forests

MDPI

Article

Traditional Ecological Knowledge in Community Forest Management: Evolution and Limitations in Mexican Forest Law, Policy and Practice

José Antonio Sierra-Huelsz [1,2,3,*], Patricia Gerez Fernández [1], Citlalli López Binnqüist [1], Louise Guibrunet [4] and Edward A. Ellis [1]

1 Centro de Investigaciones Tropicales, Universidad Veracruzana, Xalapa, 91000 Veracruz, Mexico; pgerez@uv.mx (P.G.F.); cilopez@uv.mx (C.L.B.); eellis@uv.mx (E.A.E.)
2 People and Plants International, Bristol, VT 05443, USA
3 Instituto Tecnológico y de Estudios Superiores de Occidente (ITESO), Tlaquepaque, 45604 Jalisco, Mexico
4 Instituto de Investigaciones en Ecosistemas y Sustentabilidad. Universidad Nacional Autónoma de México, Morelia, 58190 Michoacán, Mexico; l.guibrunet.10@ucl.ac.uk
* Correspondence: jashpat@gmail.com

Received: 20 February 2020; Accepted: 25 March 2020; Published: 3 April 2020

Abstract: Community forest management (CFM) is often a field of encounter between knowledge systems, where a conventional forestry blueprint is frequently applied in contexts rich in traditional ecological knowledge (TEK). This is the case in Mexico, a bioculturally diverse country and a reference of community forestry. Based on a review of laws, policies, literature, and empirical examples, we explore technical, epistemological, political, and contextual dimensions associated with the inclusion and exclusion of TEK in CFM in Mexico. Our analysis is composed of three steps: (1) A diachronic analysis of how TEK and associated practices have been considered by federal forest laws and codes (1960–2018), (2) a diachronic analysis of the scope of conventional forestry and its evolution in time and space, and (3) situated examples illustrating the inclusion and exclusion of TEK in CFM. We argue that: (1) Legal recognition of TEK as a concept does not necessarily entail the legal recognition of all traditional management practices; (2) the inclusion of TEK in CFM is heterogeneous across communities, ecosystems, regions, products and historical trajectories; and (3) different traditional practices are not equally integrated in CFM: traditional practices that contradict the spatial segregation of activities (i.e., land sparing) favored by conventional forestry tend to be less easily accepted or ignored by government institutions.

Keywords: Mexico; community forest management; traditional ecological knowledge; forest policy; knowledge systems

1. Introduction

1.1. Setting the Scene: CFM and TEK

Community forest management (hereafter CFM) took hold in the 1980s and 1990s in the context of decentralization policies [1], as an approach striving for conservation and development, mostly in the tropics [2]. Globally, community forest management often arose as a response to post-colonial state forestry, private logging and top-down conservation [1,3]. Broadly, CFM implies the devolution of forest management rights to local populations, and fostering forest-based livelihoods that maintain forest cover and biodiversity conservation [2]. Under CFM, local populations are considered suitable forest stewards, with rights to derive benefits from and take decisions over local forests [2].

Community forest management has been established in some of the most bioculturally diverse regions in the world (e.g., Brazilian Amazon, Papua New Guinea, and Mexico). In these contexts, community-based along with other small-scale local forest operations are known for their strong sense of place and represent an important ground where traditional knowledge and scientific/technical knowledge interact [4–8]. While important variation exists, this interaction is often depicted as an encounter of two archetypically different landscape management paradigms [9]. On the one hand, technical knowledge is used in dominant approaches to forestry [10] and biological conservation [11], guided by the Western (modern) nature–society dualism and epitomized by the land sparing paradigm [12]. This approach, that historically shaped conventional forestry, is bounded by economic rationality, where production is guided by an ideal of efficiency, for which intensification and specialization are key strategies [13,14]. On the other hand, traditional ecological knowledge is embedded in a diverse array of ontologies, epistemologies and rationalities. Under these traditions, nature and society tend to be more intertwined concepts, and the human species considered as an element of nature. The land sharing paradigm echoes such conceptions, where conservation, production and social activities coexist in space, often in the form of diversified production systems. Traditional diversified production systems may include different forms of shifting cultivation, agroforestry systems and natural forest management [8].

As local, peasant, traditional, and indigenous forms of ecological knowledge, hereafter traditional ecological knowledge (TEK), are increasingly documented, validated and valued, the search for synergies between TEK and environmental sciences has exploded [9,15]. The instrumental potential of TEK for improving conservation, restoration and resource management sustainability is largely recognized [8,16,17]. As pervasive environmental and social crises have exposed the limitations of science and technology, other rationalities and alternative worldviews are pointed to as a potential source of solutions to those crises [18–20], leading environmental scientists to increasingly adopt more holistic approaches [13,21], some of which embrace TEK [20,22,23].

In parallel, the recognition of diverse value and knowledge systems has become a core element of the environmental justice scholarship [24]. As part of a search for alternative social and environmental relations, decolonial thinking emerged in Latin America as a critique to the homogenizing power of modernity, which excludes peoples, identities, worldviews and knowledges [25,26], thus highlighting the political dimension of indigenous knowledge [27]. Anthropologists and ethnobiologists stress that TEK and other forms of knowledge form part of complex worldviews that are "internally coherent, meaningful and intrinsically worthy of respect" [15] and that their recognition is necessary for the respect of indigenous rights, in particular self-determination [28,29]. There are therefore both instrumental and moral reasons to include TEK in forest management policy and practice.

Traditional ecological knowledge and its role in sustainability has, hence, been gaining prominence both in research and in international policy fora. The CBD, for instance, launched a Plan of Action on Customary Sustainable Use, which required the development of case-studies sustainable practices of indigenous people [30]. Focusing on the potential value of TEK as an alternative source of "knowledge and wisdom" for sustainable natural resource management, Parrotta and co-authors [5] described a long-term international initiative to "increase awareness of and interest in traditional knowledge and practices within the forest science community". Other works set to document how the interaction of knowledge systems occur on the ground [31], often suggesting tensions [32] and limited cross-fertilization between knowledge systems [33], where expert knowledge continues to dominate CFM [34,35]; although examples of fruitful inclusion exist, where local silvicultural practices are recognized, validated and further promoted [36,37]. Although the current and potential role of TEK in CFM has now been established, little research has explored the role of legal frameworks such role. This article contributes to addressing this research gap in the case of Mexico.

The use of the concept of TEK can be criticized on the grounds that it can become a "confounding label" often profiting non-indigenous groups [38]. We still believe that the concept of TEK is necessary, to understand the interaction between distinct knowledge systems and to recognize the current and

potential role of local knowledge in community forest management. We use this concept with care, in particular by avoiding to essentialize TEK as a homogenous phenomenon, and rather recognizing the diversity of its expressions and its dynamic nature. As conventional forestry increasingly incorporates a wider set of practices and concepts beyond timber extraction (e.g., multiple use, ecosystem services, climate change mitigation) [39], the potential of new synergies and complementarities between TEK and technical knowledge also evolves. In this paper, we present a heuristic effort to advance the understanding of how TEK has been considered in CFM law, policy and practice in the Mexican context.

1.2. Mexico's Biocultural Diversity: Community Forest Management in Context

Mexico is characterized by strong TEK [23] and an important CFM sector[1] [40]. Mexico is one of the most bioculturally diverse countries in the world [41], a result of long-term interactions between culturally diverse human groups and a mega-diverse environment [42]. Mexico boasts a wide array of ecosystems including temperate and tropical forests, ranging from arid lands to rain forests, from coastal vegetation to alpine tundra [43]. Here, human-environment interactions have produced a rich repertoire of TEK expressed in multiple forms to conceptualize, manage and use local natural resources [44]. In Mexico, this history includes the domestication of maize initiated c.a. 5000 years ago [45], and the subsequent emergence of Mesoamerican civilizations ca. 3000 years ago [46]. Since the beginning of Spanish colonial rule in the 16th century, most indigenous groups have interacted with European and other cultures in deeply unequal manners [47–49]. Nowadays, biocultural diversity in Mexico is tightly associated, but not restricted, to indigenous groups. Current indigenous identities are generally linked to ancestral territories and are the result of both cultural continuity and adaptation [50,51].

Mexico is considered as one of the pioneers and often a global model of CFM [52], which has largely been enabled by preexisting communal land tenure. As a result of the agrarian reform that followed the Mexican Revolution (1910–1917) approximately 60% of the forests are collectively owned by communities in the form of *ejidos* and *comunidades* [53]. A few large-scale community forestry operations started in the 1970s [40]. However, it was in the mid-1980s when CFM fully emerged as the concessions of communal forests to private and parastatal companies ended, in part as a result of social movements, and of the enactment of a new forest law in 1986 [52]. Successive national (e.g., PROCYMAF I and II; [54]) and international development programs (e.g., Finnish and German Cooperation) supported the consolidation of CFM in a number of communities in states with the country's largest timber production e.g., Durango, Oaxaca, Quintana Roo [55,56]. Despite various successes, the CFM model has not operated evenly across regions [57,58], and diverse challenges and setbacks continue to emerge, particularly the rising inequalities within forest communities [59].

In Mexico, the tensions between local perceptions and conventional conservation have been documented in some length [60–62]. In contrast, the tensions between conventional forestry and TEK had received less attention [63,64]. Ibargüen and Chapela [65] documented examples of traditional forest knowledge in Mexican communities, preliminary identifying the contexts in which such knowledge can be integrated in commercial CFM. Our research builds on that study and goes beyond it by focusing more particularly on the consideration of TEK in CFM law, policy and practice.

1.3. Objectives of the Research and Analytical Approach

In this paper, we present, to our knowledge, the first study which explicitly explores at the national scale, the elements of TEK which have been included or excluded from CFM law, policy and practice in Mexico. While we strongly believe that TEK deserves recognition, this contribution is not normative on how this should occur. Based on the premise that the consideration of TEK in CFM may vary in space and time and include complex processes, we take a heuristic approach that provides a broad but nuanced picture of the consideration of TEK in Mexican CFM. We note that CFM can operate within or outside the bounds of conventional forestry, which for the purpose of this study we define as the approach fostered by governments to the legal management of forests for commercial purposes with the direction of a professional forester following an officially sanctioned forest management plan (FMP,

or equivalent instrument)[2], in contrast to forests managed by local people without the intervention of government and forestry professionals.

The overarching question that guides our research is: How has TEK been included in CFM through law, theory and practice in Mexican history? To answer this question, our research explores the relation between TEK and CFM from three related perspectives: (1) How TEK and associated practices have been considered in Mexican forest laws and codes. (2) The scope of conventional forestry and its evolution in time and space. (3) Situated examples to illustrate the inclusion and exclusion of TEK in Mexican CFM practices associated with timber and non-timber forest product management. Using these three analyses, we argue that: (1) legal recognition of TEK as a general concept does not necessarily entail the legal recognition of all particular traditional management practices; (2) the prevalence of TEK in CFM is heterogenous across communities, part of this variation is related to different periods of government interventions to establish conventional forest management across ecosystems, regions, products and historical trajectories; and (3) on the ground, different traditional practices are not equally integrated in CFM, and in particular those traditional practices that contradict the spatial segregation of activities (i.e., land sparing) favored by conventional forestry tend to be less easily accepted or ignored by government institutions.

2. Methods

For this study we reviewed literature from various disciplines including forestry, ethnobiology, sociology, anthropology, geography, and development, as well as gray literature (e.g., laws, forest management plans and technical reports). We draw from both published and unpublished research, our own professional experience in various relevant arenas, and those shared by colleagues, practitioners, producers and government officials.

1. TEK in Mexican forest laws and codes. We reviewed the Mexican federal forest laws and codes from 1960 to 2018 (Table 1), and performed a content analysis to document how TEK, as well as related concepts and management practices (Table 2) have been considered in those documents.
2. Evolution of the scope of conventional forestry in time and space. We conducted a diachronic analysis on how the domain of state-sanctioned forest management has evolved in Mexico. This includes the review of forest policies, technical documents, our experience and other available sources to document what products, ecosystems and management systems have been regulated across time by Mexican Forest authorities.
3. Examples of inclusion and exclusion of TEK in CFM. Situated examples of CFM to illustrate varied configurations of consideration of TEK in CFM as well as types of interactions between TEK and scientific and institutional knowledge and practices in Mexico—including those where TEK is used in CFM with no interference from laws or policies (it is beyond the scope of regulation), TEK is ignored, and TEK is explicitly supported by law, or integrated in management plans. These examples are based on the literature, our professional experiences and those experiences, criticisms, examples and insights shared by other actors involved with CFM including forest technicians, scholars, government officials, and community members in the context of three different meetings (e.g., *Seminario sobre Paisajes Bioculturales y Conocimiento Tradicional Comunitario*, National Forest Commission 2019) where preliminary results of this study were presented and discussed.[3]

Table 1. Forest laws and codes analyzed for this study. Code (*reglamento* in Spanish) is a legal instrument subordinate to a law (ley) that set its specifics. A newly enacted law replaces the old one, an older code is in effect until a new code is enacted.

Year Issued	Name of Regulation	Category
1960	Ley Forestal [66]	Law
1961	Reglamento de la Ley Forestal [67]	Code
1986	Ley Forestal [68]	Law
1988	Reglamento de la Ley Forestal [69]	Code
1992	Ley Forestal [70]	Law
1994	Reglamento de la Ley Forestal [71]	Code
1997	Reforma a la Ley Forestal [72]	Law amendment
1998	Reglamento de la Ley Forestal [73]	Code
2003	Ley General de Desarrollo Forestal Sustentable [74]	Law
2005	Reglamento de la Ley General de Desarrollo Forestal Sustentable [75]	Code
2014	Reglamento de la Ley General de Desarrollo Forestal Sustentable [76]	Code amendment
2018	Ley General de Desarrollo Forestal Sustentable [77]	Law

Table 2. Concepts and forest management practices associated with traditional ecological knowledge reviewed in Mexican forest laws and codes (modified from [65,78–80]).

