

OPEN

3

Indigenous Knowledge in Mexico: Between Environmentalism and Rural Development

Mina Kleiche-Dray and Roland Waast

Introduction

Since the 1990s, several international agreements (Article 8J of the Biological Diversity Convention, 1992) and international protocols (Nagoya Protocol, 2010) have begun to assess the capacity of indigenous knowledge to contribute to socioeconomic progress as well as to environmental protection. In the course of this process, the knowledge and practices of peasants and natives have been called to the rescue to resolve a number of new problems. These include the loss of biodiversity, threats from carbon dioxide emissions and environmental conservation, with consequent debates about the property rights of local and autochthonous populations – such as that on “biopiracy” versus “bioprospection”. However, the farming methods favoured by the indigenous populations often conflict with national development projects oriented towards the market economy. This discrepancy gives rise to tensions and to local, national and international conflicts that can be observed throughout Latin America. They are typified in a country such as Mexico, which will serve here as an example. Mexico has been the subject of a number of studies¹ and is often seen as a laboratory of both ideas and long-term development projects related to these issues. It has 12% of the biodiversity of the planet; natural vegetation occupies more than 71% of its territory, and its forest resources occupy 64.8 million Ha,² 70% of which belong to autochthonous and peasant communities (OCDE, 2013). Agriculture remains a highly important activity in the country, covering 24% of the territory (102 million Ha), of which half is *ejidataria* (communal land covered by extension services). Some

16 million of its 112 million inhabitants identify themselves as belonging to the *población indígena* and 7 million speak a native language. The population that lives in the areas of greatest biodiversity is generally classified as being one of the poorest. Some 88% of the 1,033 indigenous municipalities are classified as being in “great poverty”. In fact, Mexico is the country that has the most revealing poverty rate in the OCDE.³ Furthermore, its natural resources are deteriorating, under pressure from grazing, from slashing and burning brush in preparation for tillage, from excessive tillage and from intensive irrigation (OCDE, 2007). In this context, more and more social movements and proponents of environmental projects – such as the local branch of *Vía Campesina* – have emerged. They rely on autochthonous knowledge in the struggle against the rapid expansion of intensive agriculture, the monoculture of GM organisms, extensive ranching, biofuels, land-grabbing and extractive industries.

Of course, these social movements are by no means recent. However, everything indicates that they have gained a fresh impulse from the institutionalization of a national environmental policy, the boom of alternative rural development projects and the initiatives of new actors, such as movements of identity assertion and the national and international NGOs that support them (i.e. GRAIN).

These new actors favour decentralized management of natural resources, the setting up of local seed banks, the promotion of an agriculture free from chemical inputs, and the development of local markets. Family farming and small-scale agriculture – a political category that also covers the agricultural practices of the native and peasant populations – constitute the prime area targeted by their projects. In this complex context, “developmentalist” policies enter into competition with new projects classified as “socioenvironmental” (Léonard and Foyer, 2011).

New issues consist of the acknowledgement of indigenous and peasant knowledge, and its inclusion in the design, elaboration, implementation, execution and evaluation of projects that support family and small-scale agriculture.

Similarly, questions have arisen regarding ways of setting up a national environmental project that would involve native and peasant populations as well as new actors – NGOs, state and municipal authorities, and national and international private organizations (including large farmers and multinational firms) – in governance and decision-making. How can a sustainable and equitable use of natural resources be guaranteed? Is such an environmental project compatible with a particular development project?

This chapter focuses on the sociocognitive dynamics underlying the practical use of natural resources in family and small-scale agriculture. We shall first review the literature in social science studies and in Latin-American post-colonial studies on these dynamics. We shall then turn to the treatment of indigenous knowledge in mainstream social sciences and its promotion by certain policy-makers. Finally we will analyse the pragmatic combination of autochthonous and scientific knowledge in the process of governance, incorporating environmental matters by means of constant political, local and historical reconfiguration. These field perspectives are based on work in the Mixteca region (State of Oaxaca, Mexico).

Decolonizing indigenous and peasant knowledge

The objective of this chapter is to understand how, on the one hand, indigenous and peasant knowledge penetrates technoscientific knowledge and how, on the other hand, it becomes part of rural-development projects and environmental issues. Of major help in this attempt are the general concepts of “translation” (Callon and Latour, 1981; Akrich et al., 2006), “boundary-object” (Leigh Star and Griesemer, 1989; Trompette and Vinck, 2009) and “transcodification” (Lascoumes, 1994). They have been forged in the field of social studies of science in order to deal with similar problems (Callon, 1986 on scientists, fishermen and the plan to breed sea shells). These concepts postulate a continuity between the logics of knowledge production and political logics, and a centrality of the dynamics of translation and hybridization in different epistemic spheres (Harding, 1997). Social studies of science examine the mediations between knowledge of differing types (and especially between scientific and profane knowledge), and between scientific knowledge and the political logics involved in action.⁴

Meanwhile, the anthropology of local knowledge has analysed the categories grouped under the term “traditional knowledge”. Agrawal (1995, 2002) points out the context of their use (and the political dimensions involved in asymmetrical exploitation of this knowledge compared with that of “scientific knowledge”), particularly in development projects. In regard to environmental issues, several authors have stressed the embedding of different types of knowledge in their conditions of production, their historical, social and institutional settings, and the need to study the full context of practices and circulation when they are put into operation (Fairhead and Leach, 2003; Goldman et al., 2011).⁵ All these aspects have to be analysed if one is to understand exchanges

between types of knowledge and the construction of new hybridized forms in the processes of environmental governance. These various types of knowledge also have to be viewed in the asymmetrical perspective of North/South encounters (Gaillard et al., 1997; Escobar, 1995; Waast, 1996) and centre/periphery geopolitical relationships (Polanco, 1989; Raj, 2007).

Other useful perspectives have been developed over the last 15 years in Latin American post-colonial studies (Escobar, 2003; Boidin, 2010). Their Latin American proponents (e.g. in the Modernity/Coloniality/Decoloniality (M/C/D) programme, school of thought represented in Latin America) have catalysed a current of critical rethinking of “Eurocentric modernity”. Using the notion of coloniality of power and of knowledge (Quijano, 1994; Lander, 2000; Mignolo, 2000; Dussel, 2007), the M/C/D programme describes colonization in a much more complex way, going beyond the conventional analysis in terms of political and economic oppression. A racial and ethnic classification of the world has given rise to a cultural oppression in which only one type of awareness and a single form of reason are taken into account. It is on this basis that geocultural identities have been attributed to the regions and populations of the world (Crespo, 2014).

The notion of “coloniality” reveals three parallel processes of “modernization”: (1) the exclusion of other cultures or civilizations from participation in the construction of modernity; (2) the imposition of geocultural identities (Crespo, 2014); and (3) the exclusion of any forms of knowledge (other than the colonial) in the historical construction of the world. The M/C/D programme is an invitation to perform a “decolonial spin” (Castro Gomez and Grosfoguel, 2007) that involves taking into account the various places of enunciation and their critical or resistant approach towards colonial modernity. The programme uses the notion of “frontier epistemology” (Mignolo, 2007) to rewrite the narrative of modernity from alternative standpoints, re-evaluating dominated cultures and peoples and their histories of resistance. It aims, for instance, to retell the history of Latin America by taking into account relationships between society and nature.

