frequently been taught that their families and communities were backward. Interestingly, this negative assessment of their cultures can be done in their native languages as well as in Spanish. As pointed out by directors of a prominent training program for bilingual educators in the northeast Peruvian Amazon (known as FORMABIAP), previous bilingual education in Peru, especially the programs carried out by the Summer Institute of Linguistics beginning in the early 1960s, supported education in indigenous languages but with the aim of assimilation—of creating "good mixed-blood people that know the bible well" ("*buenos mestizos que sepan bien la biblia*"). This history serves as a counterintuitive case in which indigenous languages were promoted as a means to reduce cultural diversity. Indigenous leaders like Alfonso Lopez Tejada have pushed back on the long-standing tradition in which "others teach us that we are poorer off," and emphasized instead that "we need to educate our coming generations in a way in which they do not lose their soul. We cannot simply desire to be like the other, but rather we must maintain the knowledge that we have received and transmit it to the generations that come." Bilingual, intercultural education must emphasize not only the language itself, but respect and value indigenous epistemologies, which is an indispensable element in the maintenance and flourishing of cultural diversity.

2.3. Cracks in Authority: Acknowledging Diversity in Voices or Visions

In our final section we examine diversity in beliefs about environmental diversity and environmental problems as a form of diversity in and of itself. In our first example of the section, we examine the unexpected proliferation of epistemological diversity regarding modern climate change and the challenge it poses to scientific authority. The one example of diversity in our study that is unwelcome, this merits more serious, transdisciplinary attention than it has received to date. In our second example, we compare the diversity of beliefs about biological and cultural diversity in the Brazilian Amazon and Atlantic forest, the latter of which is becoming celebrated for its hybridity, which may presage a shift in the ways in which diversity is considered and valorized.

2.3.1. A Climate of Diversity and a Diversity of Climates

As the foregoing sections have shown, scientists have been champions of diversity in many spheres of life, both biological and cultural, but not in ways of knowing the world, not in epistemologies. Exceptions to this—such as the recent valorizations of indigenous environmental knowledge or holistic medicine—stand out for their rarity, and science arguably still provides the "metric" by which they are judged. Quite different is the case of contemporary climate change; the unexpected proliferation of folk theories of climate change, especially the steadfast denial of the thesis of anthropogenic climate

change, has been highly unwelcome to the scientific community. This increasing push-back to scientific authority undermines the political will to tackle climate change and thus demands our attention. This is also an example of the fact that high diversity is not by definition a good thing.

Human thinking about the relationship between climate and society is ancient. In the second millennium B.C., sages in India contemplated the relationship between humoral oppositions within the human body and the divide of India into wet and dry zones [70]. A millennium later Hippocrates [71] famously discerned a relationship between the character of the land and the character of the people living on it. The thesis that temperate climates produce temperate peoples was repeated by Ibn Khaldun [72] in fourteenth century North Africa and by Montesquieu [73] in eighteenth century France. This scholarly tradition of climate knowledge persisted into the nineteenth century, when it was challenged by the rise of the modern scientific paradigm.

Jankovic [74] has described the resulting "epistemic contest", focusing on one of the hoariest of climate beliefs, the role of wind in human illness. This contest ended with a decisive victory for the scientific paradigm, whose understanding of wind completely supplanted and marginalized folk theories regarding its medical properties; and more generally, scientific views of climate completely eclipsed lay views. Whereas this seemed to signal the end of the millennia-old history of folk theories of climate and its impact on human society, events proved otherwise.

Modern climate science appears to be in an unchallenged position of authority vis-à-vis the study of climate and society. The field is dominated, Hulme [75] tells us, by quantitative, predictive modeling in the natural and biological sciences. There is "little recognition of evolving, adapting, and innovating societies, and little endeavor to consider the changing values, cultures, and practices of humanity" [75], or the diversity of global climate systems [76]. So determinate is the role of the climate scientists, indeed, that Hulme [75] calls this "climate reductionism", or "neoenvironmental determinism". But the lay public is proving to be unaffected by this academic hegemony.

A lay critique of the thesis of anthropogenic climate change has arisen over the past decade, in particular in the United States. This is dramatically manifested in the phenomenon of public criticism of scientific articles on climate change, when published in journals that invite on-line comment. The Yale legal scholar Dan Kahan is one of the few to seriously study this phenomenon. He rejects the idea that critiques of climate change science simply stem from "irrationality" [77]. Kahan argues that the problem is not that the public is irrational, but rather that their "reasoning powers have been disabled by a polluted science-communication environment" [77]. Scientific belief or disbelief has come to be associated with group identity, Kahan argues, and this pollutes the science-communication environment with "divisive cultural meanings" [77].