Management System/Practice/Concept	Reference
Slash and burn agriculture/fallow management	[78,80]
Agroforestry systems	[79]
Non-timber forest products	[65]
Fire management	[78]
Small-scale management	[65]

3. Results

3.1. Incorporation of TEK in Mexican Federal Forest Law

3.1.1. Recognizing TEK as a Concept

The 1997 forest law was the first to mention Traditional Ecological Knowledge [72], and its salience has increased in subsequent forest laws. The 1997 law sets to promote the participation of indigenous communities in forest management in their territories, recognizes their knowledge ([72], art. 1, VIII), and sets to disseminate traditional methods and practices of "sustainable forest exploitation" ([72], art. 41, III). Subsequently the 2003 law and the current 2018 forest law expanded the frame in which TEK is considered, raising its profile [77]. Under the 2018 forest law, local participation and TEK is considered necessary for the respect of the rights of people and communities, which includes for example the translation and interpretation of forest management documents and procedures into indigenous languages ([77], art. 60). This law recognizes the diverse set of values held by local communities ([77], art. 7, XVII, art. 8, VIII) and recognizes TEK as a valid form of knowledge beyond instrumental considerations.

3.1.2. Recognizing Traditional Practices: Regulation of Forest Product Extraction

Communities were largely excluded from commercial timber management until 1986, when the forest law explicitly set to foster and support CFM. In contrast, at least since the 1930s [81], communities have been continuously allowed to manage non-timber forest products (here after NTFPs) even at commercial scale ([66], art. 103). Particularly during the 1930s, the federal government supported the creation of cooperatives and NTFPs harvesters' organizations, an initiative that in some cases had lasting effects [81,82]. The 1960 law even allowed landless people to commercially harvest NTFP in federally owned land ([66], art. 94).

Since the 1960 law there have been differentiated regulations for different NTFP categories, however the definition of these categories changed from the 1960 to the 1992 law, changing how

different NTFPs are regulated. For example, in the 1960 law, the extraction of forest soil (an NTFP under Mexican law) did not require any authorization. In contrast, since 2003 forest soil is one of the most regulated NTFPs which harvest requires an authorized management program. Since the 1990s, official norms (*Normas Oficiales Mexicanas*) have been issued to guide the harvest of specific groups of NTFPs (e.g., pine resin, barks).

The 1960 forest law explicitly discriminated against some traditional wood processing techniques that were considered wasteful (e.g., axe carving, of charcoal in "primitive" kilns), against more efficient industrial timber processing. Subsequent laws did not discriminate traditional practices on this basis ([66], art. 74). Such policies tended to marginalize products like *tejamanil* (traditional wooden roof tiles), that were once common in the central highlands and require very specific knowledge to select appropriate trees and the cut the tiles with hand tools [65].

For timber management, the 1986 forest law proposed specific approved silvicultural systems for each forest ecosystem [68]. Under the current law specifications for silvicultural interventions are not predefined, they are left to the forest technical service provider to propose and justify them in the forest management plan. The management plan to be authorized is reviewed and subject to the criteria of the federal officials [77]. This process would potentially allow the inclusion of elements of TEK in management plans. However, the current official norm (NOM-152-SEMARNAT 2008, [83]) that establishes the general criteria for forest management plans, makes no reference to traditional silvicultural systems (i.e., shifting cultivation, traditional agroforestry systems and natural forest management strategies) [78,80,84].

3.1.3. Recognizing Traditional Practices: Regulation of Multiple Use and Forest-Agriculture Interfaces

The 1986 law, and its companion 1988 forest code, pioneered land use zoning that explicitly considers the opinion of landowners and general citizenry ([68], art. 7, 27; [69], art. 91). For communal tropical forests, the 1988 code segregated Permanent Forest Areas (PFA) where only forest management that maintained continuous forest cover was allowed. Outside the PFA, agriculture, livestock, orchards and mixed uses where allowed. Notoriously, swidden agriculture (aka. slash and burn), a traditional practice widespread in tropical areas, was explicitly accepted (not without some restrictions ([69], art. 91). In contrast, subsequent forest laws (2003 and 2018) set to gradually eliminate swidden agriculture in favor of permanent agriculture [74,77].

How tropical mature forest and tropical secondary forest are legally defined is important for the recognition of traditional practices and allow producers to legally engage in new management opportunities compatible with swidden agriculture [85]. Secondary forests are subject to less restrictions, including their felling for agriculture, or harvest of wood products. Tropical secondary forest (under the name *acahual*) was legally defined for the first time in the 1994 forest code [71]. Subsequent forest codes changed the structural parameters increasingly limiting the legal definition of *acahual* to the very early stage of tropical forest succession. The current code (2014 version) considers tropical moist and rain forests (*selvas medianas* and *selvas altas*) to be secondary when it has <15 trees of 25 cm in diameter at breast height (DBH) or 4 m^2 in basal area ha^{-1} [76].

The 1986 law and 1988 forest code used the term "mixed uses" for referring to agroforestry systems [68,69]. It was in the 1992 forest law where agroforestry plantations were explicitly included and were considered as a restoration strategy to be encouraged [70], but no explicit mention to traditional agroforestry systems can be found in these or any of the subsequent forest laws and codes.

Forest laws and codes have recognized fire as a pervasive agricultural management tool to be tolerated and regulated, but for many years, with few exceptions, forest fire suppression was the norm. One of the few exceptions was the 1986 forest law, in which burning of 3 to 10 ha for agricultural purposes was tolerated depending the type of vegetation in an explicit acceptance of small-scale subsistence management. The 2003 forest law introduced a more comprehensive idea of fire management, beyond fire suppression ([74], art. 55). In 2009 an official norm was issued stating the specifications for forest and agricultural fire management [86], which includes the requirement

to inform municipal authorities and to follow burn calendars where those exist. The 2018 law also includes fuel management as an objective of forest policies ([77], art. 119).

Timber harvests from trees outside forests (*sensu* [87]) have being subjected to less legal requirements compared to timber harvested in forests across the different laws. Furthermore, the current 2018 law does not require authorization to harvest and transport this timber, however an official verification can be asked to certify that specific timber comes in fact from trees outside forests. In contrast, across laws NTFP has being equally regulated regardless the vegetation from which they are derived.

The current forest law (2018) recognizes TEK on a conceptual level, but it does not fully recognize the practices associated with TEK in agriculture-forest interfaces ([77], e.g., art. 99). Arguably, the 1986 forest law, which established CFM before conservation took hold of forest policy, was more accommodating of traditional management practices.

3.1.4. Between Subsistence and Markets: Regulating Use and Harvest Scale

Before the emergence of CFM, subsistence use of forest resources was already considered in the forest law, firewood being one of the core resources considered. In the 1960 law, subsistence household use (*uso doméstico*) was accepted but conditioned. The use of dead firewood was preferred, and the harvest of wood products from green trees, such as poles and other materials for rural construction required an official authorization from the forest authority. The 1988 forest code explicitly stated that non-commercial harvests would be authorized only to forest land owners or holders. Following the 1992 forest law, specific official norms for domestic use of firewood and NTFPs were issued.

The current 2018 law and the 2014 version of the forest code allow the harvest of most forest resources for direct rural household consumption without a permit, a situation that may differ within protected areas. In contrast, firewood collection is restricted to dead wood, and since 2005 this also includes debris from silvicultural treatments, including tree pruning. This regulation is often matched with local norms prohibiting the use of green firewood [88].

Small-scale commercial harvests of forest products have long been subjected to somewhat simplified process for authorization. Under the 2018 law, even small-scale harvests require an authorization for sales, while in some previous laws there were some exceptions. For example, the 1960 law did not require authorizations for small-scale commercial herb harvesting ([66], art. 98), and the 1986 tolerated (without issuing any fine) the harvest and transportation of up to 5 m3 of timber, or 1 ton of NTFPs with low economic value ([68], art 83 VI).

3.2. Evolving Scope of Conventional Forestry

3.2.1. Evolving Policy Objectives

The industrialization of forest management was a central objective of the 1960 forest law ([66], art. 3, VIII, art. 76, 77), which favored parastatal and private companies to whom large swaths of communal forests were granted through concessions, allowing only a few communities with industrial capacity to manage their forest [40,81]. In a historic change, the 1986 forest law focused on social development of rural regions ([68], art. 2, IX, XII). Pushed by social movements and coinciding with the end of various forest concessions contracts, the 1986 law enabled and created the conditions and institutions to support the expansion of community forestry, including public forest services (the foresters that provide technical support to forest producers) [40]. Before the 1986 law, communities were largely excluded from timber management, yet this was not the case for NTFPs harvest. Communities were always allowed to commercially manage NTFPs, and for different periods, beginning in the 1930s, the federal government supported the creation of cooperatives and harvester's organizations [81,82].

The 1992 forest law and its 1994 code intended to foster private forest industry through deregulation, privatizing forest services, and putting CFM on the sidelines [40]. Fueled by public backlash, in 1997 the law was significantly reformed and set again CFM at the forefront of the Mexican forest policy,

but forest services remained private, a situation that continues to this day [40]. These private forest services are provided by a wide range of actors including individual private foresters and for-profit firms, NGOs, and inter-community forest organizations [89,90].

The protection of the environment has continuously gained preeminence in the Mexican legal framework and within forest law. The enactment of the 1988 environmental law (LGEEPA) set a milestone that permeated subsequent forest laws and policies. Forest laws have increasingly expanded their conservation focus from watershed and wildlife conservation (1960, 1986; [66,68]), to include biodiversity (1992; [70]), genetic resources (2003; [74]), and climate change (2018; [77]) as major themes.

Mexican laws have long intended to regulate all forest regions and most forest products, but in practice, the state's effort to regulate and support forest management has greatly varied across forest types and forest products. For most of the 20th century, policies and expertise on conservation and forestry was concentrated on temperate forest areas, particularly those located in central and northern Mexico [81,91]. Protected areas were concentrated in the temperate highlands; in sharp contrast, felling lowland tropical forests was officially promoted. Until 1982 tropical deforestation was a central component of rural development and agrarian distribution programs that promoted the colonization of sparsely populated frontier regions [81,91].

3.2.2. Evolving Priorities: New Ecosystems and Products Included in Conventional Forestry

After a significant policy turn that included tropical forests as conservation priorities [81,91], the Mexican protected areas system now includes a much wider diversity of ecosystems [92], although some bias and limitations persist [93]. In the 1988 forest code and in subsequent laws, the management of rare and vulnerable ecosystems became increasingly restricted. Currently, commercial harvest of forest products from tropical rain forests (*selva alta perennifolia*), cloud forests (*bosque mesófilo de montaña*), mangroves, and high altitude forests (above 3000 masl) face severe legal restrictions, making the legal harvest of forest products nearly impossible in of some of them ([76], art. 14, I). For example, one of the very few management programs for a cloud forest in Mexico was authorized in 2018 only after a complicated process that demonstrated that the forest was secondary, and was in part the result of active restoration [94,95].

Consistent with the official goal of forest industrialization, for most of the 20th century, forest regulations and forest extensionists have focused on forests and products of industrial interest. Pine and fir timber from the highland forests, two precious timber species from the tropical forests of the Yucatan Peninsula (i.e., big-leaf mahogany and Spanish cedar), and a short list of NTFPs marketed as industrial commodities, including turpentine, *chicle* (latex of sapodilla tree), *candelilla* wax, among a few others were matter of official interest and regulation [96]. Forest products limited to regional markets remained for the most part outside the scope of official programs and management plans. This was also the case of whole forest ecosystems that were considered of limited industrial interest. With few exceptions [97], tropical dry forests (TDF) without commercial-sized timber were outside the scope of forest and environmental policies. Interest towards TDF increased in the 1990s and early 2000s, when some of the first protected areas were specifically designed to protect this ecosystem (e.g., Chamela and Huautla Biosphere Reserves), and when some of the first forest management plans of this vegetation type were approved [98,99].

Concurrently with policy changes in the late 1980s and 1990s, new markets emerged, fueling the commercial demand for species with previously limited or regional use. Demand for NTFP and non-conventional wood products including those utilized for making handcrafts [98,100], traditional spirits [101,102], or for tourism construction [103,104] or horticultural support stakes [97]. These emerging markets, coupled with new international agendas on conservation and development [105], have resulted in increased official attention towards a wider diversity of forest products [106]. This official attention resulted in the relatively recent incorporation of forest products, which were previously managed according to TEK, in forest management plans and in the radar of the environmental protection enforcement agency (PROFEPA, the acronym in Spanish [107]). One example of this trend is *copal*, the resin of *Bursera* spp. trees with

a traditional ceremonial use, which is mostly commercialized under traditional channels including street markets and fairs, and that is now being included in officially sanctioned forest management plans [108]. Despite the increased interest in a wider diversity of ecosystems, the historical bias towards temperate forests has not entirely disappeared. Communities containing various ecosystems tend to concentrate production in pine forests, while tropical and cloud forests are more often either deforested or set aside for conservation, and only harvested for subsistence uses [63,109]. Tropical dry forests still receive the least attention by forest policies and forestry professionals, and practical challenges to commercially manage diverse and less productive forests persist, including relatively high transaction costs of legal management [110].

3.2.3. Evolving Land Tenure: The 1992 Agrarian Counter Reforms

Official management plans generally spatially segregate forest stands as management units within communal landholdings. Changes in forest land tenure have impacted how forests are managed. The constitutional amendments of 1992 allowed the parcelization of communal lands, sometimes affecting forest lands [111]. Some forest products, including many NTFPs, are often managed by individual harvesters in individual plots or even on individual trees. For instance, *copaleros*, resin tappers of the aromatic *Bursera* spp. trees in the tropical dry forests of Morelos (S Mexico), used to harvest this resin across the communal landholding prior to parcelization [112]. Since parcelization, they now return annually to harvest the same trees in their individual plots. This change implies that individual trees may be tapped each season without a full year to recover, as tappers are developing a closer knowledge of each individual tree and are taking decisions accordingly. Tappers know the productivity and resin quality of each tree, can tightly monitor their performance, and can decide not to tap and individual that shows signals of stress [112]. This case illustrates how land tenure policies affect forest management practices and the reproduction of TEK.

3.3. Examples of TEK Inclusion and Exclusion in Mexican CFM

Traditional ecological knowledge can be found in CFM in diverse contexts across Mexico, where TEK interacts with conventional forestry in heterogeneous manners. In this section, we document the impacts on the ground of the explicit recognition of ritual practices in forest law, examples where traditional knowledge and practices have been included in management plans, and cases where other types of TEK and related practices remain beyond the scope of regulation. We move on to explore the co-existence of technical and traditional knowledge and the tensions that result from it. Then, we document elements of TEK that have failed to be recognized in forest law or that enter in more direct conflict with it, and finish this section by reflecting on the particular challenges associated with accommodating diversified land-uses.