The essential “coloniality of nature” in Latin America is linked to the disruption of indigenous ecosystems and methods of production, annulling the potential autonomy of these societies (Leff, 1986; Castro Herrera, 1996) and leading to a “subalternation” of the dominated bodies of both human beings and nature (Castro-Gómez, 2005). Arturo Escobar uses the concept of “nature regimes” to define the processes, articulating modes of perception and experience that determine the

ways of using space. These processes are identified as “resistance”, “compromise” and “hybridization”.

Taken up by political ecology, along with the notion of “colonized nature” (Escobar, 2011), this sort of thinking enables us to understand that the categories of “traditional knowledge” and “local knowledge” can only be grasped in opposition to that of “scientific knowledge”. All knowledge is produced within social, political and economic relationships of certain types. And the actors who promote one or another type of knowledge in modern society always do so through a binary classification: modernity/coloniality or universality/pluriversity.

“Decolonizing nature” involves understanding, first and foremost, how “subaltern knowledge” has been identified and characterized by science – that is, disqualified, and sometimes reappropriated in downgraded form as a mere resource – and also the ways in which all actors relate to nature. Nature is not merely seen as a resource but in a different framework altogether: as culture.

From “traditional and local” to “indigenous” knowledge

This statement by A. Escobar leads us to examine the ways in which mainstream science has treated indigenous knowledge.

In the early 1980s, agronomists, in evaluating the technical component of farmers’ agricultural practices, began to write about indigenous knowledge and know-how. The agronomists resumed observations and studies made by naturalists, ethnologists and linguists during and after the colonial period, focusing on instruments (tools), crop rotation, preparation of the land and so on. Within the social sciences, specialists in “development” subsequently took up the topic, accompanied by a few anthropologists.⁶ This eventually muted into a craze, despite the fact that level-headed specialists stressed that local knowledge should not be made into a fetish.

In the 1990s the notion moved from agricultural questions to environmental studies, passing from issues of production and productivity to those of conservation and the management of natural resources. It came to the attention of experts, research centres and international organizations (Bell, 1979; Chambers, 1988). Many anthropologists climbed on the bandwagon. Their intervention opened up two distinct perspectives. On the one hand, the majority supported recognition of traditional knowledge, as it represented for them – at the very least – new fields of study, new sources of finance for applied anthropology, and access to a “specialist” status. On the other hand,

the term “indigenous knowledge” began to develop as a more militant concept, highlighting the dependence and marginalization of “indigenous” peoples. This latter term differs from the previously predominant notions of “traditional” and “local knowledge”, which have now come to be seen as condescending. The former term is linked to a modernizing project for society, and the latter to the universality of “scientific knowledge”. These two notions enabled that of “indigenous knowledge” to emerge as a relatively open-minded alternative. Its promoters stressed that indigenous knowledge cannot be reduced to a recipe for development (Agrawal, 1995; Sillitoe, 1998). The notion of “indigenous knowledge” has been instrumental to the recognition of local knowledge in the legal field, in that of intellectual property rights and more generally in the right of peoples to their own culture.

Work on this subject continued to develop in the 2000s, massively appropriated in environmental studies and anthropology. In these circles, there has been passionate debate on the subject. The arguments deployed have often helped “indigenous” peoples and peasants to obtain the benefits brought about by development as well as greater political autonomy.⁷ The journal *Human Ecology* has become a major vector of this environmental and anthropological work.⁸ The notion of “traditional knowledge” has since followed its own developmental path, with a strong environmental focus. Many authors use the two concepts – traditional and indigenous – interchangeably (Godoy et al., 2005).

As for Latin America, the local history of all these notions is not very different. The term “indigenous knowledge” appeared very early on and spread primarily through Brazil, Mexico, Bolivia and Chile. Interestingly, it eventually deserted scientific literature and was linked mainly to social movements. At present there are few studies published on the topic in the social sciences and humanities. Possibly the recognition of intellectual property rights after the Rio Conference in 1992 put an end to debate in the region.⁹

Very few studies deal with the way in which companies avoid complex negotiations with local communities – buying, for example, medicinal plants on local markets, and hiring and training collectors and growers of plants required for natural cosmetics. Likewise, few authors now undertake studies of traditional knowledge in regard to medicinal plants, experiments with traditional knowledge in public health services, and discussions about climate change and other current issues.

While the term “indigenous knowledge” has been fading out, that of “agroecology” has grown in popularity, especially in Latin America. Agroecology as a scientific field valorizes native and peasant farming

practices as a socioproductive alternative to modern agriculture (Altieri et al., 2006) that is also environmentally friendly. According to its protagonists, native and peasant practices can inspire the ecological scientific approach and at the same time become a sustainable way of farming.

Scientific and institutional interest in indigenous and peasant farming practices is not really new, however. In Mexico, a key figure in this intellectual tradition was Efraim Hernandez Xolocotzi (known as Efraim H.X.), an agronomist who was educated in the USA and taught at the University of Chapingo. He was called back to Mexico to support the Green Revolution at its very beginning but soon became critical of it (Jiménez Sánchez, 1984). He contributed to the creation of an agroecological movement in Mexico. Basically, his objective was to show how important it was to study traditional agrosystems, stressing the fact that resource scarcity drives man's creativity and encourages him to develop a set of cultural and productive practices to adapt to the environment and to the conditions of production (Díaz León and Cruz León, 1998). According to Efraim H.X. and his disciples, especially Victor Toledo (1992), "the indigenous model" of agriculture can serve as a basis for the development of agroecological knowledge and practices. In the 1980s a socialist current in Mexico – consisting primarily of biologists, ethnobotanists and agronomists – joined in social and environmental thinking and engaged directly with native and peasant communities.

Agroecology has been politicized in different ways for different purposes, depending on whether it is being promoted by academic activists, by peasants, by religious militants, by agronomy advisors or by officials. This can be said about projects ranging from the design of public policies to initiatives of an extremely local nature. This is what we will now discuss, tracing this shift in the political field and, in particular, in public rural development policies aimed at small-scale family farming.

Indigenous knowledge as a lever for rural development and environmental policies

After a period of liberalization of structural adaptation plans following the financial crisis of 1982 – which resulted in the ratification of the North American Free Trade Agreement (NAFTA) and the political and financial crisis of 1994–2005 – Mexican agriculture had to face international competition in a context of market deregulation and trade liberalization. A policy of food security¹⁰ replaced that of food self-sufficiency, which had been the credo of agrarian reform and the Green Revolution. By the 1990s the *ejidos* had been privatized and extension

services reduced. As a result, foreign purchases of foodstuffs increased (Warman, 2001).¹¹

Nevertheless, political discourse has continued to defend the importance of developing autonomous and efficient agrifood systems. In a country where only 6% of farmers are classified as “modern”,¹² the Mexican Government has had to propose various programmes and measures to mitigate the impacts of rising food prices for the poorest strata of the population (Gravel, 2009). The main measures aimed at the poorest farmers were a distribution of grants according to cultivated acreage (such as the so-called Procampo Programme) and aid to the poorest women (Progresa/Oportunidad). The less marginalized categories were urged to adopt the Green Revolution technology package (hybrids, fertilizers, pesticides and mechanization) in programmes such as Object Income and Masagro.

Thus in 2007 the state designed a new national policy for rural development as a whole. With the programme *Nuevo Programa Especial Concurrente* (PEC), the government began to take an interest in the integration of the native and peasant population into national development. This PEC was launched in areas of great and very great marginalization, the population itself taking part, thanks to the organization of a forum (*Foro de Consulta Popular*), to which all stakeholders in the rural sector were invited.¹³

However, only 15.7% of all financial resources considered in the PEC were directed towards the support of agricultural food production (Gomez-Oliver, 2008). Furthermore, programmes that targeted small farmers – either by distributing a technology package or by granting subsidies – encouraged deforestation, and this gave rise to further intensification of farming.

