

Analysis

Governance from below and environmental justice: Community water management from the perspective of social metabolism



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1. Introduction¹

“A spectre is haunting the overdeveloped world – the spectre of degrowth” (Akbulut et al., 2019); in Latin America a similar movement traverses the region: a demand for environmental justice promoted by peasant and indigenous communities. Both social movements are intimately entwined and mutually supportive. Both question the myth of neoliberal efficiency and the free market’s ability to confront the twin problems of social inequality and environmental degradation as well as the possibility of a single approach to defining the quality of life.

The neoliberal onslaught of the last quarter of the XX century created the conditions for these social reactions opposing the unbridled support of growth and technological control by capital. In Latin America, this model was directed towards extracting increasing volumes of resources (forests, fossil fuels, minerals, water, and genetic) while imposing structural changes that displaced production of foods and other necessities for exports and offshore assembly operations (Delgado, 2017). This dynamic not only generated environmental and economic transformations but a profound political change, replacing the “welfare state” with a market-oriented apparatus at the service of capital. A realignment of political forces paved the way for reorganizing the legal structure, facilitating the devolution of control of many state functions to local power elites, the concession of public services to private corporations, and the sale of public assets to private interests (Harvey, 2010). These profound changes in governance are having far-reaching impacts on the social metabolism, provoking environmental justice and degrowth movements, which is the focus of our analysis. In this article, we contrast the “top-down” governance model with the approach “from below” being implemented by the communities in which the collaborative fieldwork was conducted.

Our work in Latin America, and especially in Mexico, starts from a grassroots decolonial perspective (Arias, 2018). We formulated a

research program in “ecological economics from below” based on a heterodox approach. Our work is based on three quite distinct traditions: 1) the Marxist heritage highlights the crucial role of the “theft” of common property that continues to be central to “primitive capital accumulation” along with the importance of distributive conflicts among social classes, rooted in labour exploitation in production that generates surplus value but now extends far beyond the workplace to encompass the capture of rents for land and other natural resources, integrating peasants and indigenous peoples as active players in social struggles to protect themselves and nature (Barkin et al., 2019); 2) the work of Illich (1973) questioned the viability and character of industrial society, calling for a new intercultural social relation based on “conviviality” (Barkin et al., 2019), a profound respect for and care of nature, as well as a different model of austere consumption defined by satisfying our basic needs without sacrificing our social life and enjoyments; and 3) the praxis of rural communities using their singular forms of intervention to strengthen and deepen their institutions, preventing the expansion of international capital or domestic development programs designed to deprive them of their heritage and livelihoods and even destroy their ways of life (e.g. Scott, 1985; Temper et al., 2018). All three emphasize the importance of social control of the “tools” needed to protect their communities and their heritage, transforming the institutions that were imposed on them.

Our presentation focuses on the indigenous communities that are reconfiguring their social structures and patterns in response to the hegemonic model of government. These movements express themselves as narratives that cannot be understood with the academic language or through conventional analyses of environmental justice (Martínez-Alier, 2012; Martínez-Alier et al., 2014, 2016). The environmental justice movements we describe are efforts to build autonomous societies (e.g. Porto-Gonçalves and Leff, 2015). In what follows, we examine the proposal for “governance from below”, *comunalidad*,² as practiced by

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¹ We are particularly grateful to the anonymous reviewers whose constructive comments contributed to substantially improving this article. We consider that the modifications clarified the profound differences between an analysis applying ecological economics in “Western” societies and in the indigenous cultures with which we are collaborating.

² *Comunalidad* is a term coined by two Mexican anthropologists (Díaz, 2007; Martínez Luna, 2010) that should NOT be translated into English. We explain its significance in the text and use the Spanish word throughout.