The public commentary on the article in which Kahan makes this point illustrates the problem. The commentators are critical of many dimensions of climate science, beginning with its methods. For example, one commentator refers to the supposed "cherry picking" of data to support pet theories, whereas another claims that scientific objectivity is suspect because of dependence on "a small peer group for both money and prestige." Other commentators are critical of the politics of science, variously claiming that it is anti-religion, anti-business, and anti-growth. Others are more conspiratorial, suggesting that greenhouse gas emissions could already have been reduced through exploitation of cold fusion, but for the fact that the scientific community has collectively chosen to deny clear evidence of its feasibility. Some of the criticism is so inchoate that it is hard to see what the

point is except to simply disagree with the mainstream scientific community, and what is explicitly perceived to be its self-referential, self-privileging stance. In short, some critics seem to be claiming space for alternate voices chiefly on the grounds that no space for alternate voices exists.

Great diversity of public views of contemporary climate change has developed, therefore; and scientists do not see this as a good thing. Climate scientists regard this public critique and debate as a luxury that the world cannot afford as climate change—and the difficulty of redressing it—advance with every passing year. They see it as an obstacle to solving the problem of climate change, and also as something fundamentally apart from climate change. As a result, denial has been categorized as an educational problem, or a political problem, but not as a scientific problem demanding scientific scrutiny. There has been some public opinion-type study of climate change denial [78], but there has been little if any attempt to interpret it within the problem of climate change itself. Its status external to the problem of climate change is reflected in Kahan's characterization of denial as "pollution" [77].

Social scientists have been as constrained as natural scientists with respect to the climate change deniers. Scholars who have spent a generation studying the social reproduction of science baulk when it comes to climate change science, because most regard climate change as such a serious threat to society. Bruno Latour [79], in a famous article, suggests that even though it may "burn my tongue to say that global warming is a fact whether you like it or not," given a career spent assailing just such statements, he feels that the looming environmental crisis is so serious that he must say it. In short, Latour hesitates to critique the methods by which climate scientists claim authority for their findings, because he deems those findings so important. And he is equally hesitant to rationalize the critiques of those methods and findings by the climate change deniers. This has led to a degree of scientific "erasure" of those critiques, in a way that is reminiscent of what Ortner [80] calls "ethnographic refusal", which is a reluctance to grace politically incorrect behavior with professional scrutiny.

Gregory Bateson, whose work is cited by the editors as one of inspirations for this collection, would fault this inattention to the lay beliefs of climate change denial. Bateson always urged us to take a systemic view of environmental problems, including the way that we study problems and communicate the results of our studies. As he famously wrote, "[T]he problem of how to transmit our ecological reasoning to those whom we wish to influence in what seems to us to be an ecologically "good" direction is itself an ecological problem" [81]. Thus, Batseon would see the problem of transmitting our reasoning about climate change to the denial community as an ecological problem. According to Bateson, therefore, the "friction" [30] encountered in the dissemination of the scientific findings on climate change, and the surprising lack of friction encountered in the dissemination of the lay critique, are part and parcel of the problem of climate change itself. And if they are not understood, then climate change is not understood.

The case of climate change denial suggests that modernity and globalization have not led to an undifferentiated view of the world, and that the hegemony of modern science has not gone unchecked. Epistemologies of climate have become more, not less, diverse in recent years. Whereas this is not a welcome development to scientists, it is not without its utility. The efflorescence of climate change denial beliefs are a signpost pointing toward the need for a more systemic approach to climate change, one that encompasses the cultural context not just of climate but of the knowledge—and indeed lack of knowledge—of climate. The growth in both understanding and mis-understanding of climate change

are coupled, and this transdisciplinary relationship must be understood if the very real challenges of climate change mitigation and adaptation are ever to be met.

2.3.2. Amazonian Purity and Atlantic Forest Hybridity in Brazil

In our final example, we return to an examination of assumptions and expectations of purity *versus* hybridity through a comparison of representations of the Amazon and Atlantic Forest in Brazil.