This seems to be at odds with the aim of developing a national environmental policy. Yet ratification of the Convention on Biological Diversity and recognition of native struggles (in the San Andrés agreements of 1994) finally led to the creation of the Environment Ministry (the Secretariat of the Environment and Natural Resources/Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)) in 1994. An environmental policy that attempts to integrate the international standards of Agenda 21¹⁴ was established. In 2000 a National Plan for Sustainable Development was adopted. To top it off, in 2000 the Mexican Constitution was changed so as to acknowledge the cultural and ethnic diversity of Mexican society. This particular interest has been reinforced since 2007 in the sustainable development programmes in which ecological viability is treated as one of the five cornerstones of federal action. This functions in tandem with the Sector Programme for the Environment

and Natural Resources, the objective of which is to “associate the conservation of natural capital with economic and social development” (OCDE, 2013: 40). The dual process involved in the recognition of indigenous knowledge has thus been made part of the development pattern for agricultural and environmental policies.

In this dual ministerial context, the Mexican Government undertook the task of integrating the participation of the native and peasant population into its agricultural policy and also into its political agenda, thereby institutionalizing national environmental policy.

The Ministry of the Environment has confirmed that “the native populations that maintain a very close link with natural resources and biodiversity actively support sustainable development through on-site conservation of ecosystems and natural habitats, and the maintenance and recuperation of viable populations of species in their natural surroundings”.¹⁵

In 1997 the Ministry of the Environment initiated the Conservation and Restoration Programme of soils. In 1998 it launched the National Reforestation Programme and other programmes that sought to combine economic and social development with environmental conservation. The objective was to devote economic resources to National Protected Areas and to the restoration of regions identified as priorities from an environmental perspective.

The main tools that the government has used have always been aimed at the conservation of biodiversity and of forests, in accordance with the National Strategy for Biodiversity (2000), complemented by the Mexican Strategy for the Conservation of Plants (which has existed since 2008 and was revised in 2012) and subsequently enhanced by the National Strategy combating invasive species. Major programmes within this framework have been specifically dedicated to native and peasant populations.

A twist was introduced, however, when the Ministry of the Environment developed its Regional Sustainable Development Programme (*Programa de Desarrollo Regional Sustentable* (PRODERS)) in an attempt to link the environmentalist vision to a developmentalist one. The programme was presented as a comprehensive initiative by means of which SEMARNAT contributed to the support of sustainable development in poor rural regions. These regions often include native and peasant populations who live where the major biological and environmental riches are located, far from the rural nodes. The management of this programme was supposed to be decentralized and participative, based on a long-term vision (Toledo and Bartra, 2000).

Thus it would seem that – despite almost ten years of government efforts to institutionalize an environmental policy linked to the development of sustainable agriculture in the most disadvantaged areas of the country – most observers agree that the main thrust of agricultural policy has been, and remains, the pursuit of greater productivity (OCDE, 2013). The bulk of financial resources are still being oriented towards commercial agriculture and “modern farmers”: the most important subjects in the sector. This conclusion is congruent with the criticism emanating from the post-colonial school, which interprets from these policies a vision based on denial of all rationality and veritable knowledge in other forms of culture. This attitude does not leave room for any concepts other than those of a modernizing society and its links to high-productivity projects. Ultimately, it leaves no space for plurality or, in the words of Arturo Escobar, “pluriversity” (Escobar, 2011). Although this trend presents itself globally, the fact remains that conflicting logics – even at a government level – mean that heterogeneous projects are now being implemented for merely practical reasons. Several studies have attempted to bring visibility to the success of various local experiences that overcome this contradiction between developmental and environmental concerns. The government – notably two ministries (Environment and Agriculture: SEMARNAT and SAGARPA (*Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación*)) – gave direct or indirect support to these local experiences, particularly (a recent development) various civil society groups that had made progress in the conservation of soil and water, the protection of biodiversity and wildlife, and the autonomy of their food systems. We shall now describe a case of this sort that illustrates the importance of practical reason in action.

Towards an institutionalization of native and peasant knowledge

We will now deal with a case study that needs to be contextualized. Its whole story takes place in the Mixteca Region of Oaxaca, Mexico. To begin, we will discuss traditional knowledge and its evolution over the course of time.

Construction of agricultural knowledge and practices, and their exchange over the course of time

The Mixteca region of south-east Mexico covers the eastern part of Oaxaca state. It extends over an area of 4 million Ha, in which there are

221 municipalities, 155 of them located in the state of Oaxaca. It is in the Mixteca region that the largest “indigenous population” of Mexico is concentrated, with more than 1 million people (34% of the Oaxaca population)¹⁶ (INEGI, 2010). *Mixtec* inhabitants belong, however, to a diversity of peoples: Chochoiteca, Tlapaneca, Nahuatl, Triqui, Zapotec and Amuzgo (Rivas Guevara et al., 2009). Their history is traversed by episodes of expropriation and reappropriation of their land.

The Aztecs and later the Spanish colonized the region and divided local political entities into small communities, grabbing the best land. Since the Mexican independence, the Agricultural Reform has redistributed the *haciendas* (large farming units) into *ejidos*, the privatization of which has been authorized by federal law since the 1990s. The result has been a broad diversity of land use and tenure in the native and peasant communities of the *Mixteca* – *bienes comunales* (commons), *ejidos* (public lands with extension services), *tierras de uso común* (collective lands managed by means of community meetings) and *tierras privadas* (private lands). Control is highly concentrated: 1.7% of the *ejidos* and communities control 70% of the land, and 0.41% of the private properties cover 20% of the total of privatized lands. Thus more than 85% of private units and *ejidos* are smaller than 5 Ha (Sanchez Lopez, 2013). This inequality has generated agrarian conflicts that continue to this very day.

However, despite this conflict-ridden history, periods of tranquillity have made it possible to introduce new plants, and new techniques of cultivation and food preparation, since colonization. This has been due to exchanges among communities during religious festivals and at markets, and migration to other regions (Katz, 1994, 2002). During the colonial period, the cultivation of wheat and sugarcane, extensive ranching, and the breeding of silkworms and cochineal progressed, gaining economic importance (Long and Attolini, 2009; Lazos, 2012). With the decline of the silk industry and cochineal at the end of the nineteenth century, artisanal palm weaving gained importance, driven primarily by the Spaniards, who managed to establish an international market. On the other hand, deforestation and the erosion of soils worsened when goats were introduced and lime was exploited (Velásquez, 2002).

Subsequently the Mexican Government’s “developmentalist” project also had an impact on these dynamics, by influencing local agricultural practices. From 1935 to 1988, the Mexican Government implemented more than 19 “developmentalist” programmes (Altieri et al., 2006) dedicated to crops ranging from cochineal, fruit trees, coffee, hybrid corn,

and vegetables to livestock and the improvement of agricultural infrastructure. During the 1970s the government also tried to promote a Green Revolution technology package (improved seeds, mechanization, the use of fertilizers and chemical pesticides) by means of aids and extension services within the framework of its Integrated Rural Development Programme (*Programa Integral de Desarrollo Rural* (PIDER)). Though PIDER achieved a significant volume of production, it led to the loss of native varieties of maize, beans and squash; the contamination of soil and water; the overexploitation of aquifers; deforestation; and soil erosion (Altieri et al., 2006).