3.3.1. Ritual Practices: Legally Recognized, Not Regulated

Rituals are part of those traditional customs recognized but not regulated in the forest law and code ([77], art. 144, V). Ritual practices are diverse, including the settings and the elements used. The use of plants and other forms of life in ceremonies and rituals is for the most part legally allowed when no commercial transaction is involved ([76], art. 71; [77], art. 7), and the elements of biodiversity are directly collected by their final users. While ceremonial uses of biodiversity are considered to part of subsistence, in some cases the quantities harvested can be high and regulation less clear, as in Central Veracruz (E Mexico) where *Tillandsia* and *Dasylirion* spp., among other species, are harvested by the thousands to adorn at least 70 large-sized ceremonial arches that are built from the ground-up every year [113].

Ritual practices establishing reciprocity with the land can be found in forest territories throughout Mexico, particularly among indigenous peoples [42,114]. Mayan farming tradition has a wide repertoire of rituals that are practiced across the agricultural cycle, including those asking permission to fell forest, asking for rain, thanking for the harvest, among others [115]. The Nahua people of Sierra de

Zongolica practice *Xochitlalis*, a ritual stemming from the Mesoamerican worship of the land, where offerings and petitions are made to its guardian spirits. Currently, *Xochitlalis* are practiced in diverse settings ranging from local social events (i.e., football matches) to agricultural cycle milestones [116]. In contrast with a relative revival of *Xochitlalis* rituals performed in the region, the formerly common practice of performing a *Xochitlalis* before felling a tree is losing prevalence. This change can be traced back to the expansion of government-supported pine plantations and the popularization of chainsaws "that allows to fell many of them" [116].

Reciprocity rituals can be found in various forest regions that practice forestry commercially e.g., [117,118]; but such rituals often seem restricted to the realm of agriculture [119], and are rarely practiced in direct association with market-oriented forest operations. This is the case of some communities of Oaxaca's Sierra Sur, where permission rituals are performed before the opening of a new forest road [95], and at the beginning of the logging season [64].

3.3.2. TEK Included in Management Plans

Few forest management plans explicitly set to incorporate or recuperate traditional knowledge into commercial CFM operations [108,120,121]. Conversely, it is more common to find scattered elements of TEK in official management plans. At the most elemental level, a precise local knowledge of the terrain and the distribution of species of interest is valued in management plans [122]. Management plans require forest inventories where plant species are often identified by local technicians that not only know the species, but also inform about their uses and mechanical characteristics [123]; information which is crucial in diverse ecosystems and for lesser known forest products [124]. As new markets emerge for forest products with a long history of traditional subsistence use and localized markets, these products are often incorporated in forest management plans [103]. In these cases, at least on paper, some traditional practices are adjusted to fit official requirements for management plans e.g., tropical polewood [103].

Less common is the inclusion of local landscape classification systems. For example, in various forest *ejidos* in Quintana Roo (SE Mexico), Mayan soil classification is used to designate forest stands in officially sanctioned forest management plans [125], as they found it useful and widely known by Mayan *campesinos* [126]. Interestingly, officially supported forestry programs in the region have long incorporated indigenous soil classification [127], years before this classification was formally described by ethnopedologists [128].

In few cases, TEK is at the center of the proposed management system. In the state of Morelos, for instance, traditional *copal* resin tapping techniques, zoning and scheduling are incorporated in a management plan [108]. In other cases, elements of TEK are incorporated as part of silvicultural innovation. Supported by long term research and collaboration [129–131], in Quintana Roo's Zona Maya, an ambitious and innovative silvicultural system that integrates some elements of TEK has been incorporated in recent management plans [121]. One of the signature elements of this forest management system is the integration of small-scale clear-cuts using traditional Mayan slash and burn techniques, which seek to create the appropriate full light and scarified soil conditions to successfully regenerate the valuable big-leaf mahogany [130,131]. The authorization of such an innovative management approach has been in process for a long time, and its large-scale implementation would require a future assessment. Preliminary evidence suggests that while small-scale clear-cuts have been implemented, the integration of traditional slash and burn techniques and on-site maize cultivation are not applied due to logistical challenges and environmental concerns from forest authorities and NGOs [132].

In parallel, as the inclusion of TEK is not an official requirement for forest management plans to be approved by the Ministry of the Environment (SEMARNAT), forest technical service providers have limited incentives to include TEK in such management plans.

3.3.3. TEK Is Used in CFM beyond the Scope of Regulation

Diverse elements of TEK lie beyond the scope of regulation, often pass unnoticed by forest authorities, although some of them may be known by foresters that work in close contact with local communities [133]. Moon phases are commonly known to guide local landscape management activities such as seeding, tree planting e.g., Ocuilan, State of Mexico; [133], and timber e.g., Mayan *ejidos*, Quintana Roo [134] and NTFP harvesting [135]. In these cases, carrying out these activities in the correct moon phase is considered important for successful plant establishment and timber durability.

The depth and breadth of TEK can be exemplified by mezcal, a now booming traditional distilled spirit produced from various, often wild, *Agave* species [101,102,136]. The knowledge to produce traditional mezcal includes not only landscape management practices but also significant post-harvest processing. For example, in the Montaña's region of Guerrero (S Mexico), *Agave cupreata* from oak and pine forests is recognized to develop more complex flavors and higher alcohol content compared with those grown in adjacent tropical dry forests [102]. In central Veracruz (E Mexico) some smallholders consider the abundance of ant colonies inside old oak trees, as an indicator that it is time to harvest it to transform into charcoal, because "it will fall anyway with any coming storm" [95].

Policies tend to ignore diverse ontologies and complex concepts. For example, the Yucatec Mayan concept *kanan ka'ax*, literally means "look after the forest", puts much attention on taking care of the forest during the swidden agricultural cycle and a particular care for mature forests. This care includes both physical practices, such as responsible fire use and fostering forest regeneration in the fallows, but also prayers that reinforce the effect of the physical practices, maintain reciprocity with spiritual forest guardians, and take care of particular forest elements [118,137]. Similar concepts can be found in other indigenous cultures across Mexico, the Zapotec concept of *gapanu* that is loosely translated as "care with use" [138].

Because they go beyond mere practice but represent a general approach to forest management intrinsically related to a local ontology and culture, these concepts are beyond the scope of regulation and do not appear in Mexican laws, policies and programs.

3.3.4. Tensions Related to the Co-Existence of Conventional and Traditional Practices

Conventional silvicultural practices generally focus on improving forest stand growth, product quality and economic efficiency; sometimes contradicting local rationalities where felling trees is only justified in case of current necessity and direct use [139,140]. As documented elsewhere, not all communities involved in CFM strive to maximize profit from forest management; other important factors shaping decisions being cultural values of forests (recreational and spiritual activities), a concern for biodiversity conservation [109], production of public goods and services, supplying products for household use to community members, and very importantly to maximize employment [141,142]. These contrasting rationalities have been a source of tensions, particularly at the inception of forestry programs. For example, in pine plantations pruning and thinning small-sized pine trees initially conflicted local tree owners e.g., Zongolica, Veracruz [116]. For many years, communities in the Sierra Norte de Oaxaca rejected clear cuts as a system to regenerate natural pine forests [63]. These tensions may be particularly relevant and challenging for the management of rural forests (*sensu* [143]) and trees outside forests, which are usually harvested by particularly marginalized people for whom harvesting trees is an occasional activity [140].

Non-economic land values, sometimes aligned with traditional worldviews, affect management decisions at planning stages or during harvest operations. Extracting less timber volume than allowed, and setting aside areas off-logging without any official recognition, is not uncommon in CFM contexts e.g., Sierra Norte, Oaxaca, SE Mexico [109]. In some cases, communities have had to defend these conservation-oriented decisions against foresters or forest authorities to whom these decisions are counter-intuitive e.g., Ocuilan, State of Mexico, C. Mexico [133]. Local criteria for conserving particular tree species sometimes contradict technical criteria. That is the case of Ejido San Dimas (Durango, NW Mexico) where community members confronted their forest technical adviser in order to leave

Prunus serotina var. *capuli* trees standing. This species is locally known for being a critical food source for the endangered military macaw (*Ara militaris*), against the opinion of the forester who sees *Prunus* trees as competition to pine timber crop [144].

In other cases, conserving particular species or individual trees is not necessarily done for the sole purposes of conservation, but also for the maintenance of local livelihoods. In Quintana Roo (SE Mexico), particularly in Mayan communities, some communal assemblies and harvesters guard against logging *Manilkara zapota* trees despite shifting official criteria towards this species. While the regional economic importance of this species as a source of *chicle*, an NTFP, has steeply declined in the last five decades, and various communities now harvest *M. zapota* timber, in some Mayan communities these trees still tend to be protected as a legacy of the *chicle* tapping culture, and also due to its role in producing fruits that feed wild game important for local livelihoods [103]. Thus, the success of CFM can be explained by the permanence of TEK and related practices that complement or address failures of the conventional management plans: for instance, in Noh Bec, a community long considered to be a poster child of tropical CFM, local logging operators go slightly off-script from what is considered in the management plan, and retain individuals of lesser-known tree species that they recognize to be marketable in the emergent market for tourist construction materials [141].

3.3.5. Traditional Practices in Tension with Forest Law

TEK-based practices do not always fit the criteria and specifications set by the forest code and official norms, and in some cases enter in conflict. This is often the case for NTFP, for which knowledge is heterogeneous and where traditional ecological knowledge shapes diverse sets of practices, and sometimes serves as the basis of local governance arrangements [102,135]. For example, in a community in the state of Guerrero (S Mexico), the harvest of the economically important *Brahea dulcis* palm is only allowed once per month for each individual plant, an arrangement based on TEK that unlike the official norm (that sets a fixed percentage of leaves that can be harvested for all palm species), takes into consideration the locally-observed growth rate of new leaves [88,145]. Such official criteria adheres to a precautionary principle, rather than to detail knowledge of the ca. 100 palm species in the country, a stark contrast with the sophisticated knowledge and practices performed in various locales. Traditional management can include complex practices including palm promotion and combinations of leaf harvest intensity and frequency [135], beyond what can be specified in the official norm.

Non-timber forest products have been overregulated [146]. Differences between local TEK-based NTFP governance arrangements and official norms rarely imply direct persecution of local managers, but more often contribute to a disconnection between legal requirements and local practices. This disconnection is onerous, as it contributes to the high costs incurred to legally harvest NTFPs with an authorized management plan. Simplified authorizations exist to legally harvest timber from trees outside forests, but NTFPs are equally regulated no matter the management system from which they are derived. This means that the extraction of NTFPs (which management is often more closely associated to traditional practices) faces a heavier regulatory burden than timber extraction.

Diversified land uses a common element of traditional management systems, tend to be excluded or outright confronted by forest policies. Mexican forest communities generally have strong agricultural traditions [147], and much of what is recognized as traditional silviculture can be traced back to a wide diversity of agroforestry systems, ranging from homegardens, to complex fallow management systems that include practices such as slash-and-burn [78,80,84]. Traditional practices associated with the management of relatively fluid forest-agriculture interfaces have often been a major point of contention for laws and their implementation. Key examples of this contention are the legal definition of secondary forests and agricultural fallows [85], policies and perceptions towards swidden agriculture [148], agricultural fire use policy, and the type of agroforestry systems and type of forest regeneration that are supported [149]. All these policies intend to limit forest loss, and expand and recover forest areas, based on the crisp demarcation of forest areas from other land uses. At the same time, fire, a widespread traditional landscape management tool is increasingly regulated.

Fire suppression policies have not eliminated agricultural fire use and the occasional wildfires associated with them. However, these policies, have favored the creation of communal forest firefighting brigades, and discouraged the practice and transmission of traditional fire knowledge [63,150]. Simultaneously, in some forest communities, shifts in the local perceptions of fire were further galvanized by the decline of agricultural activities, associated with migration and the rise of CFM [63]. Government and NGO programs have supported traditional farmers to adopt some forms of permanent agriculture [151] or fire-less swidden agriculture [152]. While a detailed assessment is needed, preliminary evidence suggests limited long-term adoption of such practices [132]. Official adoption of integrated fire management approaches is still relatively recent, in many regions its instrumentalization is still in an early phase [153], and traditional fire knowledge often ignored or vilified [150,154,155].

In different regions of the country, as part of agroforestry systems and swidden agriculture, traditional practices favor and protect natural forest regeneration, and occasionally include some small-scale plantings [63,118,156]. Contrastingly, reforestation generally does not form part of local traditional practices [118]. Such large-scale plantings have commonly been incorporated in forest communities as part of government programs, which sometimes occurred even when natural regeneration was deemed sufficient by local actors [63]. Despite the meager seedling survival rates of reforestation programs [157], reforestation is commonly included as a condition for management plans to be authorized. This logic pervades as official programs tend to support the establishment of new (often monospecific) plantations [158], e.g., *copal Bursera* spp. resin [159], instead of documenting and supporting existing (often sustainable) local practices [160]. Mezcal offers a striking example of this paradigm, in which the traditional management of wild *Agave* populations in forest and agroforestry systems are disregarded and monospecific plantations are widely promoted, in an attempt to mimic the global commercial success of the industrially produced tequila [101,102].

Despite its demise by forest laws ([77], art. 99) and institutions [148], swidden agriculture persists in various forest regions. Legal definitions of tropical secondary forests focus on narrowly defined structural criteria that sets forests older than four years to be legally equivalent to old growth forest (thus its management is heavily regulated [85]). This definition accompanied with the demarcation of PFA favors shorter fallow periods, more intense agricultural management, reduces the availability of some forest products for subsistence, and hinders the commercial management of secondary forests [85,161,162].

4. Discussion

4.1. Summary of Evolution of the Inclusion of TEK in Policy—Key Moments and Heterogeneous Situations

Some milestones allow to trace the evolution of TEK in the context of Mexican CFM. The emergence and consolidation of CFM was enabled by the 1986 law, and environmental conservation rose at the forefront of forest policy and law in 1988 with the new forest code and the General Environmental Law [163]. Constitutional changes in 1992 led to forest parcelization and in some cases further privatization [164]. Additionally, in 1992, a new forest law dissolved public forest service, in favor of private forest technical service providers. The 1997 forest law included TEK for the first time on instrumental grounds, while the 2018 forest law elevated the recognition of TEK on the moral grounds of indigenous rights.