Brazil is a world leader in "megadiversity" [82]—a designation of those nations with the greatest number of species. The notion of extreme diversity in Brazil is not restricted to biodiversity, however. Owing to its history of immigration, as well as the indigenous populations dwelling within its borders, Brazil ranks high on registers of ethnic diversity as well. While Brazilian Amazonia is credited with the great proportion of this diversity, the inclusion of Brazil's coastal forest—the Atlantic Forest—in consideration of the country's diversity is a relatively recent occurrence. Whereas Amazonia is generally represented as a uniformly pristine forest inhabited by a uniformly indigenous population, the Atlantic Forest is now celebrated for precisely those messier kinds of diversity glossed over in Amazonia—ideas which have implications for conservation values and practice in the region.

Amazonia is a dominant concept not just for foreigners [83,84], but it is a point of reference—a "diversity touchstone"—for those working in Atlantic Forest conservation circles. The Atlantic Forest long existed in the "iconic" [83] shadow of Amazonia in spite of shared nationality, vegetation [85], and indigenous ethnicities. For centuries, the Atlantic Forest was a landscape to be settled and used as a point of entry into the Amazonian region that dominated European imaginations (e.g., as to the setting of "El Dorado"). This changed as the Atlantic Forest became recognized in the late 1980s as a "biodiversity hotspot"—a region of megadiversity in its own right. Such designations were the product of both conceptual linkages to—and differentiations from—Amazonia.

In ecological terms, Amazonia is generally represented as being a uniform and archetypal rain forest. However, this elides an array of ecosystems such as savannas, marshlands, flood plains, black-water ecosystems, upland forests, and flooded forests [86]. Socially, Amazonia is cast as the prototypical home of primeval peoples, in spite of the fact that 98% of its population (roughly 25 million people) is comprised of non-indigenous or mixed-heritage residents.

In contrast, the Atlantic Forest is celebrated by its proponents as a "complex of forest types" [87]. These include high-elevation grasslands, open scrub lands (*caatinga*), semi-deciduous pine forest, woodland-savannah ecosystems (*cerrado*), mangrove swamps, and coastal scrub on sandy soils (*restingas*). The transition zones between the various forest formations do not fit neatly into any given classification and are referred to as "areas of ecological tension." In fact more than 75% of the Atlantic Forest does not properly belong to the dense aseasonal moist forest that has come to be identified as archetypal "rainforest". It is conceded by the very scientists that participated in its definition in 1990, that the "Atlantic Forest" is "a popular term with no real scientific basis…subject to extensive discussion and widely diverging opinion" [88].

Furthermore, in the Atlantic Forest, the social groups that represent diversity are of mixed ethnicity or descendants of immigrants. For example, it is the "neo-traditional" groups of *Quilombolas, Caiçaras, Açorianos,* and *Jangadeiros* that are seen as the embodiments of the social diversity of the region, even over the indigenous groups that have resided in the Atlantic Forest for millennia, such as

the *Pataxó, Xoklén,* or *Tupi*. To take just the first two examples, *Quilombolas* are descendents of communities of fugitive slaves, and *Caiçaras* are descendants of Portuguese, Amerindians, and Africans. Both have lived for centuries in relative isolation from the greater Brazilian society due to geographic inaccessibility and low spatial mobility, and they utilize knowledge and production systems derived from local indigenous populations. Such populations are emblematic of the new forms of diversity that have been created in densely populated and highly anthropogenic landscapes, and are now being celebrated by international organizations dedicated to the preservation of culture (e.g., UNESCO) and forest conservation (e.g., The Nature Conservancy, World Wildlife Fund, and Conservation International).

In summary, more nuanced difference in Amazonia tends to be obscured in the name of diversity, whereas in the Atlantic Forest that same level of difference is championed. This is not to say that in the Atlantic forest all diversities are valorized, since even in the Atlantic forest certain types of diversity are under-represented or under-emphasized. For example, certain forest types, such as swidden fallows (*capoeiras*), and certain populations more integrated with Brazilian society at-large, are excluded from the Atlantic Forest claim to mega-diversity. However, on the whole it is noteworthy that the Atlantic Forest is celebrated because of its heterogeneity and hybridity, given the tendency to obscure hybrid forms of diversity in the Amazon (and in other locations spoken about previously in this study, such as in Mananara, Madagascar and in Intag, Ecuador). One reason for this is that the attention to the Atlantic Forest's environmental and cultural diversity, and conservation value, is relatively new. The Atlantic Forest—unlike Amazonia—received no detailed or systematic studies until the 1980s. The first biological collection followed five centuries of selective harvesting, plantation agriculture, cattle ranching, mining, and urbanization. Conservation biologists, therefore, readily admit that neither baseline estimates nor full censuses of biodiversity in the Atlantic Forest are possible. Yet it is this "impossibility" of knowing, they argue, that makes conservation and restoration in the region more urgent. This lack of baselines makes possible a novel set of perspectives regarding the hybridity that is prevalent not only in the Atlantic Forest, but in most places, including in Amazonia itself.