The government saw the main problems of the Mixteca as matters of water and soil. By the 1970s, it tried to recover the Mixtecan technique of terraced agriculture that the inhabitants had lost (Mendoza García, 2002, 2004). This had been used in small valleys and heavy rainfall areas. The federal government attempted to restore the ancient terraces using heavy machinery. Facing poor results, it decreed that the Mixteca was unable to sustain the development of an alimentary agriculture. The main replacement project was to plant palm trees to supply a craft industry. As of 1973, weavers were organized into cooperatives (Velasco Rodríguez, 1994) supported by the Palm Trust (Fideicomiso de la Palma (FIDEPAL)). Unfortunately, the government neither managed to consolidate this cottage industry nor to diversify the uses of woven palm fibre. Marketing, support for cultivation, the development and exploitation of palm plantations, and the industrialization and export of goods made from natural fibres all disappeared during the 1990s.

Despite these setbacks, today in the Mixteca, small-scale and family farming cover areas larger than in other Mexican regions. Some 30 years ago, most of the Mixtec population was involved in agriculture. But migration has had a profound impact – especially since the 1990s, which saw extensive migration to the United States. Emigration now accounts for more than 30% of the population (Lazos, 2012). This has weakened local institutions considerably, including mutual aid, collective work (such as the *guetza* and *tequio*)¹⁷ and social networks. The *milpa* – the food and agriculture system, associating representations and rituals with the cultivation of maize, beans and squash – seems to subsist only in homes that need fresh maize for the festivities of the Day of the Dead, which maintain a symbolic link with the land (Lazos, 2012). All the varieties of maize that needed a lot of work and a lot of space have gradually been abandoned and replaced by commercial crops, such as passion fruit and new varieties of tomatoes that are grown in gardens and greenhouses¹⁸ (Katz, 1994). Today the farming system has to

be complemented by additional income from welfare programmes and remittances sent by emigrant relatives. Thus the native and peasant population tends, on the one hand, to diversify their diet by buying more meat and industrial food and beverages; on the other hand, they consume fewer of the wild greens (*quelites*) that were always seen as “poor people’s food” (Katz, 1992).

The “farmer to farmer” model in the Mixteca region (Oaxaca state)

Life is difficult, and modernity, cash crops and intensive technology are attractive; but there are alternatives. Our case study accounts for a civil society group (*Centro de Estudios de Tecnologías Alternativas para México*/Center for the Study of Appropriate Technologies for Mexico (CETAMEX)) and the institution that was finally built by its efforts. Institutions of this sort were set up with the support of the government, although sometimes the support was indirect, as in the case of the Center for Comprehensive Peasant Development in the Mixteca (*Centro de Desarrollo Integral Campesino de la Mixteca* (CEDICAM)).

The CETAMEX group has roots in the vast experience of the team that worked with civil society in the Mixteca Alta from 1983 to 1997. CETAMEX (headquartered in Mexico, DF) is financed by the World Neighbors organization (*Vecinos Mundiales*), whose objective is to resolve internal community conflicts by means of collective work performed for the benefits of the community (Blauert, 1990). World Neighbors is a Protestant religious organization that comes from Oklahoma. It formed links with a Catholic movement, *Pastoral de la Tierra*, which emerged in indigenous and peasant communities in the Mixteca region of the state of Oaxaca in the 1980s, with the help of Guatemalan peasants who were there on missionary service for World Neighbors organization.

Thanks to the advice and support of these Guatemalan peasants, catechists of *Pastoral de la Tierra* as agricultural development promoters (Holz-Giménez, 2006) – who also gave agricultural advice derived from their own peasant experience – and the technology support of people from CETAMEX, a project was launched in Santiago Tilantongo (a Mixtecan municipality) by Jesús León Santos, a local farmer.¹⁹ This was in the early 1980s, and Santos and his colleagues received some funding from World Neighbors (Blauert and Quintanar, 2000). They decided to adopt the strategy of the World Neighbors movement (i.e. to work only with local authorities and to avoid direct dealings with federal government agencies (Bunch, 1985)) and to build up farmer-to-farmer networks (*campesino a campesino*), which focused on

improving native and peasant farming practices (Boege and Carranza, 2009; Holt-Giménez, 2010).

Initially the “parent group” of CETAMEX provided services that were instrumental to promoting the use of organic fertilizers, reforestation, and the construction of tree nurseries in the municipalities of Yodocono and Tilantongo by 1982 (Altieri et al., 2006). Jesús León Santos and his colleagues subsequently worked in different municipalities and in nine communities (Nochtixtlan and neighbouring communities) of Mixteca Alta. They restored the fertility of the soil when the surface layer was exposed to the effects of agents of erosion (air, water and anthropogenic activity). They made fundamental contributions to the recovery of the *tequio* (*yeta* or *guetza*), to mutual aid and to collaborative organization of work. They also recovered several techniques such as *barbecho* (long-fallow land), *recorte* (delumping), *rayada* (planting in rows), *cajeteadá* (planting corn or cornfields in pits or bowls), *coa* (plowing), *yunta* (the yoke) and other local devices that retained moisture and prevented soil compaction. Subsequently, to improve the soil, they used green manures (*bocashi*) and selected their own seeds. They dug trenches on field borders and on slopes of land, forming terraces to prevent erosion, to maintain moisture and to revive springs (Rivas Guevara, 2008; Rivas Guevara et al., 2009). As a first step they undertook reforestation, using local tree species that could generate firewood, timber and wood for crafts, and they created a new organization of community nurseries.

Their second step was to restore the cultivation of *maíces de cajete* by accumulating in ravines a water supply and the *limon* that had been swept away by landslides. This system (known as *jollas*) makes it possible to use residual soil moisture at the end of the rainy season to plant *maíces* and thus avoid a hunger gap by guaranteeing a full year’s harvest of maize. The *jollas* system was created by the Mixtecs between the pre-classical and the post-classical ages in response to demographic pressure (Romero Frizzi, 1990); until the 1980s it functioned in the sub-region of the Mixteca Alta (in the Nochtixtlan, Tiaxiaco, Teposcolula and Coixtlehuaca districts). At the time, this crop system was the second most important in the Oaxacan Mixteca (Romero Penaloza et al., 1986).

It is worth noting that, in a region where *tequio* and/or the *guetza* had often been abandoned, the conservation and restoration of soil and water required intensive labour.

Fortunately, the Ministry of the Environment became concerned with soil erosion, and subsequently the government launched a national programme for soil conservation (PRODERS). This included a specific project (ProArbol) that benefited CETAMEX. Free, adapted trees were

distributed, enabling the CETAMEX members to save time and labour and to concentrate on agrifood systems.

Major institutions, such as the General Directorate of Regional Programmes, were established to harmonize the programmes of different ministries. This was notably instrumental in bringing together the three ministries of the Environment, Agriculture and Social Development in support of the Sustainable Productive Development in Marginal Rural Areas (*Programa de Desarrollo Productivo Sustentable en Zonas Marginadas Rurales* (PDPSZRM)) programme. In the late 1990s, this programme, supervised by eight secretariats, implemented about 50 regional projects. The community was considered to be the basic territorial unit within Regional Development Councils (which brought together institutional and civil-society actors in prioritized microregions). These councils had to design and implement development plans whenever involvement of the community was needed. PRODERS also organized local workshops for training and for developing new skills in communities.