Traditional and techno-scientific knowledge systems have interacted in Mexican CFM heterogeneously. We argue that part of this heterogeneity is associated with the different histories of external intervention, a history that has being particularly long in timber-rich locales. In such contexts, from the 1940s to the 1980s (in many cases with older precedents, dating back to at least the 19th century, private and parastatal companies managing forest concessions imposed a forest management model [81], which while unjust (as logging by external actors was imposed on local communities), sometimes employed local crews creating new technical capacities and shaping local relationships with the forest [81,165]. Successive national and international development programs that supported

the consolidation of CFM in Mexico continued to use the blueprint of conventional forestry and further developed technical and organizational capacities [54–56]. All those interventions were instrumental for cementing forest related identities and practices, particularly in some of the most productive timber producing communities, where forestry is key to local livelihoods [56,63,165].

Conversely, in other contexts, usually in communities where official CFM was established later, where NTFPs and non-conventional forest products dominate, or those where forestry is more marginal, conventional forestry tends to have permeated to a lesser extent and TEK remains essential for forest management decisions e.g., *copal* resin, tropical polewood [108,124]. In some contexts where local communities have a long history of commercial forest management, as is the case with various industrial NTFPs (e.g., *chicle* [82]) and some timber management operations [166], the boundaries between TEK and technical knowledge can be particularly fluid given their long history of interaction and mutual influence in a situated-practice context [167].

4.2. Evolution and Limitations Identified

The rights of indigenous peoples and other communities have been increasingly established at the forefront of Mexican Forest Law as an overarching narrative, which affords TEK an unprecedented level of legal recognition. In contrast with the 1997 forest law where TEK was included on the instrumental grounds of fostering participation and sustainability, the 2018 law expanded its scope and incorporated a moral dimension framing the inclusion of TEK. Under this current law, communities' values, knowledge, practices, experience and innovation are to be respected, promoted and recognized including both in subsistence and in commercial contexts ([77], art. 7 XXXV, art. 29 II, art. 89, art. 144 V). Discourses boasting Mexico's biocultural diversity are becoming increasingly common in the governmental realm, with official webpages showcasing the role of indigenous people in forest conservation and sustainable management [168] and featuring ritual practices in indigenous forest communities [169].

In contrast with the unprecedented level of recognition of TEK at a discursive level, recognition of traditional management systems and practices is heterogeneous both legally and in practice. Explicit incorporation of elements of TEK in management plans are beginning to occur; often knowledge systems co-exist, sometimes as the result of respect, and others as they belong to seemingly different spheres e.g., agriculture and forest [119]. However, in some cases traditional management practices are still either ignored, omitted or illegalized. This is the case of traditional fire management and swidden agriculture, traditional practices that are in frequent tension with official policies in Mexico and elsewhere [170,171]. These practices are often perceived as synonymous with wildfires and deforestation, even though scholars urge for more nuanced and contextualized assessments [148,150]. For instance, the gradual loss of traditional fire knowledge has been shown to be associated with poor fire management and increased wildfire risk [155,172]. Swidden *milpa* agriculture is still demonized [47,148]. Arguably one key misconception of traditional swidden agriculture is that this type of temporal agriculture is equated to permanent deforestation ([69], art. 91; [77], art. 99). Evidence indicates that at a plot level swidden agriculture allows rapid forest recovery [173], that can be further accelerated by traditional agricultural practices [78,174], and in regions like Quintana Roo, evidence shows that it conserves forest cover, unlike permanent industrial agriculture [175].

In parallel, planting trees (and other perennials) is pervasively portrayed as benign in environmental policies [63,81], regardless of evidence questioning its pertinence [176], effectiveness [157] or demonstrating potentially negative consequences, including reducing biodiversity, disrupting food sovereignty, among others [102,177]. This tendency is evident in forest and agroforestry policies that focus on promoting new plantings [59], disregarding long established traditional agroforestry systems [149]. It is by no means our intent to criticize all reforestation efforts, but we concur with other authors on the need for evidence-based planting strategies that are suited to local contexts [178].

As TEK increasingly becomes part of policy discourses, some elements of TEK are explicitly integrated within the conventional Mexican forestry practice. Those TEK elements that are integrated

in conventional forestry, usually allow for the generation of synergies and complementarities with the established conventional forestry paradigm; this requires some level of ontological convergence, that is to say, compatibility between TEK and the dominant approach [28]. In contrast, those TEK-based practices that do not conform to zoning policies (often those on the agriculture-forest interfaces) face more resistance to be integrated in conventional forestry.

This insight suggests that the inclusion of TEK in policy and practice tends to occur mostly when it helps promoting conventional forestry objectives, rather than as a result of a moral recognition of local communities' rights. This opens the debate as to which degree the inclusion of TEK in policy benefits the holders of TEK (local communities). As Agrawal [38] critically pointed, the adoption of TEK in discourses by non-indigenous actors, is accompanied with the risk of folklorizing TEK and disempowering indigenous peoples.

Path dependency is arguably important. Forest communities with long histories of conventional forestry may not want or be able to easily return to more traditional landscape management strategies of diversified production systems with fuzzier interfaces between management systems [179]. Some external initiatives to reintegrate small-scale traditional agriculture in forest areas as part of silvicultural management system may face limited support from local and external actors [131,179].

Our results support the notion that conservation-oriented regulations pose challenges to legal forest management, particularly for some types of forests (e.g., tropical ecosystems) and products (e.g., NTFP). Noteworthy, such conservation-oriented restrictions often further burden those communities where conventional forest management was not historically adopted. Without advocating for total deregulation, we believe that additional and more diverse ways to support sustainable forest management in such contexts should be explored.

Beyond the federal forest laws and management plans, other policy instruments not explored here create some opportunities for communities to formally include elements of TEK into landscape management decisions. Examples are communal by-laws (*Estatuto Comunitario and Reglamento Interno*), which set the rules of communal decision mechanisms, rules related with subsistence resource use and the protection of natural and cultural areas such as sacred sites [180]. Additionally, participatory land use planning (*Ordenamiento Territorial Comunitario*) can serve as a consensus-building exercise among local stakeholders to regulate land use, which to some degree helps defend communal territories from external extractivist projects [109,181]. We recognize the value of participatory instruments in conservation and resource management, while acknowledging that such mechanisms may face limitations to fully recognize local value-systems [182]. Moreover, state level forest laws and codes are not analyzed here, which are regulations that can establish criteria more adapted to regional conditions. Since state laws cannot contradict federal laws and most state forest institutions have limited capacity to operate, their effect on the ground is expected to be limited but merits further examination.

4.3. Discourses Associated with TEK and How They Relate to Changing Discourses around Conservation

In Mexico there is a broad discursive consensus that conservation and resource management should be conducted in close collaboration with local communities [183]. In practice however, forest and conservation policies in Mexico are still, to some degree, "fields of debate and struggle" where urban conservationists' priorities are to a large extent imposed over the rural poor [58] whose management practices are still often regarded as the main drivers of forest loss and degradation [57,58,64].

The 1986 forest law set the stage that allowed CFM to fully emerge [40]. Shortly after, the 1988 forest code was enacted on pair with the first General Environmental Law (*Ley General del Equilibrio Ecológico y Protección al Ambiente*, [163]), a milestone that begun to shift the CFM discourse from rural development towards conservation [56,63,184]. This shift was accompanied by the subsequent enactment of legal norms (*Normas Oficiales Mexicanas*) that with a conservationist intent, limited communities' use of traditional management practices at a commercial scale [146]. As part of the conservation orientation of forest policies in the last two decades, the governmental budget dedicated to payment for environmental services (PES) and establishing plantations increased, to the detriment

of federal subsidies to forest production, management of natural forests and CFM in particular [184]. At the same time, PES promotes the abandonment of productive forest uses, including subsistence hunting, increasing dependency on external food supplies and threatening agrodiversity and associated TEK [185]. Some of these concerns are also raised in areas with forest plantation initiatives [179]. In particular, ecosystems and species that are legally considered as rare and vulnerable are more likely to be included under PES and other conservation schemes, and are more rarely included in CFM.

Traditional management of agricultural-forest interfaces, notably swidden agriculture, has been considered to contribute to deforestation [148]. Conventional forestry has tended to impede any deforestation, including temporary deforestation that forms part of traditional slash and burn/swidden agriculture. We argue that beyond the conservation of individual plots, it is necessary to consider the spatio-temporal complexity of traditional management systems in order to include and benefit from TEK in forest management. For example, distinguishing temporary deforestation from permanent deforestation is a first step to change the perceptions on swidden agriculture [186].

4.4. On the Interaction between TEK and Scientific Knowledge

In theory, conventional forest management is guided by techno-scientific knowledge. In reality, as forest and environmental bureaucracies authorize, supervise and often subsidize forest management, practices tend to be often influenced by the institutional and personal rationalities of official bureaucracies [63]. The timing to plant trees become a matter of when government subsidy and supervision are available, rather than a timing dictated by local or scientific criteria indicating higher potential of success.

Mexican forest officials have limited power, resources and capacities, face complex realities, and often organized communities [63], which restricts their influence. Techno-scientific forest knowledge has expanded in a context of relative institutional weaknesses; beyond outright imposition, Mathews [63] argues that this expansion has often been the result of more subtle interactions between forest bureaucracies and forest communities including negotiation, ignorance, simulation, omission, tolerance and complicity. A comment by a government official on NTFPs management plans exemplifies part of this complexity: "the forest technicians make their study based on what the official norms say, and then the community use their knowledge to make it sustainable" [187].

The interaction of local and techno-scientific knowledge is largely modulated by the interaction between communities and the forest technical service providers that advise and prepare management plans for them. Technical services highly vary in their motivations, involvement, and knowledge of local contexts; and include a relatively wide spectrum of non-profit and for-profit actors [89,90]. In some cases, these actors closely collaborate with academia [102,188]. Moreover, technical services often have strong personal ties with local forest communities and some are native of local forest communities themselves [189,190]. The role individual life histories and identities play in the conceptualization and integration of diverse forest knowledge would require further study.

Beyond government, forest technical services, and communal institutions; the knowledge of a suite of actors can influence forest operations (e.g., contractors, intermediaries, buyers). In Mexico, out of a sample of 2616 forest communities, 35% lead logging operations, while in 27% of them logging operations are led by external contractors and timber buyers, and the remaining 38% are potential forest producers [191]. Local crews take decisions regarding logging based on their own criteria and knowledge [141], which may differ from what is stated in management plans or the criteria of external logging contractors that are more focused on immediate profit and less on forest sustainability [119,192]. In some contexts, local crews with specialized TEK but with limited technical training, are hired to harvest and process forest products including charcoal, NTFPs, and logging from trees outside-forests [116].

Moreover, markets drive what is harvested, and less directly also influence forest management as a whole. In short, for value chains in which communication between end users and harvesters is direct, clients can order products with specific characteristics. For example, clients can ask the exact measures

and species of tropical hardwood poles that will be harvested [124], or the method by which *copal* resin is collected [193]. Along the same lines, when buyers and harvesters both hold TEK, buyers sometimes ask their wood to be felled taking into account the moon phase [134].

TEK and techno-scientific knowledge apply predominantly to different domains, e.g., technical knowledge in production forests and TEK in agricultural areas [119], technical knowledge for timber and TEK for NTFPs, technical knowledge for market products and TEK for ritual practices and non-economic values. In many cases, the relative separation of these domains arguably promotes the co-existence of knowledge systems, minimizing conflict.

Contrasting with timber, the depth of TEK associated with NTFPs is more commonly recognized by a wide suite of actors from academia, government and NGOs. Conversely, TEK regarding timber management is rarely acknowledged. More research would be needed to document why this is. Preliminary evidence suggests various potential explanations: (1) A long history of external actors leading logging operations may result in the displacement of existing TEK associated with timber; (2) existing local management systems for wood products are often ignored by institutions [179]. While TEK focused on commercial sawn-timber may be limited, the TEK regarding other wood products is significant, including, poles, *tejamanil*, firewood, charcoal; and (3) traditional silvicultural systems as diversified and small-scale as they generally are, have not developed specific practices for large scale timber production, thus the introduction of conventional forestry to communities "filled a void" for large scale timber production that TEK alone did not supply.

As globally CFM generally imply some form of co-management [194]. How TEK interact with technoscientific knowledge cannot be separated from how co-management arrangements are configurated in each country, and the existing contradictions need to be analyzed as part of the tensions between top-down forest regulation and indigenous (and local) autonomies [38,195].

4.5. Factors beyond Government Actions Also Affect the Use of TEK

Many factors are involved in how knowledge systems interact in CFM, of which forest and environmental policies represent just one. Diverse process can be associated with TEK decline and in some cases revival.

The most obvious change for a community that transitions from subsistence towards commercial forest management, is the commoditization of some forest goods, which can lead to a profound transformation of people's relation to nature, and the gradual disappearance of non-economic values of nature [196–198]. Concurrently, the adoption of new technologies and associated practices, as well as the increased frequency and of harvests in commercial settings, can displace traditional practices and can make some reciprocity rituals less meaningful or practical [116]. As a commercial activity, the influence of markets and individual buyers on forest management cannot be minimized, as they determine the specifications of the forest products that will be harvested [104].

Agrarian societies, particularly in Latin America, have transitioned towards diversified rural societies, where "new ruralities" emerge, with the development of new complex social and economic dynamics and the formation of new urban-rural linkages [199]. These new dynamics include increased schooling, migration and remittance economies, non-agricultural waged activities, government funded conditional cash transfers [200,201], often coupled with dwindling agricultural subsidies [199], and the presence of conservation funding [202]. All in all, the decline of land-based livelihoods, increased schooling and migration are associated with demographic and cultural change [203] and TEK loss [135,204,205], all of which challenges and reshapes communal governance [206].

Negative perceptions of TEK contribute to its loss; dynamics that cannot be dissociated from historic and persisting racial and ethnic discrimination towards indigenous and Afro-Mexican peoples [207,208], and the construction of the post-revolutionary state based on cultural and racial homogenization [47,49]. Including biocultural diversity and TEK as part the training programs of forestry and environmental professionals would be a starting point for a more fluid dialogue between knowledge systems [209] and a revalorization of indigenous knowledge.

5. Conclusions

In tune with the global evolution of forest governance discourses [210], in Mexico, TEK as a general concept has been included in forest laws and codes, initially for instrumental reasons (to foster participation in forest management and hence sustainability) and more recently recognized by law on moral grounds (in relation to indigenous and community rights). As positive as legal recognition may be, traditional management systems are heterogeneous and often more complex and adaptable than what is recognized in legal documents. As conventional forestry was introduced in different moments and in different circumstances, including contrasting governance arrangements (e.g., concessions or CFM), depending on the ecosystem (e.g., temperate vs. tropical), type of forest product (e.g., timber vs. NTFP), and region, interactions between TEK and scientific forestry are unsurprisingly heterogeneous.