This evaluation of the perception of the Amazon as a "pure" form of diversity and the Atlantic Forest as a "hybrid" diversity may offer insights into the mutability of dichotomizing and purifying practices of modern attempts at understanding diversity [21]. Although the Atlantic Forest was largely overlooked in favor of Amazonian imaginations dating back to the early colonial period, current attention to the Atlantic Forest and its hybrid diversity challenges facile dichotomies of nature and culture, and begs new ways of rallying together for common interests such as biodiversity conservation. The increasing attention to and valorization of a hybrid landscape such as the Atlantic Forest may forecast a shift in conceptions of—and priorities for—alternative diversities.

3. Summary and Conclusions

Interest in similarity *versus* difference is an ancient human preoccupation, and the link between difference in nature and difference in culture has always been present, as expressed in ideas about the Great Chain of Being [89] as well as totemism, the articulation of human differences in terms of differences in the natural world [90]. Whereas the abstract idea of "diversity" and its self-conscious conservation is a modern invention, diversity itself is ancient. As our analysis of agro-biodiversity in

the Bolivian Andes shows, Andean farmers have long promoted diversity within traditional farming systems albeit with no conscious focus on diversity. This presents a paradoxical challenge to modern conservation and sustainable development efforts: can the direct, explicit promotion of diversity actually work, if this was not how diversity was historically produced? In particular, are current orthodox metrics and measures of diversity, hewing to particular notions of purity, accurate, useful, or equitable? The contemporary world seems to increasingly challenge such definitions of diversity, as illustrated by our analysis of land cover mapping in Madagascar. The result is ever narrower and more impoverished definitions of diversity that prove increasingly insufficient unto the real world, but whose objectivity is trumpeted precisely as their actual utility is diminished. There seems, indeed, to be a relationship between increasing reductionism within science and increasing skepticism of science in the wider world, as shown by our analysis of the proliferation of a modern, public discourse of climate change denial. Both the science and the denial of climate change, therefore, are linked; both are part of the problem of climate change itself. This relationship is also illustrated by our analysis of the use of remote sensing by the mining industry in the Ecuadoran Andes. Whereas such analyses are presented as unprejudiced, they are not. Again, claims for empirical objectivity seem to coevolve with the politics of representation. Our ethnographic examples all show that definitions of diversity can vary. As illustrated by our analysis of indigenous rights debates in the Peruvian Amazon, some definitions are empowering for the peoples involved, and some are disempowering. The definition of diversity is a strategy of power, therefore: who gets to define it matters. The selection of one definition and archetype of diversity (e.g., the Amazon) can suppress or erase other types and definitions (e.g., the Atlantic Forest). The case of the Atlantic Forest also demonstrates, however, that even though we tend to think of diversity (its creation not destruction) as lying outside of time, in fact it is always being created. Even though this newly created diversity challenges traditional concepts of diversity, there is some evidence that science is opening itself up to its recognition.

Modernity has made a self-conscious project of diversity, therefore: what is it, is it declining, and how do we measure it? As Latour points out, however, such a declensionist view over-simplifies the real dynamic of modernity, which is to always both mix and purify. If Latour is right, then perhaps what is characteristic of modernity is that it obfuscates its impact on diversity, one of the results of which is that both the concept and state of diversity become contested. This contest is reflected in the existence and persistence of problematic definitions of diversity, as attested to in most of the examples presented here. The politics of the representation of diversity also affects its academic study. Academics clearly like some sorts of diversity but not others, lamenting the loss of diversity we treasure but ignoring the increase in diversity that we deplore, and reflexively seeking out purity over hybridity. But our ethnographic examples problematize the difference between the two—e.g., between the archetypal diversity of virgin tropical forest and indigenous tribes on the one hand, and on the other hand the emergent diversity of agroforestry landscapes and communities adapting to globalization. The increasing inutility of archetypal concepts of diversity challenges scientific orthodoxy, and the response to the challenge, can be either to broaden the concept or to hold ever more tightly to the old one. A danger of the latter is what Bateson [36] called the double bind: a positive feedback loop, wherein the declining political capital of science leads to a tighter grip on outmoded concepts, which only add to this decline.