In 1989 a new institution was created in the Mixtec region itself: CEDICAM. This brings us back to the beginning of our story: that of a peasant movement (CETAMEX, see above). CEDICAM (*Hita Nuni* in the Mixtec language) is based in Asuncion Nochixtlan. Its role is to promote the “farmer to farmer” relationships by means of workshops and educational demonstrations. It consists of 12 Mixtec farmers who have qualified as demonstrators in the 14 Tilantongo communities. Jesús León Santos is one of the founding members of CEDICAM. He is also in charge of networking with support agencies, including Mexican governmental programmes. Santos argues that care for water and soil are essential for sustainable agriculture (Velásquez Hernández and Santos, 2006).

Finally, the pioneers who were involved in the beginnings of the CETAMEX farmers’ group have recovered both their agricultural practices and a balanced diet. Others are following the same path, but this is not why they have been praised throughout the world. What is admired, above all, is their contribution to ecology (conservation of soil and water, and reforestation). In 2008 their main representative, Jesús León Santos, was awarded the annual international Goldman Environmental Prize in recognition of their efforts. Santos embodies the success of traditional peasant and indigenous agricultural practices in combating desertification. He has spread the word to all arenas in which the environment is an issue of concern.

Several experiments of this type (see Chapter 10) have shown that the initiatives of communities themselves, supported by civil-society

associations, constitute a warning call to governments. The governments, in turn, rely on these institutions to design and implement appropriate programmes. One of the most important actions in this programme, which has made Mexico an international model, is the National Programme for Payment of Environmental Services (PES), which covers 3.25 million Ha of forest. The ProArbol Programme establishes the principle of financial compensation for all actions that retard deforestation and promote the recovery of forest soils.

The teachings that have brought the Mexican experience into the limelight concern potentials and limits of projects that are “truly alternative”, and which at some point need to rely on the state’s capacity for action. In a way, this shows that nothing can be done without the state, but that with only state support nothing can be done at all.

Conclusion

In Mexico the issue of environmental governance is linked to that of social and economic development by its explicit objective: “food sovereignty”. We have examined this relationship at different levels – national, regional and local – and we have found that effective environmental governance calls for a simultaneous analysis of Mexican agricultural policy as a whole, including the “traditional” practices of the native and peasant world. Moreover, our analyses have been diachronic as well as synchronic, and historical as well as structural. Their aim is to clarify, identify and characterize economic trends and the ways in which different sorts of knowledge contribute to this aim, by their interplay in the process of constructing environmental standards.

We have described the construction of environmental governance in the Mixteca region in Mexico, which is home to numerous native and small-scale peasant communities, known for both its food requirements and its exemplary efforts in reforestation over the past 30 years. The environmental governance process has been worked out here in terms of participation. In practice this implies the integration, accommodation and hybridization of traditional native and peasant knowledge. How do these different sorts of knowledge fit in with knowledge of the modern technoscientific sort? We have attempted to unpack the intellectual framework involved and the steps through which the process passes. We have relied on a theoretical framework that involves both science and technology studies (STS) and post-colonial studies (with its Latin American version, the M/C/D Programme). We have explained that a historical trend has assigned a subordinate place to

indigenous knowledge; but also that, for practical reasons, it is translated and exchanged when it is acted upon. Exchanges can be structural (e.g. in the Green Revolution) or merely circumstantial (e.g. in the course of colonization). They can also take place between different agricultural communities that have different types of knowledge. Since ancient times, market places have been the locus of an exchange of plants (and the ways to grow them) – that is, for an exchange, adaptation and transposition of knowledge brought in from abroad. Native and peasant knowledge is not fixed; it evolves, just as technoscientific knowledge does. “Pre-modern” knowledge has now come to inspire a number of academic works, and has also influenced technical and ecological thinking. Attention has been drawn to it, and it itself has become an object of knowledge. We have shown that this upsurge of scientists’ interest has been aligned with the policy debates of the day, in such matters as technology and agriculture, ecology and the environment, and cultural and social issues. There is now in Mexico an agroecological approach that is recognized by the academy and that is used by technical operators.

All of this has drawn attention to the weight of practical considerations in the evolution and reception of different sorts of knowledge, including scientific knowledge. Practical reasons not only spur a few dissident approaches but also orient the action of farmers and governments. We have dealt, to some extent, with the case of a local initiative promoted by native and small-holding farmers. They began by resisting the options and programmes designed for them by the Ministry of Agriculture, but subsequently attempted to gain self-sufficiency by restoring their traditional collaboration and recovering discontinued agricultural techniques. In doing so they have contributed to the conservation of soils and wooded areas, and this in turn has brought them recognition and help from the Ministry of the Environment. Action can change perspectives, with some actors learning to see others in new ways and opening up opportunities to build alternative projects through interaction with partners who had not originally been envisaged.

To what extent can autochthonous and peasant populations seize such opportunities, which are generally based on “secondary contradictions”? The answer to this question is less clear. There are many contradictions between environmental and agricultural policy. There is, however, a dominant trend. In Mexico it would seem that (intensive) agriculture has gained the upper hand. But this does not prevent other concerns (social and environmental) from being asserted. There has

been a focus on environmental protection through reforestation. Reforestation programmes have fostered the creation of opportunities for participation at a microregional level, complementing policies dedicated to nature reserves and support for community initiatives. Simultaneously, however, the “productivist” agricultural programme designed for marginal areas (*Procampo*) has been repeated (at least for 2007–2012), despite the fact that it has accentuated deforestation. History shows also that state support, direct or indirect, is necessary for small-scale initiatives to blossom, if not during their take-off period then at least for their subsequent development and replication in other regions. Unfortunately, today there is a downward trend in budgets dedicated to environmental protection and rural development.²⁰ This makes new local initiatives even more precarious.

Therefore, despite the number of programmes that have been devoted to marginalized populations over the last ten years, the National Strategy seems to lack an overall plan of action. What direction will this policy take? How will it take into account the multiple experiments that have been carried out in the more vulnerable and marginalized regions?

Similar contradictions exist at an international level. The Biodiversity Convention made a breakthrough when it obtained the FAO’s agreement on phylogenetic resources, recognizing that autochthonous peoples owned *pro parte* biodiversity and its uses. But its implementation is still in question. It is true, furthermore, that recognition of the important part played by peasant and indigenous family agriculture (providing 70% of the global food production; the FAO dedicated the year 2014 to this sector) could have a leveraging effect in promoting an operational recognition of native and peasant knowledge. However, few people argue that it would be enough to feed the planet, to alleviate dramatic famines throughout the world and to supply large cities. This is what accounts for the dual system that exists today, and what legitimates the pursuit of other avenues of (scientific) research. For example, another Mexican citizen, Dr Sanjaya Rajaram, won a World Food Prize in 2014 for his work on the genetic improvement of maize, thanks to biotechnology.²¹

At the preparatory meetings of the international climate conference (COP21), held in Paris at the end of 2015, a wish was expressed: to combine concern for family and peasant farming with thinking about climate change. It is yet to be seen whether the international conference will provide native and peasant knowledge with a real opportunity to contribute to the construction of policies dealing with climate issues.