On the ground, the co-existence of technical and traditional knowledge systems in CFM contexts reflects a variety of situations ranging from respect, ignorance, and at times an apparent demarcation of the realms between knowledge systems. Despite some advances in recognition at the discursive level, some TEK practices remain illegal. For instance, in forest-agriculture interfaces, traditional practices are often considered deforestation hazards rather than landscape management strategies, echoing the global dominance of a land sparing paradigm persistent in forest management and conservation [211].

Our analysis suggests that the inclusion of TEK in Mexican CFM is heterogeneous and dynamic, but tends to occurs where it is perceived to be complementary to conventional forestry approaches, highlighting the dominance of instrumental versus moral considerations for recognizing and including TEK in community forestry. At the same time, the persistence of some traditional practices and values that do not conform to official discourses embedded in law and policies showcases their limits and contradictions, as well as the importance of TEK to local communities.

6. Notes

[1] The Mexican 2018 forest law recognizes CFM as forest management conducted in a collective manner for commercial purposes, both in communal (in the form of *ejidos* and *comunidades*) and private lands ([77]], art. 7 XXXV). However, some government programs supporting CFM and most of the literature on Mexican CFM have focused only on areas under communal land tenure, leaving out small private properties which are common in some indigenous regions. At the same time, timber derived from rural forests ([*sensu* [143], e.g., agroforestry systems, agricultural fallows, small forest patches]) and trees outside forests are not necessarily labeled as pertaining to CFM. It has to be noted that in 1992 a constitutional reform promoted the parcelization of *ejido* lands and enabled their privatization [212,213]. This implies that in some cases, land under the broad communal tenure can be individually managed [111]. In this article we mostly focus on community-owned and-managed forests, but also include some insights and examples from small forest areas under private property regime, from which challenges for TEK in those contexts can also been identified.

[2] Forest management plans require various technical elements including: Forest zoning, inventory, harvest volumes, layout of annual harvest areas and harvest plans, post-harvest treatments, forest roads, reforestation and environmental impact mitigation when applicable. The inclusion of TEK is not required for a forest management plan to be approved.

[3] Author's experience includes both, academic research on community forestry, ethnobotany, anthropology and land use science; and professional practice including field based educational experiences, consultancies, community-based and inter-institutional initiatives. Our field methods include focus groups and participatory workshops, interviews, participant observation, forest inventories, and analysis of forest operations. We have conducted fieldwork across the country, although most of it in C and SE Mexico. J.A.S.H. has worked in Morelos, Sierra de Huautla region (2006–2007, and 2017); Quintana Roo, mainly in the Zona Maya region (2012–2014), Central Veracruz (2019–present). P.G.F. has worked in Central Veracruz (1980–present); Oaxaca, Sierra Norte and Sierra Sur regions (1993–2000); Veracruz, Sierra de Zongolica region (2015–present); and conducted forest certification in Chiapas, Durango, Hidalgo, Michoacán, Oaxaca, Puebla and Quintana Roo (1994–2004).

C.L.B. has worked in Puebla, Sierra Norte region (1999–2016); Veracruz, Sierra de Zongolica region (2006–present). E.A.E. has worked in Quintana Roo (1999–2001, 2013–present), Campeche (2007–2008, 2013–present), Yucatán (2013–present), Central Veracruz (2008); Estado de México, Cutzamala River Basin (2014); Oaxaca (2016).

Author Contributions: J.A.S.-H. was the leading author who conducted all of the research, including the systematization, data analysis, and writing of this paper; J.A.S.-H., P.G.F., C.L.B. and L.G. participated in the conception and writing of the manuscript; J.A.S.-H. and P.G.F. conducted the analysis of forest laws; P.G.F., C.L.B. and E.A.E. have been working in Mexico on community forest management, biocultural and conservations initiatives for over 20 years; they also revised, commented on, and improved the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: J.A.S.-H.: P.G.F., C.L.B. and E.A.E. acknowledge Centro de Investigaciones Tropicales, Universidad Veracruzana for the institutional and financial support. This study is part of ongoing research of the Non-timber Forest Product Network (Spanish acronym, RPFNM) of CONACyT.

Acknowledgments: We recognize Gabriela Álvarez Anaya for helping with the analysis and language editing. We thank Ana Ortiz-Monasterio Quintana, Salvador Santos Colli-Balam, Lucero González García, Francisco A. Ortiz Navarro, José Juan Blancas Vázquez, Luis Sánchez Méndez, Mirna Ambrosio Montoya, and various CONAFOR officers for their insights and comments.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Agrawal, A.; Chhatre, A.; Hardin, R. Changing governance of the world's forests. *Science* **2008**, *320*, 1460–1462. [CrossRef] [PubMed]
2. Arnold, J.E. *Forests and People: 25 Years of Community Forestry*; Food and Agriculture organization of the United Nations: Rome, Italy, 2001.
3. Charnley, S.; Poe, M.R. Community forestry in theory and practice: Where are we now? *Annu. Rev. Anthropol.* **2007**, *36*. [CrossRef]
4. Klooster, D.J. Toward adaptive community forest management: Integrating local forest knowledge with scientific forestry. *Econ. Geogr.* **2002**, *78*, 43–70. [CrossRef]
5. Parrotta, J.A.; Agnoletti, M. Traditional forest knowledge: Challenges and opportunities. *For. Ecol. Manag.* **2007**, *249*, 1–4. [CrossRef]
6. Parrotta, J.; Yeo-Chang, Y.; Camacho, L.D. Traditional knowledge for sustainable forest management and provision of ecosystem services. *Int. J. Biodivers. Sci. Ecosyst. Serv. Manag.* **2016**, *12*, 1–4. [CrossRef]
7. Rockwell, C.; Kainer, K. Local and scientific perspectives on the bamboo-dominated forest in Acre, Brazil: A complementary knowledge base for multiple-use forest management. *Int. For. Rev.* **2015**, *17*, 51–64. [CrossRef]
8. Traditional Ecological Knowledge UBC. Transforming Approaches to Forests and Forestry through Traditional and Local Knowledges. Conference. Available online: http://tek.sites.olt.ubc.ca/files/2019/08/PRINT_COMPLETE-Welcome-Package-2.pdf (accessed on 19 February 2020).
9. Berkes, F.; Colding, J.; Folke, C. Rediscovery of traditional ecological knowledge as adaptive management. *Ecol. Appl.* **2000**, *10*, 1251–1262. [CrossRef]
10. Purdon, M. The nature of ecosystem management: Postmodernism and plurality in the sustainable management of the boreal forest. *Environ. Sci. Policy* **2003**, *6*, 377–388. [CrossRef]
11. Jepson, P. Nature conservation. In *International Encyclopedia of Geography: People, the Earth, Environment and Technology*; Wiley: New York, NY, USA, 2016; pp. 1–22.
12. Linnell, J.D.; Kaczensky, P.; Wotschikowsky, U.; Lescureux, N.; Boitani, L. Framing the relationship between people and nature in the context of European conservation. *Conserv. Biol.* **2015**, *29*, 978–985. [CrossRef]
13. Tomaselli, M.; Hajjar, R.; Ramón-Hidalgo, A.; Vásquez-Fernández, A. The problematic old roots of the new green economy narrative: How far can it take us in re-imagining sustainability in forestry? *Int. For. Rev.* **2017**, *19*, 139–151. [CrossRef]
14. Zhang, Y. Multiple-use forestry vs. forestland-use specialization revisited. *For. Policy Econ.* **2005**, *7*, 143–156. [CrossRef]

15. Alexiades, M.N. The cultural and economic globalisation of traditional environmental knowledge systems. In *Landscape, Process and Power: Re-Evaluating Traditional Environmental Knowledge*; Heckler, S., Ed.; Berghahn: New York, NY, USA, 2009; pp. 68–90.
16. Uprety, Y.; Asselin, H.; Bergeron, Y. Preserving ecosystem services on indigenous territory through restoration and management of a cultural keystone species. *Forests* **2017**, *8*, 194. [CrossRef]
17. Raymond, C.M.; Fazey, I.; Reed, M.S.; Stringer, L.C.; Robinson, G.M.; Evely, A.C. Integrating local and scientific knowledge for environmental management. *J. Environ. Manag.* **2010**, *91*, 1766–1777. [CrossRef] [PubMed]
18. De Sousa Santos, B. *Cognitive Justice in a Global World: Prudent Knowledges for a Decent Life*; Lexington Books: Plymouth, UK, 2007.
19. Leff, E. *Racionalidad Ambiental: La Reapropiación Social de la Naturaleza*; Siglo XXI: Mexico City, Mexico, 2004.
20. 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] [PubMed]
21. Kajikawa, Y.; Tacoa, F.; Yamaguchi, K. Sustainability science: The changing landscape of sustainability research. *Sustain. Sci.* **2014**, *9*, 431–438. [CrossRef]
22. Apgar, J.M.; Argumedo, A.; Allen, W. Building transdisciplinarity for managing complexity: Lessons from indigenous practice. *Int. J. Interdiscip. Soc. Sci.* **2009**, *4*, 255–270. [CrossRef]
23. Betancourt Posada, A.; Arellano López, J.G.; Camos Ortiz, G.T.; Cruz Marín, J.E. *Del Monólogo a La Polifonía.*; Universidad Nacional Autónoma De México: Mexico City, Mexico, 2014.
24. Martin, A.; Coolsaet, B.; Corbera, E.; Dawson, N.M.; Fraser, J.A.; Lehmann, I.; Rodriguez, I. Justice and conservation: The need to incorporate recognition. *Biol. Conserv.* **2016**, *197*, 254–261. [CrossRef]
25. De Sousa Santos, B. *Descolonizar el Saber, Reinventar el Poder*; Ediciones Trilce: Montevideo, Uruguay, 2010.
26. Escobar, A. Worlds and knowledges otherwise: The Latin American modernity/coloniality research program. *Cult. Stud.* **2007**, *21*, 179–210. [CrossRef]
27. Kleiche-Dray, M.; Waast, R. Indigenous knowledge in Mexico: Between environmentalism and rural development. In *Environmental Governance in Latin America*; Palgrave Macmillan: London, UK, 2016; pp. 86–110.
28. Ludwig, D. Overlapping ontologies and Indigenous knowledge. From integration to ontological self-determination. *Stud. Hist. Philos. Sci. Part A* **2016**, *59*, 36–45. [CrossRef]
29. Whyte, K. What do indigenous knowledges do for indigenous peoples? In *Keepers of the Green World: Traditional Ecological Knowledge and Sustainability*; Melissa, K.N., Dan, S., Eds.; Cambridge University Press: Cambridge, UK, 2017.
30. Tengö, M.; Hill, R.; Malmer, P.; Raymond, C.M.; Spierenburg, M.; Danielsen, F.; Elmqvist, T.; Folke, C. Weaving knowledge systems in IPBES, CBD and beyond—Lessons learned for sustainability. *Curr. Opin. Environ. Sustain.* **2017**, *26*, 17–25. [CrossRef]
31. Ojha, H.R.; Chhetri, R.B. *Knowledge Systems and Natural Resources: Management, Policy, and Institutions in Nepal*; International Development Research Centre, Cambridge University Express: New Delhi, India, 2008.
32. Siiskonen, H. The conflict between traditional and scientific forest management in 20th century Finland. *For. Ecol. Manag.* **2007**, *249*, 125–133. [CrossRef]
33. Cheveau, M.; Imbeau, L.; Drapeau, P.; Bélanger, L. Current status and future directions of traditional ecological knowledge in forest management: A review. *For. Chron.* **2008**, *84*, 231–243. [CrossRef]
34. Ojha, H.R. Techno-bureaucratic doxa and challenges for deliberative governance: The case of community forestry policy and practice in Nepal. *Policy Soc.* **2006**, *25*, 131–175. [CrossRef]
35. Scheba, A.; Mustalahti, I. Rethinking 'expert'knowledge in community forest management in Tanzania. *For. Policy Econ.* **2015**, *60*, 7–18. [CrossRef]
36. Kim, S.; Li, G.; Son, Y. The contribution of traditional ecological knowledge and practices to forest management: The case of northeast Asia. *Forests* **2017**, *8*, 496.
37. Kainer, K.A.; Wadt, L.H.; Staudhammer, C.L. Testing a silvicultural recommendation: Brazil nut responses 10 years after liana cutting. *J. Appl. Ecol.* **2014**, *51*, 655–663. [CrossRef]
38. Agrawal, A. Dismantling the divide between indigenous and scientific knowledge. *Dev. Chang.* **1995**, *26*, 413–439. [CrossRef]