Zapotec groups in the northern highlands of Oaxaca (Mexico).³ We started with the hypothesis that Mexican society is besieged by conflicts between these two competing governance models, the homogenous, hegemonic approach (top-down) and the heterogeneous proposals (bottom-up). Most of these disputes centre on the significance and definition of the rules for the distribution of the costs and benefits of the social appropriation of nature, considered in its economic, social, and environmental dimensions. Our analysis shows that the governance model conditions the orientation, intensity and division of both the benefits and costs of resource flows, involving all phases of the social metabolism (appropriation, production, consumption, distribution, and disposition) among members of the society (Martínez-Alier, 2002; González de Molina and Toledo, 2014). We adapted indicators (Mendoza, 2008) for these phases to better understand the way in which these societies are contributing to environmental justice and austerity (as a regionally and culturally sensitive version of degrowth). The theoretical-methodological focus of our work is based on a continuing collaboration with Zapotec communities that involved the integration of local researchers and an intercultural approach in the fieldwork (Clark-Tapia et al., 2016; Fuente et al., 2018), as proposed in early formulations for a post-normal science as “extended peer communities” (Funtowicz and Ravetz, 1994).

In this context, we accept the aspirations of other authors “to contribute to an emerging research agenda on the question: How can complementarities between different transformation discourses be made fertile towards a global socio-ecological transition?” (Beling et al., 2018:8) and for “paths to the pluriverse” (Escobar, 2011; Demaria and Kothari, 2017). In addition to the heterodox authors mentioned above, our exploration is enriched by the contributions of several authors, including Daly (1992), Martínez-Alier (2009), Martínez-Alier et al. (2010), González de Molina and Toledo (2014), and Pauliuk and Hertwich (2015) whose work draws on varying dimensions of social metabolism. Likewise, we incorporate the intercultural perspective offered by the narrative of *comunalidad*. This article focuses on water as a key entity, deeply rooted in virtually all dimensions of community praxis, embracing political, social, economic, cultural and environmental activities.

2. Governance as a double movement

2.1. Top-down governance

The concept of *good governance* contributes to the understanding of the phenomenon that emerged in the last decades of the 20th century. It recognizes the reduction of hierarchical checks to control government along with an increase in the participation by non-governmental stakeholders (Caldera, 2015; Sundaram and Chowdhury, 2012). The prevailing explanation of the neoliberal (top-down) governmental model is that it is a class project that argues rhetorically in favour of individual freedoms and the virtues of privatization; it unabashedly claims that this is best achieved by restoring and consolidating the power of the capitalist class (Harvey, 2010:10). Furthermore, it allows us to highlight these processes as being part of a dispute among extra-governmental stakeholders from the market or civil society about the meaning of the environmental goods and services. In Latin America, this debate is a point of departure for a research program in “ecological economics from below”.

Mexico offers an exemplary case of the penetration of capital through neoliberal governance that uses market signals as a language for valuing nature (Martínez-Alier, 2002). From the highest levels of central government down, there has been a dramatic change and

radicalization in the language used to reconceive nature: a) by assigning it a monetary value as a commensurable unit for its integration into the economy⁴; and b) by using these values to justify the extraction of resources as a source of development (Barkin, 2016). Both processes have become institutionalized as a matter of public interest⁵: resource development offers a path to a “more prosperous Mexico”. By placing a price on nature, neoliberal regimes are transforming spaces and resources that were part of the commons into commodities that can be appropriated for capital accumulation.

Within this framework, the Mexican State has relentlessly promoted legal reforms, beginning with agrarian titles, mining concessions, and foreign direct investment in the decade of the 1990s. The subsequent reform of the energy sector in 2013 completed the picture. Therefore, the topic of the sustainable scale and distribution with criteria of equity became subordinated to the market. In today’s neoliberal regime, resource management is generating: a) a degradation of biogeochemical cycles and of ecological resilience; b) the private appropriation of economic benefits; and c) the transfer of the costs of this deterioration to society and the environment (Barkin, 2016; Bustos and Leyva, 2017; Delgado, 2017).

These actions placed water management at the centre of the dispute for the public space (Barkin and Klooster, 2006). In this context, the State accelerated its process of decentralizing water services. This action was justified as a way of decreasing the pressure on public expenditure (for investment and services). Furthermore, it evaded the issue of the biophysical limitations of the hydrological cycle. This facilitated the granting of water management concessions to the private sector. This process presupposes that the free market is the most efficient instrument for allocating scarce resources efficiently.