Notes

1. Notably, studies of WP5 “Building and Exchanging Knowledges on Natural Resources in Latin America” within the ENGOV EU Programme.
2. Forests occupy 33% of the territory with 200,000 different species, which puts it in 12th place internationally, 2nd place in terms of variety of ecosystems and 4th in terms for species (OCDE, 2013).
3. It also appears in 12th place of the countries with the greatest inequality in terms of income.
4. Until now they have dealt little with specific mediations in agriculture projects, especially between scientific knowledge and native or peasant knowledge.
5. This analysis is detailed in Foyer et al. (2014).
6. The works in this field are abundant. We primarily cite Howes and Chambers (1979); Howes (1979); and O’Keefe and Howes (1979).
7. See the Waast and Rossi report (2014). The most cited works are Davis and Wagner (2003); Woods (2002); Greene (2004); and Turner, Davidson-Hunt and O’Flaherty (2003), cited in Waast and Rossi (2014).
8. See Hassink (2005); Berkes and Turner (2006); Godoy et al. (2005); Greene (2004); Aswani and Lauer (2006); and Kirsch (2001), cited in Waast and Rossi (2014).
9. The issue was resumed in Mexico after the controversy surrounding the International Cooperative Biodiversity Group-Maya (ICBG-MAYA) project in 2000: on the one hand it was denounced as “biopiracy” and on the other hand it was advocated as a development project respectful of local communities. See Alarcón Lavín (2011); see also Barreda (2001).
10. Food security is related to the healthy diet of a maximum of persons all over the world. Perhaps the social and indigenous movement forged the food sovereignty movement, which means that each group of people should design its own agriculture policy according to its needs and culture.
11. It has been observed that imports increased from 74% to 84% for oil, from 22% to 40% for cereals, from 18% to 27% for meat, and from 15% to 24% for milk. Despite the great proportion of the population linked to agriculture, Mexico has become one of the main import countries of agricultural products (in third place after the EU and Japan).
12. In other words, with sufficient capacity to integrate into the market. See Gravel (2009).
13. Seven regional forums of public consultation – coordinated by the Interministerial Commission for Sustainable Rural Development (*Comisión Intersecretarial para el Desarrollo Rural Sustentable* (CIDRS)) – were created with the objective of collecting the proposals and viewpoints of the rural population on five topics, among which were nutrition, welfare and care for the environment.
14. It was initially created as the Ministry of the Environment, Natural Resources and Fishing (Semamap) in 1994, but it later became the Ministry of the Environment and Natural Resources. Today, climate change is included within the transformation of the agency, changing the National Institute of Ecology (INE) into the National Institute of Ecology and Climate Change (INECC). The National Commission on Biodiversity (CONABIO) and the

- reformulation and strengthening of the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA, 1996) are also included. See Léonard and Foyer (2011).
15. The fundamental initiative in this regard is the Indigenous Peoples and Environmental Programme 2007–2012. See SEMARNAT, México, 2009, <http://www.semarnat.gob.mx/apoyosubsidios/programmeasparalospueblosindigenas/Documents/programprogrammemea%20de%20pueblos%20indigenas%20y%20medio%20ambiente.pdf>, date accessed 15 September 2014.
 16. Population in Oaxaca State, 3.8 million (INEGI, 2010).
 17. Flores Quintero, G. (2005) has clarified what differentiates *guetza* from *tequio*. In effect, despite what had been written, it has been shown that *guetza* is the collective work that was institutionalized during the colonial era. *Tequio* is a náhuatl word that designates the community service of the adult members of the community, whose origin dates back to colonial times.
 18. Esther Katz has observed how, in the last 30 years, the variety of cultivated species has diminished considerably. This is the case for the maize of the humid highlands. See Katz and Kleiche (2013).
 19. Olga Elena Lara, interview with Jesus Santos León, http://ssheltonimages.com/play/ptk9uDk0XuU/Part_1 (date accessed 15 September 2014).
 20. By 2011 the budget of SAGARPA was 73 billion Mexican pesos, while the budget for the environment fell to 51.2 billion Mexican pesos (out of which 12.6% was for marginalized areas: 0.99 billion Mexican pesos went to the Comisión Nacional de Áreas Naturales Protegidas (CONANP) versus 3.35 billion Mexican pesos in 2002) and 6.42 billion Mexican pesos to the Comisión Nacional Forestal (CONAFOR) (OCDE, 2013).
 21. Dr Sanjaya Rajaram belongs to Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), an organization that played a key role in the Green Revolution of the 1960s.

References

- Agrawal, A. (1995) "Dismantling the Divide Between Indigenous and Scientific Knowledge", *Development and Change* 26(3): 413–439.
- Agrawal, A. (2002) "Indigenous Knowledge and the Politics of Classification", *International Social Science Journal* 54(173): 325–336.
- Akrich, M., Callon, M. and Latour, B. (2006) *Sociologie de la traduction. Textes fondateurs* (Paris: Presses des Mines de Paris).
- Alarcón Lavín, R.R. (2011) "La Biopiratería de los Recursos de la Medicina Indígena Tradicional en el Estado Chiapas. El Caso ICBG-Maya", *Revista Pueblos y Fronteras* 6(10): 151–180.
- Altieri, M.A., Fonseca, S.A., Caballero, J.J. and Hernández, J.J. (2006) *Manejo del Agua y Restauración Productiva en la Región Indígena Mixteca de Puebla y Oaxaca* (México D.F.: CEDEC).
- Aswani, S. and Lauer, M. (2006) "Incorporating Fishermen's Local Knowledge and Behavior into Geographical Information Systems (GIS) for Designing Marine Protected Areas in Oceania", *Human Organisation* 65(1): 81–102.
- Barreda, A. (2001) "Biopiratería y Resistencia en México", *El Cotidiano* 18(110): 21–39.

- Bell, M. (1979) "The Exploitation of Indigenous Knowledge or the Indigenous Exploitation of Knowledge: Whose Use of What for What?", *The IDS Bulletin* 10(2): 44–50.
- Berkes, F. and Turner, N.J. (2006) "Knowledge, Learning and the Evolution of Conservation Practice for Social-Ecological System Resilience", *Human Ecology* 34(4): 479–494.
- Blanc, J. and Georges, I. (2012) "L'Émergence de l'Agriculture Biologique au Brésil: Une Aubaine pour l'Agriculture Familiale? Le Cas de Producteurs de la Ceinture Verte de la Ville de São Paulo", *Autrepart* 64: 121–138.
- Blauert, J.K. (1990) *Autonomous Approaches to Rural Environment Problems: The Mixteca Alta, Oaxaca, Mexico* (University of London, Wye College and Institute of Development studies, University of Sussex Brighton).
- Blauert, J. and Quintanar, E. (2000) "Seeking Local Indicators: Participatory Stakeholder Evaluation of Farmer-to-Farmer Projects, Mexico", in M. Estrella (ed), *Learning from Change: Issues and Experiences in Participatory Monitoring and Evaluation* (Londres: Intermediate Technology Publications), 32–49.
- Boege, E. and Carranza, T. (2009) *Agricultura Sostenible Campesina-Indígena, Soberanía Alimentaria y Equidad de Género. Seis Experiencias de Organizaciones Indígenas y Campesinas en México* (México, Publicación realizada con el apoyo de Pan para el Mundo).
- Boidin, C. (2010) "Études Décoloniales et Postcoloniales dans les Débats Français", *Cahiers des Amériques Latines* 62: 129–140.
- Bunch, R. (1985) *Dos Mazorcas de Maiz: Una Guía para el Mejoramiento Agrícola Orientado hacia la Gente* (Oklahoma City: Vecinos Mundiales).
- Callon, M. and Latour, B. (1981) "Unscrewing the Big Leviathan: How Actors Macro-Structure Reality and How Sociologists Help Them to Do So", in K. Knorr-Cetina (ed), *Advances in Social Theory and Methodology: Toward an Integration of Micro and Macro-Sociologies* (London: Routledge and Kegan Paul), 277–303.
- Castro-Gómez, S. (2005) *La Poscolonialidad Explicada a Los Niños* (Popayan: Universidad de Cauca).
- Castro-Gomez, S. and Grosfoguel, R. (eds) (2007) *El Giro Decolonial. Reflexiones para una Diversidad Epistémica más allá del Capitalismo Global* (Bogota: Universidad Javeriana/Universidad Central/Siglo del Hombre).
- Castro Herrera, G. (1996) *Naturaleza y Sociedad en la Historia de América Latina* (Panama: Cedla).
- Cervantes-Godoy, D. and Dewbre, J. (2010) *Importance Économique de l'Agriculture dans la Lutte contre la Pauvreté* (Paris: Éditions OCDE).
- Chambers, R. (1988) *Sustainable Rural Livelihoods: A Strategy for People, Environment and Development* (Londres: Earthscan).
- Crespo, J.M. (2014) "Propuesta de Políticas sobre Saberes y Conocimientos Ancestrales, Tradicionales y Populares en el Proyecto Buen Conocer/Flok", *Cumbre del Buen Conocer/FLOK Society* del 27 al 30 de mayo de 2014 en Quito, Ecuador, <https://flokociety.co-ment.com/text/VpC768Jfmd6/view/>
- Davis, A. and Wagner, J.R. (2003) "Who Knows? On the Importance of Identifying 'Experts' When Researching Local Ecological Knowledge", *Human Ecology* 31(3): 463–489.
- Díaz León, M.A. and Cruz León, A. (eds) (1998) *Nueve Mil Años de Agricultura en México. Homenaje a Efraím Hernández Xolocotzi* (Chapingo: Grupo de Estudios Ambientales, A.C. y Universidad Autónoma).