Ideas about diversity, and its emotional loading, thus seem to be coevolving with the times, with our society and our landscape. Its study has much to tell us about sustainable development, nature and culture, and science and modernity.

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Conflict of Interest

The authors declare no conflict of interest.

References and Notes

1. Janssens, M.; Bechtoldt, M.; de Ruijter, A.; Pinello, D.; Prarolo, G.; Stenius, V.M.K. *The Sustainability of Cultural Diversity: Nations, Cities and Organizations*; Edward Elgar Publishing: Northampton, MA, USA, 2010.
2. Folke, C.; Carpenter, S.; Elmqvist, T.; Gunderson, L.; Holling, C.S.; Walker, B. Resilience and sustainable development: Building adaptive capacity in a world of transformations. *AMBIO* **2002**, *31*, 437–440.
3. Berkes, F.; Folke, C. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience.*; Cambridge University Press: Cambridge, UK, 1998.
4. Olsson, P.; Folke, C.; Berkes, F. Adaptive comanagement for building resilience in social-ecological systems. *Environ. Manage.* **2004**, *34*, 75–90.
5. 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.
6. Nazarea, V. *Ethnoecology: Situated Knowledge/Local Lives*; University of Arizona Press: Tucson, AZ, USA, 1999.
7. Brookfield, H.; Padoch, C.; Parsons, H.; Stocking, M. *Cultivating Biodiversity: Understanding, Analysing and Using Agricultural Diversity;* ITDG: London, UK, 2002.
8. Redford, K.H.; Padoch, C. *Conservation of Neotropical Forests: Working from Traditional Resource Use*; Columbia University Press: New York, NY, USA, 1992.
9. Fairhead, J.; Leach, M. *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic*; Cambridge University Press: Cambridge, UK, 1996.
10. Robbins, P.; McSweeney, K.; Waite, T.; Rice, J. Even conservation rules are made to be broken: Implications for biodiversity. *Environ. Manage.* **2006**, *37*, 162–169.
11. Tucker, R. *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World*; University of California Press: Berkeley, CA, USA, 2000.
12. Wolf, E. *Europe and The People Without History*; University of California Press: Berkeley, CA, USA, 1982.

13. Dove, M.R. *The Banana Tree at the Gate: A History of Marginal Peoples and Global Markets in Borneo*; Yale University Press: New Haven, CT, USA, 2011.
14. Hall, S. The local and the global: Globalization and ethnicity. In *Culture, Globalization, and the World System*; King, A., Ed.; University of Minnesota Press: Minneapolis, MN, USA, 1997; pp. 19–39.
15. Ferguson, J. *Global Shadows: Africa in the Neoliberal World Order*; Duke University Press: Durham, NC, USA, 2006.
16. Sivaramakrishnan, K.; Agrawal, A. *Regional Modernities: The Cultural Politics of Development in INDIA*; Oxford University Press: Oxford, UK, 2003.
17. Appadurai, A. Diversity and sustainable development. In *Cultural Diversity and Biodiversity for Sustainable Development*; UNEP: Nairobi, Kenya, 2003; pp. 16–19.
18. Gudeman, S. *The Anthropology of Economy: Community, Market, and Culture*; Blackwell: Malden, MA, USA, 2001.
19. Scott, J.C. *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*; Yale University Press: New Haven, CT, USA, 1998.
20. Chambers, R. *Whose Reality Counts?: Putting the First Last*; Intermediate Technology: London, UK, 1997.
21. Latour, B. *We Have Never Been Modern*; Harvard University Press: Cambridge, MA, USA, 1993.
22. Blaikie, P. *The Political Economy of Soil Erosion in Developing Countries*; Longman Inc.: New York, NY, USA, 1985.
23. Robbins, P. Tracking invasive land covers in India, or why our landscapes have never been modern. *Ann. Assoc. Am. Geogr.* **2001**, *91*, 637–659.
24. Marris, E. *Rambunctious Garden: Saving Nature in a Post-Wild World*; Bloomsbury: New York, NY, USA, 2011.
25. Casid, J.H. *Sowing Empire: Landscape and Colonization*; University of Minnesota Press: Minneapolis, MN, USA, 2005.
26. Hobbs, R.J.; Higgs, E.; Harris, J.A. Novel ecosystems: Implications for conservation and restoration. *Trends Ecol. Evol.* **2009**, *24*, 599–605.
27. Robbins, P.; Moore, S.A. Ecological anxiety disorder: Diagnosing the politics of the Anthropocene. *Cult. Geogr.* **2013**, *20*, 3–19.
28. Davis, M.A.; Chew, M.K.; Hobbs, R.J.L.; Ariel, E.; Ewel, J.J.; Vermeij, G.J.; Brown, J.H.; Rosenzweig, M.L.; Gardener, M.R.; Carroll, S.P.; Thompson, K.; *et al.*; Don't judge species on their origins. *Nature* **2011**, *474*, 153–154.
29. Dove, M.; Carpenter, C. *Environmental Anthropology: A Historical Reader*; Blackwell Pub: Malden, MA, USA, 2008.
30. Tsing, A.L. *Friction: An Ethnography of Global Connection*; Princeton University Press: Princeton, NJ, USA, 2005.
31. Willems-Braun, B. Buried epistemologies: The politics of nature in (post) colonial British Columbia. *Ann. Assoc. Am. Geogr.* **1997**, *87*, 3–31.
32. Cronon, W. The Trouble with wilderness: Or, getting back to the wrong nature. In *Uncommon Ground: Rethinking the Human Place in Nature*; Cronon, W., Ed.; W. W. Norton & Co.: New York, NY, USA, 1995; pp. 69–90.