As it organizes resistance to this process, civil society is promoting alternative models of water management. As such, it reflects a direct response, illustrating Polanyi’s claim (2001) that political responses to oppressive systems are going to provoke a “double movement.” While this article values the contributions of Ostrom (1990) and McGinnis and Ostrom (2014) in raising the awareness about these models, we distance ourselves from its methodological assumption of the rational actor.

2.2. Comunalidad as governance from below

Comunalidad is the form of governance adapted in the Sierra Juárez of Oaxaca in response to long-standing demands for greater local autonomy (Díaz, 2007; Martínez Luna, 2010). Firmly anchored in the cosmivision⁶ of the Zapotec indigenous community, it includes a strong commitment to direct democracy and rebuilding community (Fuente, 2009). In contrast to the dominant system of representative democracy, this institution explicitly generates a local-regional dynamic of rotating responsibilities for leadership that attempt to end the pattern of self-

⁴ Odum repeatedly criticized this practice, proposing “emergy” as a unit of valuation; one of his last articles succinctly presented this argument (Odum and Odum, 2000). Farrell and Silva-Macher (2017) clearly describe the destructive environmental implications of this practice of internalizing externalities.

⁵ The Mexican Supreme Court dismissed, on economic grounds, a legal challenge that sought to claim that the energy reforms were unconstitutional.

⁶ We use the term cosmivision in place of the more common English language term, cosmology; in Mesoamerica, the descendants of the peoples who inhabited the region prior to the Spanish conquest are not referring to a body of knowledge (logos) but rather to an approach to interpreting their existence as communities embedded in the natural world. A noted student of the matter defines cosmivision as a “delicate and very complex explanatory model” that codifies the structure and functioning of “the human body, society, with its history, and nature.” The author goes on to explain that in modern agricultural and especially urban-industrial societies, the natural world and social complexity are significantly less important in shaping belief systems (Espinosa Pineda, 1996: 54, 57–58; our translation).

³ Variations on this model exist in other indigenous groups in Chiapas, Puebla, Guerrero, and Michoacán, as we have shown in many of the works included in the bibliography of this article.

perpetuating elites who concentrate power and resources.

Comunalidad as governance from below integrates three different interrelated processes. By asserting local autonomy in matters of territorial and political affairs it challenges the normative structures (political constitution and laws) imposed by the neoliberal State. This involves a dispute with the State for the direct control of the social metabolism: the allocation of material and energy flows from natural resources and the distribution of the economic and environmental costs and benefits. These processes can be described as:

- 1) Appropriation of (rural) territory rather than possession of land: The original impetus of the Mexican agrarian reform (1917) was to create a communal structure in which the beneficiaries would jointly manage their holdings⁷; this system rapidly disintegrated as local elites and individuality overwhelmed the political process, save in few notable exceptions. In parts of the indigenous Zapotec world, the defence for communal management has prevailed and become a powerful force, preventing the privatization and alienation (sale) of the land. The land was transformed from a 'simple' productive element to a complex integrated space that encompasses a wide range of cultural, symbolic, and historic meanings along with its potential substantive contributions. This transformation places the peoples in this region in direct conflict with the national political system that claims sovereignty over sub-soil resources and water, redefining this space as a storehouse of monetary values that can simply be substituted for another space, should national development programs call for its appropriation by capital.
- 2) The transition to direct democracy: In 1995, the Congress of Oaxaca recognized an alternative governance system based on customary law in indigenous communities ("practices and customs").⁸ As a result, in many parts of the state community assemblies have become the central governing institutions for grassroots participatory decision making. Among the most important matters considered by these bodies are land management and municipal governance, including community services, productive activities, and schooling. By bringing these administrative and management matters into the public sphere, the assembly has been able to effectively reduce or eliminate corruption and co-optation by state or national institutions.
- 3) The transition from peasant to Zapotec identity. Peoples in the Sierra Juárez are asserting their identity as a Zapotec people, appealing to the 2001 amendment of the Mexican Constitution to differentiate themselves from rest of Mexican society based on their ethnic, historical, cultural, and political roots. This process is facilitated by a number of political developments: a) Mexico's ratification of Convention 169 of the International Labour Organization as a binding agreement giving them rights to "free, prior, informed consent" with regard to governmental decisions affecting their territories (1990); b) the recognition of the nation as pluri-cultural in the context of the commemoration of 500 years of "conquest" (1992); c) the armed uprising of the Zapatista Army of National Liberation (EZLN) in 1994 and its impact on the creation of the National Indigenous Congress that led to the inclusion of the rights of indigenous peoples in the constitution (2001) (Mora, 2018); and d) Mexico's ratification of the United Nations Declaration on the Rights of Indigenous Peoples (2007). By strengthening local institutions, indigenous authorities have effectively expanded their autonomy in managing the social metabolism.