39. FAO. Sustainable Forest Management. Available online: http://www.fao.org/forestry/sfm/en/ (accessed on 19 February 2020).
40. Bray, D.B.; Merino-Pérez, L.; Barry, D. *The Community Forests of Mexico: Managing for Sustainable Landscapes*; University of Texas Press: Austin, TX, USA, 2005.
41. Loh, J.; Harmon, D. A global index of biocultural diversity. *Ecol. Indic.* **2005**, *5*, 231–241. [CrossRef]
42. Boege, E. *El Patrimonio Biocultural de los Pueblos Indígenas de México: Hacia la Conservación in Situ de la Biodiversidad y Agrodiversidad en los Territorios Indígenas*; Instituto Nacional de Antropología e Historia, Comisión Nacional para el Desarrollo de los Pueblos Indígenas: Mexico City, Mexico, 2008.
43. Challenger, A.; Soberón, J. Los ecosistemas terrestres. *Cap. Nat.* **2008**, *1*, 87–108.
44. Toledo, V.M.; Barrera-Bassols, N. *La Memoria Biocultural: La Importancia Ecológica de las Sabidurías Tradicionales*; Icaria editorial: Barcelona, Spain, 2008.
45. Vallebueno-Estrada, M.; Rodríguez-Arévalo, I.; Rougon-Cardoso, A.; González, J.M.; Cook, A.G.; Montiel, R.; Vielle-Calzada, J.-P. The earliest maize from San Marcos Tehuacán is a partial domesticate with genomic evidence of inbreeding. *Proc. Natl. Acad. Sci. USA* **2016**, *113*, 14151–14156. [CrossRef]
46. Carmack, R.M.; Gasco, J.L.; Gossen, G.H. Origins and Development of Mesoamerican Civilization. In *The Legacy of Mesoamerica*; Routledge: New York, NY, USA, 2016; pp. 56–95.
47. Carrillo Trueba, C. *El Racismo en México: Una Visión Sintética*; Consejo Nacional para la Cultura y las Artes: Mexico City, Mexico, 2009.
48. Carrillo Trueba, C. *Pluriverso: Un Ensayo Sobre el Conocimiento Indígena Contemporáneo*; Universidad Nacional Autónoma de México: Mexico City, Mexico, 2008.
49. Castellanos Guerrero, A.; Gómez Izquierdo, J.; Pineda, F. Racist discourse in Mexico. In *Racism and Discourse in Latin America*; van Dijk, T.A., Ed.; Lexington Books: Lanham, MD, USA, 2009; pp. 217–258.
50. Boege, E. Hacia una antropología ambiental para la apropiación social del patrimonio biocultural de los pueblos indígenas en América Latina. *Desenvolv. Meio Ambiente* **2015**, *35*, 101–120. [CrossRef]
51. Endfield, G.H. The resilience and adaptive capacity of social-environmental systems in colonial Mexico. *Proc. Natl. Acad. Sci. USA* **2012**, *109*, 3676–3681. [CrossRef] [PubMed]
52. Bray, D.B.; Merino-Pérez, L.; Negreros-Castillo, P.; Segura-Warnholtz, G.; Torres-Rojo, J.M.; Vester, H.F. Mexico's community-managed forests as a global model for sustainable landscapes. *Conserv. Biol.* **2003**, *17*, 672–677. [CrossRef]
53. Madrid, L.; Núñez, J.M.; Quiroz, G.; Rodríguez, Y. La propiedad social forestal en México. *Investig. Ambient.* **2009**, *1*, 179–196.
54. Torres-Rojo, J.M.; Moreno-Sánchez, R.; Amador-Callejas, J. Effect of capacity building in alleviating poverty and improving forest conservation in the communal forests of Mexico. *World Dev.* **2019**, *121*, 108–122. [CrossRef]
55. Armijo, N.; Bocanegra, M.A.; Quintana, F. La cooperación internacional para la actividad forestal en Quintana Roo: Origen, actores, desarrollo y prospectivas. In *La Agenda de Cooperación Internacional en la frontera Sur de México*; Mayo, R.R., López, J.B., Eds.; Bonilla Artigas, Universidad de Quintana Roo: Chetumal, Mexico, 2010; pp. 167–188.
56. Hinojosa Flores, I.D.; Skutsch, M.; Mustalahti, I. Impacts of Finnish cooperation in the Mexican policy making process: From the community forest management to the liberalization of forest services. *For. Policy Econ.* **2016**, *73*, 229–238. [CrossRef]
57. Hernández-Aguilar, J.A.; Cortina-Villar, H.S.; García-Barrios, L.E.; Castillo-Santiago, M.Á. Factors limiting formation of community forestry enterprises in the Southern Mixteca region of Oaxaca, Mexico. *Environ. Manag.* **2017**, *59*, 490–504. [CrossRef]
58. Merino-Perez, L. Conservation and forest communities in Mexico: Experiences, visions, and rights. In *Community Action for Conservation*; Springer: New York, NY, USA, 2013; pp. 25–44.
59. Skutsch, M.; Olguín, M.; Gerez, P.; Muench, C.; Chapela, G.; Benet, R.; Chavez, A.; Galindo, R. Increasing Inequalities in Access to Forests and Forest Benefits in Mexico. *J. Lat. Am. Geogr.* **2018**, *17*, 248–252. [CrossRef]
60. Durand, L.; Lazos, E. The local perception of tropical deforestation and its relation to conservation policies in Los Tuxtlas Biosphere Reserve, Mexico. *Hum. Ecol.* **2008**, *36*, 383. [CrossRef]
61. Haenn, N.; Olson, E.A.; Martinez-Reyes, J.E.; Durandd, L. Introduction: Between capitalism, the state, and the grassroots: Mexico's contribution to a global conservation debate. *Conserv. Soc.* **2014**, *12*, 111–119.

62. Legorreta-Díaz, M.; Márquez-Rosano, C. *Paradojas de Las Tierras Protegidas:Democracia y Política Ambiental En Reservas de Biosfera En Chiapas*; Universidad Nacional Autónoma de México: Mexico City, Mexico, 2014.
63. Mathews, A.S. *Instituting Nature: Authority, Expertise, and Power in Mexican Forests*; MIT Press: Cambridge, MA, USA, 2011.
64. Pérez Ríos, E. De pinos y motosierras: Revisión crítica al aprovechamiento forestal comunal en San Jerónimo Coatlán, Oaxaca. *Polis Rev. Latinoam.* **2019**, *52*, 1–17.
65. Ibargüen, L.; Chapela, G. Conocimiento tradicional forestal en México. In *Biodiversidad y Conocimiento Tradicional en la Sociedad Rural. Entre el Bien Común y la Propiedad Privada*; Concheiro, L., López, B.F., Eds.; Centro de Estudios para el Desarrollo Rural Sustentable y la Soberanía Alimentaria, Cámara de Diputados, LX Legislatura, Universidad Autónoma Metropolitana, Unidad Xochimilco: Mexico City, Mexico, 2007; pp. 299–328.
66. Secretaría de Agricultura y Ganadería. *Ley Forestal*; Diario Oficial de la Federación: Mexico City, Mexico, 1960; pp. 7–17.
67. Secretaría de Agricultura y Ganadería. *Reglamento de la Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1961; pp. 1–24.
68. Secretaría de Agricultura y Recursos Hidraulicos. *Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1986; pp. 13–28.
69. Secretaría de Agricultura y Recursos Hidraulicos. *Reglamento de la Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1988; pp. 7–45.
70. Secretaría de Agricultura y Recursos Hidraulicos. *Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1992; pp. 16–26.
71. Secretaría de Agricultura y Recursos Hidraulicos. *Reglamento de la Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1994.
72. Secretaría de Medio Ambiente, R.N.Y.P. *Reforma a la ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1997; pp. 32–47.
73. Secretaría de Medio Ambiente, R.N.Y.P. *Reglamento de la Ley Forestal*; Diario Oficial de la Federacion: Mexico City, Mexico, 1998; pp. 35–59.
74. Secretaría de Medio Ambiente y Recursos Naturales. *Ley General de Desarrollo Forestal Sustentable*; Diario Oficial de la Federacion: Mexico City, Mexico, 2003; pp. 5–52.
75. Secretaría de Medio Ambiente y Recursos Naturales. *Reglamento de la Ley General de Desarrollo Forestal Sustentable*; Diario Oficial de la Federacion: Mexico City, Mexico, 2005; pp. 1–44.
76. Secretaría de Medio Ambiente y Recursos Naturales. *Reglamento de la Ley General de Desarrollo Forestal Sustentable*; Diario Oficial de la Federacion: Mexico City, Mexico, 2014.
77. Secretaría de Medio Ambiente y Recursos Naturales. *Ley General de Desarrollo Forestal Sustentable*; Diario Oficial de la Federacion: Mexico City, Mexico, 2018; pp. 2–48.
78. Gómez-Pompa, A. On maya silviculture. *Mex. Stud./Estud. Mex.* **1987**, *3*, 1–17.
79. Moreno-Calles, A.I.; Toledo, V.M.; Casas, A. Los sistemas agroforestales tradicionales de México: Una aproximación biocultural. *Bot. Sci.* **2013**, *91*, 375–398. [CrossRef]
80. Peters, C.M. Precolumbian silviculture and indigenous management of neotropical forests. In *Imperfect Balance: Landscape Transformations in the Precolumbian Americas*; Lentz, D.L., Ed.; Columbia University Press: New York, NY, USA, 2000; pp. 203–223.
81. Boyer, C.R. *Political Landscapes: Forests, Conservation, and Community in Mexico*; Duke University Press: Bogart, GA, USA, 2015.
82. Forero, O.A.; Redclift, M.R. The production and marketing of sustainable forest products: Chewing gum in Mexico. *Dev. Pract.* **2007**, *17*, 196–207. [CrossRef]
83. Secretaría de Medio Ambiente y Recursos Naturales. *Norma Oficial Mexicana NOM 152 SEMARNAT 2006, Que Establece los Lineamientos, Criterios y Especificaciones de los Contenidos de Los Programas de Manejo Forestal Para el Aprovechamiento de Recursos Forestales Maderables en Bosques, Selvas y Vegetacion de Zonas Aridas*; Diario Oficial de la Federacion: Mexico City, Mexico, 2008; pp. 9–30.
84. Moreno-Calles, A.I.; Casas, A.; Rivero-Romero, A.D.; Romero-Bautista, Y.A.; Rangel-Landa, S.; Fisher-Ortíz, R.A.; Alvarado-Ramos, F.; Vallejo-Ramos, M.; Santos-Fita, D. Ethnoagroforestry: Integration of biocultural diversity for food sovereignty in Mexico. *J. Ethnobiol. Ethnomedicine* **2016**, *12*, 54. [CrossRef]

85. Román-Dañobeytia, F.J.; Levy-Tacher, S.I.; Macario-Mendoza, P.; Zúñiga-Morales, J. Redefining secondary forests in the Mexican Forest Code: Implications for management, restoration, and conservation. *Forests* **2014**, *5*, 978–991. [CrossRef]
86. Secretaría de Medio Ambiente y Recursos Naturales. *Norma Oficial Mexicana NOM-015-SEMARNAT/SAGARPA-2007, Que Establece las Especificaciones Técnicas de Métodos de Uso Del Fuego en Los Terrenos Forestales y en Los Terrenos de Uso Agropecuario*, 16 January 2009 ed.; Diario Oficial de la Federacion: Mexico City, Mexico, 2009.
87. De Foresta, H.; Temu, A.; Boulanger, D.; Feuilly, H.; Gauthier, M. *Towards the Assessment of Trees Outside Forests: A Thematic Report Prepared in the Framework of the Global Forest Resources Assessment 2010*; Food and Agriculture Organization of the United Nations: Rome, Italy, 2013.
88. Aguilar, J.; Gómez, T.; Illsley, C.; Flores, A.; Quintanar, E.; Tlacotempa, A.; Acosta, J.; Mancilla, S. *Normas Comunitarias Indígenas y Campesinas Para el Acceso y Uso de los Recursos Naturales*; Grupo de Estudios Ambientales, SSS Sanzekan Tinemi, Methodus: Mexico City, Mexico, 2011.
89. Barsimantov, J.A. Vicious and virtuous cycles and the role of external non-government actors in community forestry in Oaxaca and Michoacán, Mexico. *Hum. Ecol.* **2010**, *38*, 49–63. [CrossRef]
90. Garcia-Lopez, G.A.; Antinori, C. Between grassroots collective action and state mandates: The hybridity of multi-level forest associations in Mexico. *Conserv. Soc.* **2018**, *16*, 193–204. [CrossRef]
91. Simonian, L. *Defending the Land of the Jaguar: A History of Conservation in Mexico*; University of Texas Press: Austin, TX, USA, 1995.
92. Mas, J.F.; Vega, A.P. La representavidad del Sistema Nacional de Áreas Naturales Protegidas (SINAP). *Gac. Ecol.* **2005**, *74*, 5–14.
93. Koleff, P.; Tambutti, M.; March, I.J.; Esquivel, R.C.; Cantú, C. Identificación de prioridades y análisis de vacíos y omisiones en la conservación de la biodiversidad de México. In *Capital Natural de México. Estado de Conservación y Tendencias de Cambio*; Dirzo, R., González, R., March, I.J., Eds.; Comisión Nacional para el Conocimiento y Uso de la Biodiversidad: Mexico City, Mexico, 2009; Volume II, pp. 651–718.
94. Bosque de Niebla, A.C. *Autorización para el aprovechamiento maderable de especies nativas de bosque mesófilo de montaña en un total de 129.04 hectáreas, Veracruz, Mexico*; Forest Management Plan submited to Secretaria de Medio Ambiente y Recursos Naturales: Xalapa, Mexico, 2018.
95. Gerez Fernandez, P. *Personal Communication. Centro de Investigaciones Tropicales*; Universidad Veracruzana: Xalapa, Mexico, 2019.
96. Romahn de la Vega, C.F. *Principales Productos Forestales No Maderables de México*; Universidad Autónoma Chapingo: Texcoco, Mexico, 1985.
97. Lindquist, C.A. *Dimensions of Sustainability: The Use of Vara Blanca As a Natural Resource in the Tropical Deciduous Forest of Sonora, Mexico*; University of Arizona: Tucson, AZ, USA, 2000.
98. Chibnik, M.; Purata, S. Conserving copalillo: The creation of sustainable Oaxacan wood carvings. *Agric. Hum. Values* **2007**, *24*, 17–28. [CrossRef]
99. Sierra Huelsz, J.A.; Beltrán Rodríguez, L.A.; Blancas Vázquez, J.J.; Maldonado Almanza, B.J. Manejo Forestal. In *Biodiversidad de Morelos. Estudio de Estado*; Comisión Nacional para el Conocimiento y Uso de la Biodiversidad: Mexico City, Mexico. (in press)
100. Lopez Binnqüist, C.; Quintanar–Isaías, A.; Vander Meeren, M. Mexican bark paper: Evidence of history of tree species used and their fiber characteristics. *Econ. Bot.* **2012**, *66*, 138–148. [CrossRef]
101. Bowen, S.; Hamrick, D. Defining Mexico's spirit. Gastronomica. *J. Crit. Food Stud.* **2014**, *14*, 26–33.
102. Illsley, C.; Torres-García, I.; Hernández-López, J.; Morales-Moreno, P.; Varela-Álvarez, R.; Ibañez-Couch, I.; Nava-Xinol, H. *Manual de Manejo Campesino de Magueyes Mezcaleros Forestales*; Grupo de Estudios Ambientales AC: Mexico City, Mexico, 2018.
103. Sierra-Huelsz, J.A.; Kainer, K.A.; Keys, E.; Colli-Balam, S.S. Three stories under the same hut: Market preferences and forest governance drive the evolution of tourism construction materials. *For. Policy Econ.* **2017**, *78*, 151–161. [CrossRef]
104. Sierra-Huelsz, J.A.; Kainer, K.A. Tourism consumption of biodiversity: A global exploration of forest product use in thatched tropical resort architecture. *Geoforum* **2018**, *94*, 1–11. [CrossRef]
105. Sarukhán, J. *Capital Natural y Bienestar Social*; Comisión Nacional para el Conocimiento y Uso de la Biodiversidad: Mexico City, Mexico, 2006.