- Dumont, R. (1969) *Réforme Agraire et Modernisation de l'Agriculture au Mexique* (Paris: PUF).
- Dumont, R. (1981) *Le Mal-Développement en Amérique Latine* (Paris: Seuil).
- Dumoulin, D (2003) "Les Savoirs Locaux dans le Filet des Réseaux Transnationaux d'ONGs: Perspectives Mexicaines", *Revue Internationale des Sciences Sociales* 4: 655-666.
- Dussel, E. (2007) "Modernidad, Imperios Europeos, Colonialismo y Capitalismo (Para Entender el Proceso de la Transmodernidad)", in E. Dussel, *Materiales para una Política de la Liberación* (Madrid: Publicidisa), 195-214.
- Escobar, A. (1995) *Encountering Development: The Making and Unmaking of the Third World* (Princeton: Princeton University Press).
- Escobar, A. (1999) "After Nature: Steps to an Anti-Essentialist Political Ecology", *Current Anthropology* 40(1): 1-30.
- Escobar, A. (2003) "Mundos y Conocimientos de Otro Mundo. El Programa de Investigación de Modernidad/Colonialidad Latinoamericano", *Revista Tabula Rasa* 1: 51-86.
- Escobar, A. (2011) "Ecología Política de la Globalidad y la Diferencia", in H. Alimonda (ed.) *La Naturaleza Colonizada. Ecología Política y Minería en América Latina* (Buenos Aires, Ciccus/Clacso).
- Fairhead, J. and Leach, M. (2003) *Science, Society and Power: Environmental Knowledge and Policy in West Africa and the Caribbean* (Cambridge: Cambridge University Press).
- Foyer, J., Jankowski, F., Blanc, J., Georges, I. and Kleiche-Dray, M. (2014) "Saberes Científicos y Saberes Tradicionales en la Gobernanza Ambiental: La Agroecología como Práctica Híbrida", ENGOV Working Paper Series, n° 14.
- Flores Quintero, G. (2005) "Tequio, Identidad y Comunicación entre Migrantes Oaxaqueños", *Amérique Latine Histoire et Mémoire. Les Cahiers ALHIM* (8) <http://alhim.revues.org/423>, date accessed 6 December 2014.
- Gaillard, J., Krishna, V.V. and Waast, R. (eds) (1997) *Scientific Communities in the Developing World* (New Delhi: Sage Publications).
- Godoy, R., Reyes-García, V., Byron, E. et al. (2005) "The Effect of Market Economies on the Well-Being of Indigenous Peoples and on Their Use of Renewable Natural Resources", *Annual Review of Anthropology* 34(1): 121-138.
- Goldman, M.J., Nadasdy, P. and Turner, M.D. (2011) *Knowing Nature: Conversations at the Intersection of Political Ecology and Science Studies* (Chicago: University of Chicago Press).
- Gomez-Oliver, L. (2008) "Crisis Alimentaria Mundial y México", *Agricultura Sociedad y Desarrollo* 5(2): 115-141.
- Gravel, N. (2009) "La Gouvernance Rurale au Mexique en Reponse a la Vulnérabilité Paysanne Extreme", *Canadian Journal of Latin American and Caribbean Studies* 34(68): 111-145.
- Greene, S. (2004) "Indigenous People Incorporated? Culture as Politics, Culture as Property in Pharmaceutical Bioprospecting", *Current Anthropology* 45(2): 211-237.
- Harding, S. (1997) "Is Modern Science an Ethnoscience?", Shinn, T., Spaapen, J. and Krishna, V.V. (eds) *Yearbook of the Sociology of Sciences* 19 (Dordrecht: Kluwer).
- Hassink, R. (2005) "How to Unlock Regional Economies from Path Dependency? From Learning Region to Learning Cluster", *European Planning Studies* 13(4): 521-535.