33. Neumann, R.P. Disciplining peasants in Tanzania: From coercion to self-surveillance in wildlife conservation. In *Violent Environments*; Peluso, N.L., Watts, M.J., Eds.; Cornell University Press: Ithaca, NY, USA, 2001.
34. Moore, D.S. *Suffering for Territory: Race, Place, and Power in Zimbabwe*; Duke University Press: Durham, NC, USA, 2005.
35. Li, T.M. *The Will to Improve: Governmentality, Development, and the Practice of Politics*; Duke University Press: Durham, NC, USA, 2007.
36. Ferguson, J. *The Anti-Politics Machine: "Development", Depoliticization, and Bureaucratic Power in Lesotho*; University of Minnesota Press: Minneapolis, MN, USA, 1994.
37. Braun, B. *The Intemperate Rainforest: Nature, Culture, and Power on Canada's West Coast*; University of Minnesota Press: Minneapolis, MN, USA, 2002.
38. Ganzhorn, J.U.; Lowry, P.P.; Schatz, G.E.; Sommer, S. The biodiversity of Madagascar: One of the world's hottest hotspots on its way out. *Oryx* **2008**, *35*, 346–348.
39. Andriambahiny, J.; Ladatoharivola, R.; Brand, J. *Ecodeveloppement des Populations de Base Pour la Conservation de la ReServe de la Biosphere de Mananara-Nord (Phase II)* (In French); Gouvernement de la Republique de Madagascar, Association Nationale Pour la Gestion des aires Protegees (ANGAP): Antananarivo, Madagascar, 2000.
40. Neumann, R.P. *Imposing Wilderness: Struggles over Livelihood and Nature Preservation in Africa*; University of California Press: Brekely, CA, USA,1998.
41. West, P.; Igoe, J.; Brockington, D. Parks and people: The social impact of protected areas. *Ann. Rev. Anthropol.* **2006**, *35*, 251–277.
42. Alcorn, J.B. Process as resource: The traditional agricultural ideology of Bora and Huastec resource management and its implications for research. In *Resource Management in Amazonia: Indigenous and Folk Strategies*; Posey, D.A., Balee, W., Eds.; New York Botanical Garden: New York, NY, USA, 1989; Volume 7, pp. 63–77.
43. Conklin, H.C. *Hanunóo Agriculture: A Report on an Integral System of Shifting Cultivation in the Philippines;* Elliot's Books: Northford, CT, USA, 1957.
44. Dove, M.R.; Kammen, D.M. The epistemology of sustainable resource use: Managing forest products, swiddens, and high-yielding variety crops. *Hum. Organ.* **1997**, *56*, 91–101.
45. Jose, S. Agroforestry for conserving and enhancing biodiversity. *Agroforest. Syst.* **2012**, *85*, 1–8.
46. Osterhoudt, S. Sense and sensibilities: Negotiating meanings within agriculture in northeastern Madagascar. *Ethnology* **2012**, *49*, 283–301.
47. DeFries, R. Terrestrial vegetation in the coupled human-earth system: Contributions of remote sensing. *Ann. Rev. Environ. Resour.* **2008**, *33*, 369–390.
48. Miller, C. A beast in the field: The goolge mashups as GIS/2. *Cartographica* **2006**, *41*, 187–199.
49. Poole, D. *Vision, Race, and Modernity: A Visual Economy of the Andean Image World*; Princeton University Press: Princeton, NJ, USA, 1997.
50. Harwell, E. Remote sensibilities: Discourses of technology and the making of Indonesia's natural disaster. *Develop. Change* **2000**, *31*, 307–340.
51. Pickles, J. Texts, hermeneutics, and propaganda maps. In *Writing Worlds: Discourse, Text, and Metaphor in the Representation of Landscape*; Barnes, T.D., Duncan, J.S., Eds.; Routledge: New York, NY, USA, 1992.