A fourth element, embedded in the three mentioned above, has

much deeper roots in the indigenous cultures of Indo-America. Historical accounts throughout the hemisphere tell of a long-standing pattern of collective mobilizations to assert the integrity of their communities. This process has diverse implications; among them, two are quite significant: 1) it has the potential for a material-symbolic communal transformation and restoration; and, 2) it is the basis for citizenship, responding to the collective values of reciprocity, complementarity and public service. In contrast to the Hobbesian concept of a social contract, community "work" is an integral part of the indigenous social contract that attempts to balance the individual interests and collective responsibilities (Villoro, 2009). In practice, this work is a prerequisite for the exercise of rights, part of the duties and privileges of membership. Sometimes assumed to be a "gift" (voluntary service) and at other times a commitment imposed by the community, the balance between the two differs as the individual develops within the collective. It assumes many forms, including participation in the assembly for decision-making; accepting responsibilities for governance; coordinating tasks assigned by the assembly; performing voluntary work in collective projects (or "tequio" as it is known in the Sierra Juárez) for restoring and construction of infrastructure; and sponsoring festivities for enjoyment and enhancing communal identity and solidarity (Martínez Luna, 2010).

3. Social metabolism: a framework to understand community water management

3.1. General considerations

The incorporation of social practice broadened the methodologies of ecological economics began with discussions of post-normal science and continued with the use of multi-criteria analysis (Munda et al., 1998; Barkin et al., 2012; Spash, 2013) and citizen participation (O'Connor, 2000). Illich's earlier ideas (1973) move us far beyond these innovations (Kallis et al., 2014), integrating other ontologies derived from non-western cosmologies (Barkin, 2018). This study is based on an eight-year long collaborative study conducted with 15 Zapotec communities of the Sierra Juárez encompassing various environmental issues (water, forests and ecotourism) (Fuente et al., 2018), and in participatory regional workshops (Clark-Tapia et al., 2016). The social metabolism framework served as a method (quantitative and qualitative) to identify, systematize, and analyse the results of the workshops. We developed indicators that point to the relation between governance (*comunalidad*) and local responses in the construction of movements of environmental justice and austerity.

The social metabolism approach has greater potential when the full panoply of ecosystems and environmental services are included (González de Molina and Toledo, 2014). An overall examination of the social appropriation of nature (comprising many variables, depending on whether forests, water or ecotourism is examined) loses its analytical precision for lack of comparability (McGinnis and Ostrom, 2014). However, given the exploratory character of this study, the empirical analytic exercise was confined to improve knowledge on the relation *comunalidad*-water.

Our choice of water as the centre of the analysis was dictated by two key features: a) it is essential, not only for material production (agriculture and domestic use), but also, and above all, for its importance in environmental conservation, social reproduction, cosmology, and the life style of the indigenous communities; and b) the profound changes in hydrological cycles and levels of water vulnerability that manifested themselves recently (Clark-Tapia et al., 2016). In the face of growing shortages, the communities are at a crucial juncture: either they will face greater difficulties in guaranteeing supplies or they will have to deepen and broaden the civic and communitarian alliances required to face the challenge.

The analysis was based on three types of units and norms directly involved in the national debate on the control of water management:

⁷ Article 27 of the Mexican Constitution.

⁸ The Mexican government created the framework for this change in order to halt the spread of the more radical ideas for autonomy spawned by the EZLN (Zapatista) uprising in 1994.