- Holt-Giménez, E. (2006) *Campesino a Campesino: Voices from Latin America's Farmer to Farmer Movement for Sustainable Agriculture in Latin America* (Oakland: Food First).
- Holt-Giménez, E. (ed.) (2010) "Linking Farmers' Movements for Advocacy and Practice", *Journal of Peasant Studies* 37(1): 203–236.
- Howes, M. (1979) "The Uses of Indigenous Technical Knowledge in Development", *The IDS Bulletin* 10(2): 12–23.
- Howes, M. and Chambers, R. (1979) "Indigenous Technical Knowledge: Analysis, Implications and Issues", *The IDS Bulletin* 10(2): 5–11.
- INEGI (2010) Censos y Conteos de Población y Vivienda. Instituto Nacional de Estadística y Geografía. <http://www.censo2010.org.mx/>
- Jankowski, F. (2012) "Agro-Écologie, Gouvernance Environnementale et Dialogue des Savoirs dans l'État de Oaxaca (Mexique)", in M. Kleiche-Dray (ed.) ENGOV WP5 Report.
- Jiménez Sánchez, L. (1984) "Entrevista a Efraim Hernández Xolocotzi", *Las Ciencias Agrícolas y Sus Protagonistas* 1.
- Katz, E. (1992) "La Cueillette des Adventices Comestibles au Mexique", *Ecologie Humaine* 10(1): 25–41.
- Katz, E. (1994) "Du Mûrier au Caféier: Histoire des Plantes Introduites en Pays Mixtèque (XVIIe-XXe Siècle)", *Journal d'Agriculture Traditionnelle et de Botanique Appliquée (JATBA) N° Spécial Phytogéographie Tropicale* 36(1): 209–244.
- Katz, E. (2002) Rites, Représentations et Météorologie dans la Terre de la Pluie (Mixteca, Mexique), in E. Katz, M. Goloubinoff and A. Lammel (ed.), *Entre Ciel et Terre: Climat et Sociétés* (Paris, Ibis Press/IRD Editions), 63–88.
- Katz, E. and Kleiche-Dray, M. (2013) "Dynamic Processes in the Use of Natural Resources and Food Systems by Indigenous and Mestizo Communities in Mexico and Brazil", ENGOV Working Paper Series, n°3.
- Kirsch, S. (2001) "Lost Worlds: Environmental Disaster, 'Culture Loss' and the Law", *Current Anthropology* 42(2): 167–197.
- Lander, E. (2000) "Ciencias Sociales: Saberes Coloniales y Eurocentrismo", in E. Lander (ed.), *La Colonialidad del Saber: Eurocentrismo y Ciencias Sociales. Perspectivas Latinoamericanas* (Buenos Aires: CLACSO), chapter 13.
- Lascoumes, P. (1994) *L'Éco-Pouvoir. Environnement et Politiques* (Paris: La Découverte).
- Lazos, E. (2012) "Conocimiento, Poder y Alimentación en la Mixteca Oaxaqueña: Tareas para la Gobernanza Ambiental", in M. Kleiche-Dray (ed.), Engov WP5 Report.
- Leff, E. (1986) *Ecología y Capital: Hacia una Perspectiva Ambiental del Desarrollo* (México: UNAM).
- Léonard, E. and Foyer, J. (2011) *De la Integración Nacional al Desarrollo Sustentable: Trayectoria Nacional y Producción Local de la Política Rural en México* (Mexico: CEDRSSA).
- Long, J. and Attolini, A. (2009) *Caminos y Mercados de México* (México, IIH-UNAM).
- Mendoza García, E. (2002) "El Ganado Comunal en la Mixteca Alta. De la Epoca Colonial al Siglo XX. El Caso de Tepelmeme", *Historia Mexicana* 51(4): 749–785.
- Mendoza García, E. (2004) *Los Bienes de la Comunidad y la Defensa de las Tierras en la Mixteca Oaxaqueña. Cohesión y Autonomía del Municipio de Santo Domingo Tepehene, 1856–1912* (México, D.F.: Senado de la República).

- Mignolo, W. (2000) *Local Histories/Global Design: Coloniality, Subaltern Knowledge and Border Thinking* (Princeton: Princeton University Press).
- Mignolo, W. (2007) *La Idea de América Latina: La Herida Colonial y La Opción Decolonial* (Barcelona: Gedisa Editorial).
- OCDE (2007) *Política Agropecuaria y Pesquera en México: Logros Recientes y Continuación de las Reformas* (Paris: OCDE).
- OCDE (2013) *Examens Environnementaux de l'OCDE* (Mexico: OCDE).
- O'Keefe, L. and Howes, M. (1979) "A Select Annotated Bibliography: Indigenous Technical Knowledge in Development", *The IDS Bulletin* 10(2): 51–58.
- Polanco, X. (ed.) (1989) *Naissance et Développement de la Science-Monde. Production et Reproduction des Communautés Scientifiques en Europe et en Amérique Latine* (Paris: La Découverte).
- Quijano, A. (1994) "Colonialité du Pouvoir et Démocratie en Amérique Latine", in J. Cohen, L. Gómez and H. Hirata (eds), *Amérique Latine, Démocratie et Exclusion* (Paris: Harmattan), 93–101.
- Raj, K. (2007) *Relocating Modern Science: Circulation and the Construction of Knowledge in South Asia and Europe, 1650–1900* (Houndmills/New York: Palgrave Macmillan).
- Rivas Guevara, M. (2008) *Caracterización del Manejo de Suelo y Uso del Agua de Lluvia en la Mixteca Alta: Jollas y Maíces de Cajete Estudio de Caso: San Miguel Tulancingo, Oaxaca*. PhD Dissertation (Montecillo, Mexico: Colegio de Postgraduados).
- Rivas Guevara, M., Rodriguez Haros, B. and Palerm Viqueira, J. (2009) "El Sistema de Jollas: Una Técnica de Riego no Convencional en la Mixteca", *Boletín del Archivo Histórico del Agua*. Número Especial Año 13: 6–16.
- Rogé, P. et al. (2014) "Farmer Strategies for Dealing with Climatic Variability: A Case Study from the Mixteca Alta Region of Oaxaca, Mexico", *Agroecology and Sustainable Food Systems* 38(7): 786–811.
- Romero Frizzi, M. (1990) *Economía y Vida de los Españoles en la Mixteca Alta: 1519–1720* (Oaxaca: Instituto Nacional de Antropología e Historia/Gobierno del Estado de Oaxaca).
- Romero Penaloza, J. et al. (1986) *Diagnóstico de la Producción Agrícola de las Mixtecas Oaxaqueñas Altas y Baja*, Tomo II y III, Centro Regional del Sur (México: UACH).
- Sanchez Lopez, J. (2013) *Conflictos y Lucha Campesina en Oaxaca, 1970–80*. Master Thesis (Universidad de Sonora).
- Sillitoe, P. (1998) "The Development of Indigenous Knowledge: A New Applied Anthropology", *Current Anthropology* 39(2): 232–252.
- Leigh Star, S. and Griesemer, J.R. (1989) "Institutional Ecology, Translations and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–1939", *Social Studies of Science* 19(3): 387–420.
- Toledo, V.M. (1992) "Utopía y Naturaleza. El Nuevo Movimiento Ecológico de los Campesinos e Indígenas de América Latina", *Nueva Sociedad* (Caracas) 122: 73–85.
- Toledo, V.M. and Bartra, A. (2000) *Del Círculo Vicioso al Círculo Virtuoso: Cinco Miradas al Desarrollo Sustentable de las Regiones Marginadas* (México: Semarnap/Plaza y Valdés).
- Trompette, P. and Vinck, D. (2009) "Retour sur la Notion d'Objet-Frontière", *Revue d'Anthropologie des Connaissances* 4(1): 11–15.

- Turner, N.J., Davidson-Hunt, I.J. and O'Flaherty, M. (2003) "Living on the Edge: Ecological and Cultural Edges as Sources of Diversity for Social-Ecological Resilience", *Human Ecology* 31(3): 439–461.
- Velasco Rodríguez, G.J. (1994) *La Artesanía de la Palma en la Mixteca Oaxaqueña* (Oaxaca: CIIDIR-IPN, Unidad Oaxaca).
- Velásquez, J.C. (2002) "Sustainable Improvement of Agricultural Production Systems in the Mixteca Region of Mexico", NRG Paper 02–01 (Mexico, D.F.: CIMMYT).
- Velásquez Hernández, J.C. and Santos, J.L. (2006) "CEDICAM: Una Organización de Campesinos para Campesinos en México", *LEISA* sept: 24–26.
- Waast, R. (1996) *Les Sciences hors d'Occident au XXe siècle*, 7 tomes (Paris: ORSTOM), Editions: On-line sur la Base Horizon Pleins Textes, <http://horizon.documentation.ird.fr>
- Waast, R. and Rossi, P.L. (2014) "Origins and Shifts in Meaning of ENGOV's Keywords. A Bibliometric Study", in M. Kleiche-Dray (ed.) Engov WP5 Report.
- Warman, A. (2001) *El Campo Mexicano en el Siglo XX* (Mexico: Fondo de Cultura Económica).
- Woods, C. (2002) "Life After Death", *The Professional Geographer* 54(1): 62–66.



Except where otherwise noted, this work is licensed under a Creative Commons Attribution 3.0 Unported License. To view a copy of this license, visit <http://creativecommons.org/licenses/by/3.0/>