52. Velasquez Runk, J.; Negria, G.O.; Conquista, L.P.; Pena, G.M.; Cheucarama, F.P.; Chiripua, Y.C. Landscapes, legibility, and conservation planning: Multiple representations of forest use in Panama. *Conserv. Lett.* **2010**, *3*, 167–176.
53. Walker, P.; Peters, P. Making sense in time: Remote sensing and the challenges of temporal heterogeneity in social analysis of environmental change - cases from Malawi. *Hum. Ecol.* **2007**, *35*, 69–80.
54. Zimmerer, K. Soil erosion and social (dis)courses in Cochabamba, Bolivia: Perceiving the nature of environmental degradation. *Econ. Geogr.* **1993**, *69*, 312–327.
55. Agrawal, A.; Sivaramakrishnan, K. *Agrarian Environments: Resources, Representations, and Rule in India*; Duke University Press: Durham, NC, USA, 2000.
56. Gomez de la Torre, J., Control del paludismo en la zona de Intag (in Spanish). *Revista de la Federacion Medica del Ecuador* **1956**, *67*, 20–25.
57. McPherson, G.R.; DeStefano, S. *Applied Ecology and Natural Resource Management*; Cambridge University Press: Cambridge, UK, 2003.
58. Simpson, R.D.; Sedjo, R.A.; Reid, J.W. Valuing biodiversity for use in pharmaceutical research. *J. Polit. Econ.* **1996**, *104*, 163–185.
59. Terrazas, F.; Cadima, X.; García, R.; Zeballos, J. *Catálogo etnobotánico de papas nativas: Tradición y cultura de los ayllus del norte Potosí y Oruro* (in Spanish); Fundación Proinpa: Cochabamba, Bolivia, 2008.
60. Zimmerer, K.S. *Changing Fortunes: Biodiversity and Peasant liveliHood in the Peruvian Andes*; University of California Press: Berkeley, CA, USA, 1996.
61. Valladolid, J.; Apffel-Marglin, F. Andean cosmovision and the nurturing of biodiversity. In *Indigenous Traditions and Ecology: The Interbeing of Cosmology and Community*; Grim, J., Ed.; Harvard University Press: Cambridge, MA, USA, 2001; pp. 639–667.
62. Keleman, A.; García Rañó, H.; Hellin, J. Maize diversity, poverty, and market access: Lessons from Mexico. *Dev. Pract.* **2009**, *19*, 187–199.
63. Brush, S. The issues of in-situ conservation of crop genetic resources. In *Genes in the Field: On-Farm Conservation of Crop Diversity*; Brush, S., Ed.; IPGRI: Rome, Italy, 2000; pp. 3–29.
64. Devaux, A.; Hortona, D.; Velasco, C.; Thiele, G.; López, G.; Berneta, T.; Reinoso, I.; Ordinolac, M. Collective action for smallholder market access. *Food Policy* **2009**, *34*, 31–38.
65. Lockie, S.; Carpenter, D. *Agriculture, Biodiversity and Markets: Livelihoods and Agroecology in Comparative Perspective*; Earthscan: London, UK, 2009.
66. Gruere, G.P.; Nagarajan, L.; King, E.D.I.O. Collective action and marketing of underutilized plant species: The case of minor millets in Kolli Hills, Tamil Nadu, India; In *CAPRi Working Papers 69*; International Food Policy Research Institute (IFPRI): Washington, DC, USA, 2007.
67. Resolución Ministerial N° 202–2012-MC. *Directiva que Regula el Funcionamiento de la Base de Datos Oficial de Pueblos Indígenas u Originarios* (In Spanish). Ministerio de Cultura: Lima, Peru, 2012.
68. Rivero, R. Algunas consideraciones sobre la base de datos oficial de los pueblos indígenas u originarios. Available online: http://www.noticiasser.pe/27/06/2012/nacional/algunas-consideraciones-sobre-la-base-de-datos-oficial-de-los-pueblos-indigenas-/(accessed on 8 April 2013).