- a) The municipal or county level. The county (*municipio*) is the third level of government in Mexico.⁹ This level, in turn, creates local units that are charged with many operational responsibilities. The county has a range of normative attributes with regard to management of the water cycle for human consumption, defined in Article 115 of the national constitution.
- b) The agrarian community. This unit is complementary to the county, with a broader range of normative responsibilities related to the control, access and use of productive resources. The agrarian authority (sometimes known as the *Comisariado de Bienes Comunales*) is recognized by the central government, as defined by Article 27 of the constitution. The community is based on the collective ownership of the resources that predominates in indigenous parts of Oaxaca; that is, private property is not recognized.
- c) The watershed. This is the basic geographic unit for water management in Mexico (based on the *Ley de Aguas Nacionales*). Our study characterized the size, shape, drainage network, and the elevations of diverse micro watersheds.

3.2. Social metabolism: governance shapes the social processes guiding material flows of water

We adopted social metabolism (SM) as a guiding concept because of its focus on the relationship between social and natural processes. Schmid's treatment of SM (2013 [1962]) clearly traces the concept back to Marx: "Labour is not the source of all wealth. Nature is just as much the source of use values" (Marx, 1875:1). Marx referred to the social metabolism as a complex, dynamic interchange between "human beings and nature" of matter and energy, which recognized how both "nature-imposed conditions" and human actions transform this process (Foster et al., 2010). This presentation includes the following key elements in the production process: the role of work as a mediator of the social and the natural; the use-value as a satisfier and a material (physical) feature; and the mediating role of political power in the relationship between society and nature. We might also note the importance of environmental value, that is, nature's contribution in the form of ecosystem services and resources. This supply-side value approximates the replacement value of resources and places constraints on economic growth (Allen et al., 2003).

SM can be defined as "the manner in which human societies organize their growing exchanges of energy and materials with the environment" (Martínez-Alier et al., 2010: 153). The concept of SM is particularly valuable because it focuses on the role of social organization (e.g. governance) during the diverse stages of material and energy flows, from appropriation (input) to excretion (output). Between these points, intermediate flows, occurring in the "entrails" of society, transformation, consumption, and distribution, are essential parts of the process (González de Molina and Toledo, 2014). The operation of the system requires the incorporation of endosomatic and exosomatic instruments (tools) (Georgescu-Roegen, 1975). With these methodological elements, we can integrate other variables and indicators (the link between theory and empirical reference). This integral perspective of social metabolism presents affinities with Illich's (1973) concept of "conviviality".

Martínez-Alier (2002) and Daly (1992) addressed the matter and energy flows from three types of systems: the biosphere, the social, and the economic. They also considered the priorities of the goals and instruments: a sustainable scale (nature as material) and an equitable distribution among people. We modified this formulation to incorporate governance as control of energy and material flows and excluded the

⁹ The states (for example, Oaxaca) are the second level, while the first level is the federal government (the United States of Mexico). Out of the three government levels that currently exist in our country, the county has the greatest direct impact on the quality of life of people.

market as an allocation mechanism (Fig. 1). In addition, we identified and hierarchized the interrelation of two governance types (top-down vs. bottom-up) that compete in designing water flows in three metabolic stages (appropriation, consumption and excretion) (González de Molina and Toledo, 2014). *Comunalidad* directly affects local policy-making of water management strategies, vulnerability reduction, and social justice. These actions and flows are listed below and illustrated in Fig. 2.

Material (water) flows:

- f(input)-f(output): (fa) Appropriation; (fb) Consumption; (fc) Excretion

Social actions that determine water flows:

- g1: Local policymaking. Actions for maintaining the quantity and quality of the material flow in the social system (water management) for distributing the material (water) flows among individuals.
- g2: Water vulnerability reduction: (a) appropriation, (b) consumption and (c) excretion of water resources
- g3b: Social justice: consumption of water resources

Our work was organized around three policy objectives, consisting of 10 leading components (one for local policy effectiveness, eight for water vulnerability reduction and one for social justice) and 56 indicators (see Table 1 in Appendix). Each indicator was assigned an ordinal value (0-worst situation to 4-ideal scenario); that is, the higher values indicate greater achievement (Fig. 3). Source data are surveys and narratives from interviews as well as from collaborative workshops (to be published in a Mexican journal). This proposal made it possible to evaluate the role of governance (*comunalidad*) in policy formulation as a methodological strategy to identify advances in environmental justice and austerity.