106. López, C.; Chanfón, S.; Segura, G. *La Riqueza de los Bosques Mexicanos: Mas Alla de la Madera: Experiencias de Comunidades Rurales*; Semarnat, Cifor, Conafor: Mexico City, Mexico, 2005.
107. Procuraduría Federal de Protección al Ambiente. Asegura PROFEPA 700 de Palma de Llano (Sabal Mexicana) y 510 Kilogramos de Carbón Vegetal en Bahía de Banderas, Nayarit. Available online: https://www.gob.mx/profepa/prensa/asegura-profepa-700-hojas-de-palma-de-llano-y-510-kg-de-carbon-vegetal-en-bahia-de-banderas-nayarit (accessed on 19 February 2020).
108. Wild Forest Consulting, S.C. *Documento Técnico Unificado Para el Aprovechamiento de Recursos Forestales Maderables y No Maderables en el Ejido Los Sauces, Mpio. de Tepalcingo, Morelos*; Forest management plan presented to Secretaría de Medio Ambiente y Recursos Naturales: Mexico City, Mexico, 2015.
109. Pazos-Almada, B.; Bray, D.B. Community-based land sparing: Territorial land-use zoning and forest management in the Sierra Norte of Oaxaca, Mexico. *Land Use Policy* **2018**, *78*, 219–226. [CrossRef]
110. Caro Gómez, R. *Personal Communication*; Comisión Nacional Forestal: Mexico City, Mexico, 2019.
111. DiGiano, M.; Ellis, E.; Keys, E. Changing landscapes for forest commons: Linking land tenure with forest cover change following Mexico's 1992 Agrarian Counter-Reforms. *Hum. Ecol.* **2013**, *41*, 707–723. [CrossRef]
112. Blancas Vázquez, J.J. Manejo de copal en un ejido del sur de Morelos: Diferencias entre prácticas locales y documentos técnicos. In *Seminario Normatividad de Productos Forestales no Maderables: Un Análisis a Múltiples Voces., Red Temática Productos Forestales No Maderables, Centro de Investigaciones Tropicales*; Universidad Veracruzana: Xalapa, Mexico, 2019.
113. Haeckel, I.B. The "Arco Floral": Ethnobotany of Tillandsia and Dasylirion spp. in a Mexican religious adornment. *Econ. Bot.* **2008**, *62*, 90–95. [CrossRef]
114. Barabas, A.M. La territorialidad indígena en el México contemporáneo. *Chungará* **2014**, *46*, 437–452. [CrossRef]
115. Baltazar, B.; Lugo, E.; Erin, I. Cultivar el Territorio Maya. In *Conocimiento y Organización Social en el Uso de la Selva*; El Colegio de la Frontera Sur, Universidad Iberoamericana: Mexico City, Mexico, 2011.
116. De la Hidalga Ledesma, V. Interculturalidad en la Universidad Veracruzana. In *Aprendizajes Entre Diversidad de Saberes Académicos y Comunitarios Hacia el Diálogo*; Universidad Veracruzana: Xalapa, Mexico, 2019.
117. Mathews, A.S. Unlikely alliances: Encounters between state science, nature spirits, and indigenous industrial forestry in Mexico, 1926–2008. *Curr. Anthropol.* **2009**, *50*, 75–101. [CrossRef]
118. Puc-Alcocer, M.; Arce-Ibarra, A.M.; Cortina-Villar, S.; Estrada-Lugo, E.I. Rainforest conservation in Mexico's lowland Maya area: Integrating local meanings of conservation and land-use dynamics. *For. Ecol. Manag.* **2019**, *448*, 300–311. [CrossRef]
119. Merino Pérez, L. *Revaloración de La Selva y Manejo Forestal: La Experiencia de La Organización de Ejidos Productores Forestales de La Zona Maya de Quintana Roo*; Universidad Nacional Autónoma de México: Mexico City, Mexico, 1997.
120. García, A. Problemática para la producción y aprovechamiento de Leña en la zona Nahua de Guerrero. In *Seminario: Retos Para Aprovechar el Potencial Forestal de México*; SEMARNAT, Iniciativa para el fortalecimiento del manejo forestal comunitario: Mexico City, Mexico, 2019.
121. Proselva Tropical de Quintana Roo, S.C. *Documento Técnico Unificado de Aprovechamiento Forestal en 4,200-00-00 Hectáreas en el Ejido Yoactún Del Municipio de Felipe Carrillo Puerto, Estado de Quintana Roo*; Forest Management Plan submited to Secretaria de Medio Ambiente y Recursos Naturales: Chetumal, Mexico, 2017.
122. Calvo Irabién, L.M.; Olmsted, I.C.; Durán García, R.; Macías-Cuellar, H.; Almanza, H. *Programa de Manejo Para la Palma Thrinax Radiata (Chit), en Los Ejidos de Kantunilkin, Solferino y Chiquilá-San Angel, Quintana Roo*; Centro de Investigacones Cientificas de Yucatan: Merida, Mexico, 1999.
123. Biodiversa Estudios Forestales, S.C. *Documento Técnico Unificado Aprovechamiento Forestal Maderable en el Ejido La Ilusión de Ávalos*; Forest Management Plan submited to Secretaria de Medio Ambiente y Recursos Naturales: Mexico City, Mexico, 2015.
124. Sierra-Huelsz, J.A. *Tourism and Forest Livelihoods: Linking Architecture with Tropical Forest Management*; University of Florida: Gainesville, FL, USA, 2016.
125. Proselva Tropical de Quintana Roo, S.C. Modificación del Programa de Manejo Forestal de Nivel Avanzado para el aprovechamiento de los recursos maderables en 1600 has. In *del Ejido Chancah Derrepente, Municipio Felipe Carrillo Puerto, Quintana Roo*; Forest Management Plan submited to Secretaria de Medio Ambiente y Recursos Naturales: Chetumal, Mexico, 2012.

126. Ledezma Santos, R. *Personal Communication*; Organización de Ejidos Productores Forestales de la Zona Maya, Felipe Carrillo Puerto: Mexico City, Mexico, 2014.
127. Reuter, M.; Schulz, C.; Marrufo, C. *Manual Técnico Forestal, Información Básica, Métodos y Procedimientos*; GTZ, Semarnap: Chetumal, Mexico, 1998.
128. Bautista, F.; Zinck, J.A. Construction of an Yucatec Maya soil classification and comparison with the WRB framework. *J. Ethnobiol. Ethnomed.* **2010**, *6*, 7. [CrossRef] [PubMed]
129. Snook, L.K.; Negreros-Castillo, P. Regenerating mahogany (Swietenia macrophylla King) on clearings in Mexico's Maya forest: The effects of clearing method and cleaning on seedling survival and growth. *For. Ecol. Manag.* **2004**, *189*, 143–160. [CrossRef]
130. Negreros-Castillo, P.; Mendoza, M.A.A.N.-M.; Mize, C.W.; Cámara-Cabrales, L. Peninsular Silvicultural Method. Slash and Burn Shifting Agriculture Means Forest Lands Remain Forested. In *ISTF Newsletter*; International Society of Tropical Foresters: Bethesda, MD, USA, 2018.
131. Negreros-Castillo, P.; Martínez-Salazar, I.; Aquino, C.Á.; Martínez, A.N.; Mize, C.W. Survival and growth of Swietenia macrophylla seedlings from seeds sown into slash and burn fields in Quintana Roo, Mexico. *Bois For. Des Trop.* **2018**, *337*, 17–26. [CrossRef]
132. Ellis, E.A. Centro de Investigaciones Tropicales. In *Personal Communication*; Universidad Veracruzana: Xalapa, Mexico, 2020.
133. González García, L. Centro de Investigación en Biodiversidad y Conservación. In *Personal Communication*; Universidad Autónoma del Estado de Morelos: Cuernavaca, Mexico, 2019.
134. Sierra Huelsz, J.A. Centro de Investigaciones Tropicales. In *Personal Communication*; Universidad Veracruzana: Xalapa, Mexico, 2019.
135. Pérez-Valladares, C.X.; Moreno-Calles, A.I.; Casas, A.; Rangel-Landa, S.; Blancas, J.; Caballero, J.; Velazquez, A. Ecological, Cultural, and Geographical Implications of Brahea dulcis (Kunth) Mart. Insights for Sustainable Management in Mexico. *Sustainability* **2020**, *12*, 412. [CrossRef]
136. Torres-García, I.; Rendón-Sandoval, F.J.; Blancas, J.; Casas, A.; Moreno-Calles, A.I. The genus Agave in agroforestry systems of Mexico. *Bot. Sci.* **2019**, *97*, 263–290. [CrossRef]
137. Colli-Balam, S.S. *Personal Communication*; Ejido X-Pichil: Quintana Roo, Mexico, 2019.
138. Peña Azcona, I. *Percepción Socio Ambiental de las Áreas Destinadas Voluntariamente Para la Conservación en el Istmo Oaxaqueño*; El Colegio de la Frontera Sur, San Cristóbal de las Casas: Mexico City, Mexico, 2015.
139. Almada-Alcalde, H.S.A.; Anchondo, T.; Palma, F.; Palma Aguirre, N. *Nuestra Vida Rarámuri en el Bosque*; Secretaría de Cultura, INAH, University of East Anglia: Chihuahua, Mexico, 2018.
140. Quechulpa, S. El programa Scolel-te'. In *Seminario: Retos Para Aprovechar el Potencial Forestal de México*; SEMARNAT, Iniciativa para el fortalecimiento del manejo forestal comunitario: Mexico City, Mexico, 2019.
141. Navarro-Martínez, A.; Palmas, S.; Ellis, E.A.; Blanco-Reyes, P.; Vargas-Godínez, C.; Iuit-Jiménez, A.C.; Hernández-Gómez, I.U.; Ellis, P.; Álvarez-Ugalde, A.; Carrera-Quirino, Y.G. Remnant trees in enrichment planted gaps in Quintana Roo, Mexico: Reasons for retention and effects on seedlings. *Forests* **2017**, *8*, 272. [CrossRef]
142. Antinori, C.; Bray, D.B. Community forest enterprises as entrepreneurial firms: Economic and institutional perspectives from Mexico. *World Dev.* **2005**, *33*, 1529–1543. [CrossRef]
143. Michon, G.; Nasi, R.; Balent, G. Public policies and management of rural forests: Lasting alliance or fool's dialogue? *Ecol. Soc.* **2013**, *18*, 30. [CrossRef]
144. Ortiz Navarro, F.A. *Personal Communication*; Comisión Nacional Forestal: Mexico City, Mexico, 2019.
145. Secretaría de Medio Ambiente, R.N.y.P. *Norma Oficial Mexicana NOM-006-RECNAT-1997, Que Establece Los Procedimientos, Criterios y Especificaciones Para Realizar el Aprovechamiento, Transporte y Almacenamiento de Hojas de Palma*; Diario Oficial de la Federacion: Mexico City, Mexico, 1997; pp. 35–42.
146. Illsley Granich, C.; Purata, S.E.; Edouard, F.; Pardo, M.; Tovar, C. Overcoming barriers in collectively managed NTFPs in Mexico. In *Wild Governance–Finding Policies That Work for Non-Timber Forest Products*; Earthscan: London, UK, 2010; pp. 205–228.
147. Klooster, D. Campesinos and Mexican forest policy during the twentieth century. *Lat. Am. Res. Rev.* **2003**, 94–126. [CrossRef]
148. Varns, T.; Cortez, R.; Hovani, L.; Kingsbury, P. *Yucatán Peninsula, Mexico: A Jurisdictional Approach to Conserving the Maya Forest*; The Nature Conservancy: Arlington, VA, USA, 2018.