69. Castro, E.V.D. *The Inconstancy of the Indian Soul: The Encounter of Catholics and Cannibals in 16th-Century Brazil*; Prickly Paradigm Press: Chicago, IL, USA, 2011.
70. Zimmermann, F. *The Jungle and the Aroma of Meats: An. Ecological Theme in HINDU Medicine*; University of California Press: Berkeley, CA, USA, 1987.
71. Hippocrates. Hippocrates Volume I, Ancient Medicine. *In Airs, Waters, Places. Epidemics 1 and 3. The Oath. Precepts. Nutriment*; Jones, W.H.S., Ed. Harvard University Press: Cambridge, MA, USA, 1923.
72. Khaldûn, I., *The Muqaddimah: An. Introduction to History*; Bollingen Foundation: New York, NY, USA, 1958.
73. Montesquieu, C.B.D. *The Spirit of the Laws (Esprit Des Loix)* (In French), 2nd ed.; J. Nourse & P. Vaillant: London, UK, 1752.
74. Jankovic, V. Gruff boreas, deadly calms: A medical perspective on winds and the Victorians. *J. R. Anthropol. Inst.* **2007**, *13*, S147–S164.
75. Hulme, M. Reducing the future to climate: A story of climate determinism and reductionism. *Osiris* **2011**, *26*, 245–266.
76. Hulme, M. Problems with making and governing global kinds of knowledge. *Global Environ. Change* **2010**, *20*, 558–564.
77. Kahan, D. Why we are poles apart on climate change. *Nature* **2012**, *488*, 255.
78. Leiserowitz, A. Climate change risk perception and policy preferences: The role of affect, imagery, and values. *Clim. Change* **2006**, *77*, 45–72.
79. Latour, B. Why has critique run out of steam? From matters of fact to matters of concern. *Crit. Inq.* **2004**, *30*, 225–248.
80. Ortner, S. Resistance and the problem of ethnographic refusal. *Comp. Stud. Soc. His.* **1995**, *37*, 173–193.
81. Bateson, G. *Steps to An Ecology of Mind*; Ballantine Books: New York, NY, USA, 1972.
82. Brooks, T.M.; Mittermeier, R.A.; da Fonseca, G.A.B.; Gerlach, J.; Hoffman, M.; Lamoreaux, J.F.; Mittermeier, C.G.; Pilgrim, J.D.; Rodrigues, A.S.L. Global biodiversity conservation priorities. *Science* **2006**, *313*, 58–61.
83. Slater, C. *Entangled Edens: Visions of the Amazon*; University of California Press: Berkeley, CA, USA, 2002.
84. Raffles, H. *In Amazonia: A Natural History*; Princeton University Press: Princeton, NJ, USA, 2002.
85. Prum, R. Historical relationships among avian forest areas of endemism in the Neotropics. In *Acta XIX Congressus Internationalis Ornithologici*, Proceedings of the International Ornithological Congress, Ottawa, Canada, 1986; Ouellet, H, Ed.; University of Ottawa Press: Ottawa, Canada, 1988; pp. 2562–2572.
86. Moran, E.F. *A ecologia Humana Das Populações Da Amazônia* (In French); Vozes: Petrópolis, Brazil, 1990.
87. Dean, W. *With Broadax and Firebrand*; University of California Press: Berkeley, CA, USA, 1995.
88. Câmara, I.D.G. Brief history of conservation in the Atlantic Forest. In *The Atlantic Forest of South America: Biodiversity Status, Threats, and Outlooks*; Galindo-Leal, C., Câmara, I.D.G., Eds.; Island Press: Washington, DC, USA, 2003; pp. 31–42.

89. Bury, J.B. *The Idea of Progress: An Inquiry into Its Origin and Growth*; Macmillan: New York, NY, USA, 1932.
90. Lévi-Strauss, C. *Totemism*; Beacon Press: Boston, MA, USA, 1963.

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