4. Results

We report both quantitative (4.1) and qualitative (4.2) results in this section. The quantitative results are summarized in Fig. 3, and were grouped into the three facets of water governance: a) local policy-making; b) reduction of vulnerability; and c) social justice. The qualitative results are discussed in the context of Illich's model of conviviality.

4.1. Quantitative results

4.1.1. (g.1.): Local policymaking.

Local policy effectiveness obtained the highest rank (3.72 ± 0.14) in communal organization (Fig. 3). The local management units codified an internal set of rules. Community meetings were important occasions and have the active participation of both men and women in the decision-making process. The community maintains tight control over its water system. The strength of *comunalidad* is directly related to the social processes mentioned above (Section 2.2). The internal political and social actions around water management are part of a process that is strengthening the communities' abilities to assert their authority in other spheres, such as the protection of their forests and mineral deposits. This, in turn, creates a stronger political base from which to govern themselves and to negotiate with other levels of government.

4.1.2. (g2): Reduction of water vulnerability

Of the components analysed on the second level (see Table 1, Appendix 1), Watershed recharge was closest to the ideal (3.45 ± 0.35), while Excretion was the lowest (1.48 ± 0.56). The rest of the components showed intermediate levels of vulnerability (2.9 ± 0.48).

a) (g.2.a.) Appropriation. We observed that the communities are

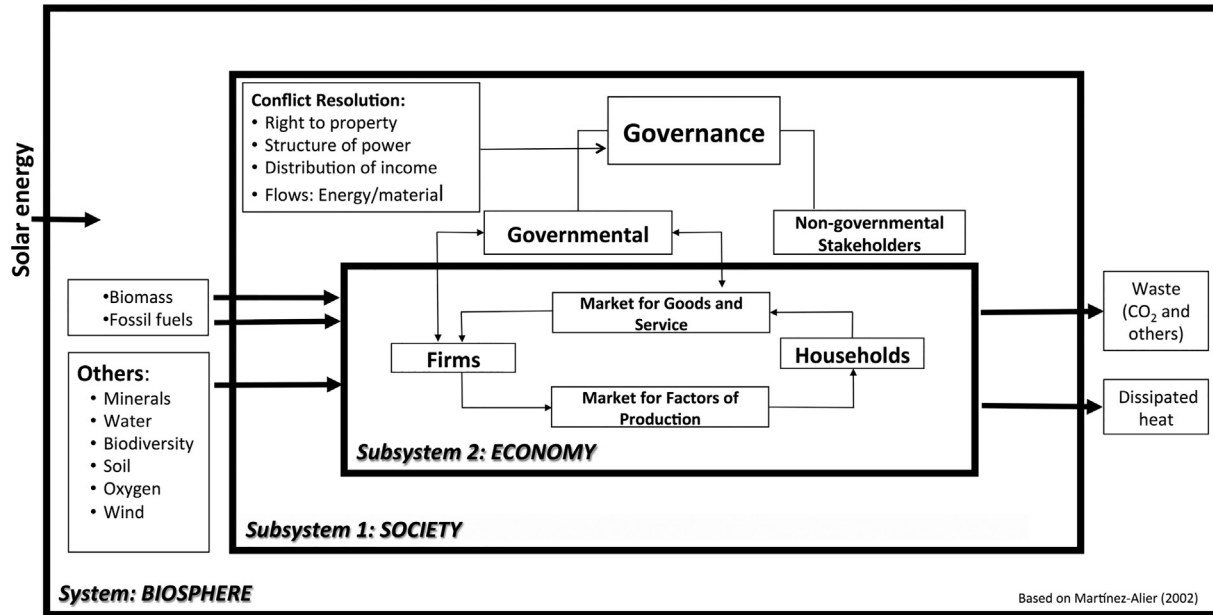


Fig. 1. Interrelations of society-governance systems as flow controls.