149. Moreno-Calles, A.I.; Maldonado Canel, P.G.; Rosales Adame, J.J.; Rosete Vergé, F.A. Sistemas agroforestales y problemas ambientales en México: Los contextos, las éticas y las políticas. In *Los Sistemas Agroforestales de México: Avances, Experiencias, Acciones y Temas Emergentes en México*; Moreno-Calles, A.I., Ed.; Red Sistemas Agroforestales de México, Universidad Nacional Autónoma de México: Morelia, Mexico; pp. 983–1030. (In press)
150. Martinez Torres, H.L.; Pérez Salicrup, D.R. El papel del campesinado ante la regulación de los incendios forestales en México: Consecuencias inesperadas. *Perspect. Rural. Nueva Época* **2018**, *16*, 51–89. [CrossRef]
151. Jenkins, M. *Maya Gold: Mixing Ancient Farming Practices with Modern Science is Saving Forests in Mexico and Producing Better Crops*; Nature Conservancy Magazine: Arlington, VA, USA, 2017; pp. 28–39.
152. López Sierra, P. *De PROCAMPO a PROAGRO: Transformaciones de la Principal Política Pública Para el Campo Mexicano a Partir Del Libre Comercio*; Centro de Estudios para el Cambio en el Campo Mexicano: Mexico City, Mexico, 2019.
153. Pérez-Salicrup, D.R.; Ortíz Mendoza, R.; Garduño Mendoza, E.; Martínez-Torres, H.L.; Oceguera Salazar, K.A.; Quintero Gradilla, S.; Castillo Navarro, F.; Alvarado Celestino, E.; González Cabán, A. Coordinación institucional para la realización de quemas prescritas y quemas controladas en México. *Rev. Mex. De Cienc. For.* **2018**, *9*, 252–270. [CrossRef]
154. Martínez-Torres, H.L.; Pérez-Salicrup, D.R.; Castillo, A.; Ramírez, M.I. Fire management in a natural protected area: What do key local actors say? *Hum. Ecol.* **2018**, *46*, 515–528. [CrossRef]
155. Monzón-Alvarado, C.M.; Keys, E. Synergistic vulnerabilities: Climate variability and fire management policy increase farming challenges in southeastern Mexico. *Reg. Environ. Chang.* **2017**, *17*, 489–500. [CrossRef]
156. González-Insuasti, M.S.; Casas, A.; Méndez-Ramírez, I.; Martorell, C.; Caballero, J. Intra-cultural differences in the importance of plant resources and their impact on management intensification in the Tehuacán Valley, Mexico. *Hum. Ecol.* **2011**, *39*, 191–202. [CrossRef]
157. Burney, O.; Aldrete, A.; Alvarez Reyes, R.; Prieto Ruíz, J.A.; Sánchez Velazquez, J.R.; Mexal, J.G. México—Addressing challenges to reforestation. *J. For.* **2015**, *113*, 404–413. [CrossRef]
158. Guerra-De la Cruz, V.; Galicia, L. Tropical and highland temperate forest plantations in Mexico: Pathways for climate change mitigation and ecosystem services delivery. *Forests* **2017**, *8*, 489. [CrossRef]
159. COFOSA. *Estudio Regional Forestal 2010, Unidad de Manejo Forestal Cañada, Oaxaca*; Consultoría Forestal y Servicios Agropecuarios, S.A. de C.V., Comisión Nacional Forestal: Oaxaca, Mexico, 2009.
160. Purata, S.; Léon, C. Copal: Alimento de dioses y protector de humanos. In *La Riqueza de Los Bosques Mexicanos: Más Alla de la Madera: Experiencias de Comunidades Rurales*; López, C., Chanfón, S., Segura, G., Eds.; Semarnat, Cifor, Conafor: Mexico City, Mexico, 2005; pp. 86–91.
161. Dalle, S.P.; de Blois, S.; Caballero, J.; Johns, T. Integrating analyses of local land-use regulations, cultural perceptions and land-use/land cover data for assessing the success of community-based conservation. *For. Ecol. Manag.* **2006**, *222*, 370–383. [CrossRef]
162. Dalle, S.P.; de Blois, S. Shorter fallow cycles affect the availability of noncrop plant resources in a shifting cultivation system. *Ecol. Soc.* **2006**, *11*, 2. [CrossRef]
163. Secretaría de Desarrollo Urbano y Ecologia. *Ley General Del Equilibrio Ecológico y Protección al Ambiente*; Diario Oficial de la Federacion: Mexico City, Mexico, 1988; pp. 24–58.
164. Secretaría de Gobernación. *Decreto Por el Que se Reforma el Artículo 27 de la Constitución Política de Los Estados Unidos Mexicanos*; Diario Oficial de la Federacion: Mexico City, Mexico, 1992.
165. Carías Vega, D. Community-based forestry and community forestry enterprises in Quintana Roo, Mexico and Petén, Guatemala: How have policies, history, and culture shaped their trajectories? *J. Sustain. For.* **2019**, *38*, 651–669. [CrossRef]
166. Bray, D.B.; Duran, E.; Hernández-Salas, J.; Luján-Alvarez, C.; Olivas-García, M.; Grijalva-Martínez, I. Back to the future: The persistence of horse skidding in large scale industrial community forests in Chihuahua, Mexico. *Forests* **2016**, *7*, 283. [CrossRef]
167. Turnhout, E.; Tuinstra, W.; Halffman, W. *Environmental Expertise: Connecting Science, Policy and Society*; Cambridge University Press: Cambridge, UK, 2019.
168. Secretaría de Medio Ambiente y Recursos Naturales. Conafor Apoya a 53 Pueblos Indígenas, Quienes Contribuyen a la Preservación de los Bosques y Selvas. Available online: https://www.gob.mx/semarnat/prensa/conafor-apoya-a-53-pueblos-indigenas-quienes-contribuyen-a-la-preservacion-de-los-bosques-y-selvas (accessed on 19 February 2020).

169. CONAFOR. Pedir Permiso al Bosque. Available online: https://www.gob.mx/conafor/articulos/pedir-permiso-al-bosque (accessed on 19 February 2020).
170. Kull, C.A. Madagascar aflame: Landscape burning as peasant protest, resistance, or a resource management tool? *Political Geogr.* **2002**, *21*, 927–953. [CrossRef]
171. Padoch, C.; Pinedo-Vasquez, M. Saving slash-and-burn to save biodiversity. *Biotropica* **2010**, *42*, 550–552. [CrossRef]
172. Martínez-Torres, H.L.; Castillo, A.; Ramírez, M.I.; Pérez-Salicrup, D.R. The importance of the traditional fire knowledge system in a subtropical montane socio-ecosystem in a protected natural area. *Int. J. Wildland Fire* **2016**, *25*, 911–921. [CrossRef]
173. Chazdon, R.L. Tropical forest recovery: Legacies of human impact and natural disturbances. *Perspect. Plant Ecol. Evol. Syst.* **2003**, *6*, 51–71. [CrossRef]
174. Nigh, R.; Diemont, S.A. The Maya milpa: Fire and the legacy of living soil. *Front. Ecol. Environ.* **2013**, *11*, e45–e54. [CrossRef]
175. Ellis, E.A.; Romero Montero, J.A.; Hernández Gómez, I.U. Deforestation processes in the state of Quintana Roo, Mexico: The role of land use and community forestry. *Trop. Conserv. Sci.* **2017**, *10*, 1940082917697259. [CrossRef]
176. Maza-Villalobos, S.; Cotler, H.; Almeida-Leñero, L.; Hoth, J.; Steinmann, V.; Mastretta, A.; Rodrigo, A. Conservando el pastizal alpino mexicano. Conocimientos, amenazas y esperanzas. *Biodiversitas* **2019**, *142*, 12–16.
177. López Binnqüist, C.; Hidalgo Ledesma, R.; Panzo Panzo, F. "Keeping our milpa": Maize production and management of trees by Nahuas of the Sierra de Zongolica, Mexico. In *Indigenous Knowledge: Enhancing Its Contribution to Natural Resources Management*; Sillitoe, P., Ed.; CABI Publishers: Abingdon, UK, 2017; pp. 40–50.
178. Veldman, J.W.; Overbeck, G.E.; Negreiros, D.; Mahy, G.; Le Stradic, S.; Fernandes, G.W.; Durigan, G.; Buisson, E.; Putz, F.E.; Bond, W.J. Where tree planting and forest expansion are bad for biodiversity and ecosystem services. *BioScience* **2015**, *65*, 1011–1018. [CrossRef]
179. Bocco, G. Qué tan alta puede resultar la acta tecnología en el trabajo académico-comunitario? In *Saberes colectivos y diálogo de saberes en México*; Argueta Villamar, A.C.-M., Hersch, P., Eds.; Universidad Nacional Autónoma de México, Centro Regional de Investigaciones Multidisciplinarias: Cuernavaca, Mexico, 2011; pp. 51–58.
180. Carbajal Morales, E.; de la Cruz Cortés, A. *Pasos Básicos Para Elaborar un Estatuto Comunal*; Tequio Jurídico, A.C., Ed.; Oaxaca: Oaxaca, Mexico, 2013; p. 19.
181. CCMSS. *Política Ambiental y Sustentabilidad Desde la Sociedad Civil Del Sur Sureste de México*; Consejo Civil Mexicano para la Silvicultura Sostentible and other 26 organizations: Oaxaca, Mexico, 2019.
182. Guibrunet, L.; Gerritsen, P.R.W.; Sierra-Huelsz, J.A.; Flores-Díaz, A.C.; García-Frapolli, E.; García-Serrano, E.; Pascual, U.; Balvanera, P. Barriers to the Recognition of Local Value—Systems: Insights from Conservation Best-Practice in four Mexican Forests. forthcoming.
183. Durand, L. Naturalezas desiguales. In *Discursos Sobre la Conservación de la Biodiversidad en México*; Universidad Nacional Autónoma de México: Mexico City, Mexico, 2017; p. 158.
184. Merino, L. Rights, pressures and conservation in forest regions of Mexico. In *Environmental Governance in Latin America*; de Castro, F., Hogenboom, B., Baud, M., Eds.; Palgrave Macmillan, London: New York, NY, USA, 2016; pp. 234–256.
185. Ibarra, J.T.; Barreau, A.; Campo, C.D.; Camacho, C.I.; Martin, G.J.; McCandless, S.R. When formal and market-based conservation mechanisms disrupt food sovereignty: Impacts of community conservation and payments for environmental services on an indigenous community of Oaxaca, Mexico. *Int. For. Rev.* **2011**, *13*, 318–337. [CrossRef]
186. Krylov, A.; Steininger, M.K.; Hansen, M.C.; Potapov, P.V.; Stehman, S.V.; Gost, A.; Noel, J.; Talero Ramirez, Y.; Tyukavina, A.; Di Bella, C.M. Contrasting tree-cover loss and subsequent land cover in two neotropical forest regions: Sample-based assessment of the Mexican Yucatán and Argentine Chaco. *J. Land Use Sci.* **2018**, *13*, 549–564. [CrossRef]
187. Conafor officer. Centro de Investigaciones Tropicales. In *Personal Communication*; Universidad Veracruzana: Xalapa, Mexico, 2019.

188. Snook, L.; Jimenez, V.S.; Mundo, M.C.; Rivas, C.C.; Ek, F.M.; Kantún, P.M.; Hernández, C.H.; Morales, A.N.; Ruíz, C.E. Managing natural forests for sustainable harvests of mahogany (Swietenia macrophylla): Experiences in Mexico's community forests. *Unasylva* **2003**, *54*, 68–73.
189. Haenn, N. The middle-class conservationist: Social dramas, blurred identity boundaries, and their environmental consequences in Mexican conservation. *Curr. Anthropol. World J. Sci. Man* **2016**, *2*, 197–218. [CrossRef]
190. López Arzola, R.; Gerez Fernandez, P. The permanent tension. *Cult. Surviv. Q.* **1993**, *17*, 42–44.
191. Torres, J.M. *Desarrollo Forestal Comunitario: La Política Pública*; Centro de Investigacion y Docencia Económicas: Mexico City, Mexico, 2015; Volume 21.
192. Ellis, E.A.; Montero, S.A.; Gómez, I.U.H.; Montero, J.A.R.; Ellis, P.W.; Rodríguez-Ward, D.; Reyes, P.B.; Putz, F.E. Reduced-impact logging practices reduce forest disturbance and carbon emissions in community managed forests on the Yucatán Peninsula, Mexico. *For. Ecol. Manag.* **2019**, *437*, 396–410. [CrossRef]
193. Sánchez Méndez, L. Centro de Investigaciones Tropicales. In *Personal Communication*; Universidad Veracruzana: Xalapa, Mexico, 2019.
194. Cronkleton, P.; Pulhin, J.M.; Saigal, S. Co-management in community forestry: How the partial devolution of management rights creates challenges for forest communities. *Conserv. Soc.* **2012**, *10*, 91–102. [CrossRef]
195. Latulippe, N.; Klenk, N. Making room and moving over: Knowledge co-production, Indigenous knowledge sovereignty and the politics of global environmental change decision-making. *Curr. Opin. Environ. Sustain.* **2020**, *42*, 7–14. [CrossRef]
196. Castree, N. *Making Sense of Nature*; Routledge: Abingdon, UK, 2013.
197. Brockington, D.; Duffy, R.; Igoe, J. *Nature Unbound: Conservation, Capitalism and the Future of Protected Areas*; Routledge: Abingdon, UK, 2012.
198. Büscher, B.; Sullivan, S.; Neves, K.; Igoe, J.; Brockington, D. Towards a synthesized critique of neoliberal biodiversity conservation. *Capital. Nat. Soc.* **2012**, *23*, 4–30. [CrossRef]
199. Carton de Grammont, H. La nueva ruralidad en América Latina. *Rev. Mex. De Sociol.* **2004**, *66*, 279–300. [CrossRef]
200. Hecht, S.B. Forests lost and found in tropical Latin America: The woodland 'green revolution'. *J. Peasant. Stud.* **2014**, *41*, 877–909. [CrossRef]
201. Hecht, S. The new rurality: Globalization, peasants and the paradoxes of landscapes. *Land Use Policy* **2010**, *27*, 161–169. [CrossRef]
202. Sims, K.R.; Alix-Garcia, J.M. Parks versus PES: Evaluating direct and incentive-based land conservation in Mexico. *J. Environ. Econ. Manag.* **2017**, *86*, 8–28. [CrossRef]
203. Carter, E.D.; Silva, B.; Guzmán, G. Migration, acculturation, and environmental values: The case of Mexican immigrants in central Iowa. *Ann. Assoc. Am. Geogr.* **2013**, *103*, 129–147. [CrossRef]
204. Martínez-Ballesté, A.; Martorell, C.; Caballero, J. Cultural or ecological sustainability? The effect of cultural change on Sabal palm management among the lowland Maya of Mexico. *Ecol. Soc.* **2006**, *11*, 2. [CrossRef]
205. Saynes-Vasquez, A.; Vibrans, H.; Vergara-Silva, F.; Caballero, J. Intracultural differences in local botanical knowledge and knowledge loss among the Mexican Isthmus Zapotecs. *PLoS ONE* **2016**, *11*, 3. [CrossRef] [PubMed]
206. Robson, J.; Klooster, D.; Worthen, H.; Hernández-Díaz, J. Migration and agrarian transformation in Indigenous Mexico. *J. Agrar. Chang.* **2018**, *18*, 299–323. [CrossRef]
207. Gall, O. Mexican long-living mestizophilia versus a democracy open to diversity. *Lat. Am. Caribb. Ethn. Stud.* **2013**, *8*, 280–303. [CrossRef]
208. Saldívar, E. Uses and abuses of culture: Mestizaje in the era of multiculturalism. *Cult. Stud.* **2018**, *32*, 438–459. [CrossRef]
209. Alexiades, M.N.; Peters, C.M.; Laird, S.A.; López Binnqüist, C.; Castillo, P.N. The missing skill set in community management of tropical forests. *Conserv. Biol.* **2013**, *27*, 635–637. [CrossRef]
210. Arts, B.; Appelstrand, M.; Kleinschmit, D.; Pülzl, H.; Visseren-Hamakers, I.; Atyi, R.E.A.; Enters, T.; McGinley, K.; Yasmi, Y. Discourses, Actors and Instruments in International Forest Governance. In *Embracing Complexity: Meeting the Challenges of International Forest Governance. A Global Assessment Report*; IUFRO World Series Volume 28; IUFRO: Vienna, Austria, 2010; pp. 57–74.
211. Mertz, O.; Mertens, C.F. Land sparing and land sharing policies in developing countries—Drivers and linkages to scientific debates. *World Dev.* **2017**, *98*, 523–535. [CrossRef]

212. Smith, D.A.; Herlihy, P.H.; Kelly, J.H.; Viera, A.R. The certification and privatization of indigenous lands in Mexico. *J. Lat. Am. Geogr.* **2009**, *8*, 175–207. [CrossRef]
213. Vázquez-Castillo, M.T. *Land Privatization in Mexico: Urbanization, Formation of Regions and Globalization in Ejidos*; Routledge: New York, NY, USA, 2004.