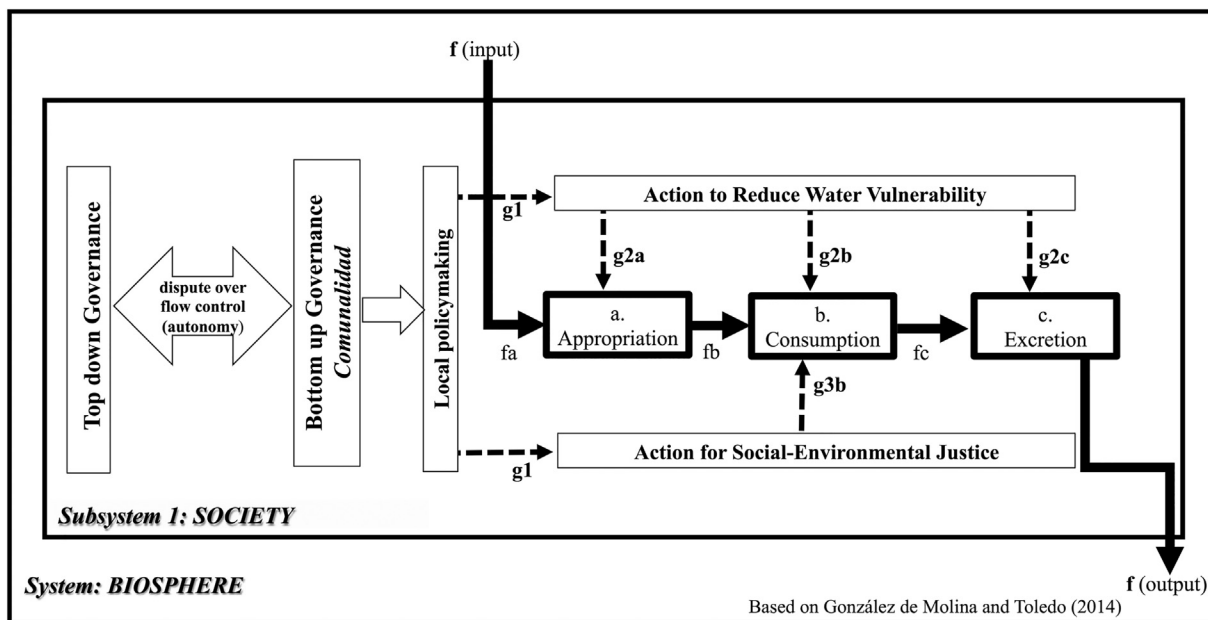


Fig. 2. Water and social actions. Solid arrows indicate water flows (f), while broken arrows show actions (g).

committed to maintaining or improving their natural conditions. We found that the recharge zones were the best-conserved part (very low vulnerability), in part, because the communities placed their water recharge zones in protected areas (accompanied by an intensive reforestation program). This decision is quite significant, since the social metabolism as a whole depends on water availability.

With regard to the supply sources, we found a high degree of control and care, with special attention devoted to avoiding contamination. The processes of water intake and uptake and the storage facilities are well managed and the communities undertake regular maintenance of the primary and secondary water distribution systems and the water storage tanks; the processes are affected by the lack availability of accessories, spare parts and components.

- b) g.2.b. Consumption. The communities are well aware of the cultural value and the human right to water. Water committees are appointed by local authorities to oversee water use and management. Their work includes a constant maintenance of the pipeline network as well as the proper use and quality of the household storage systems while also instilling a consciousness about the need for water conservation. However, one observed weakness is the relatively low-level of training in the use and handling of water in the households.
- c) g.2.c. Excretion. This component is clearly more complex and the most difficult to manage. Although they are aware of the importance of wastewater treatment, most communities lack treatment systems, not only because of complex compliance regulations but also because of their costs. Many of the existing systems operate poorly or not at all due to lack of technical support and/or high operational costs. Although communities have a traditional knowledge base for adequate wastewater management, they are constrained by state

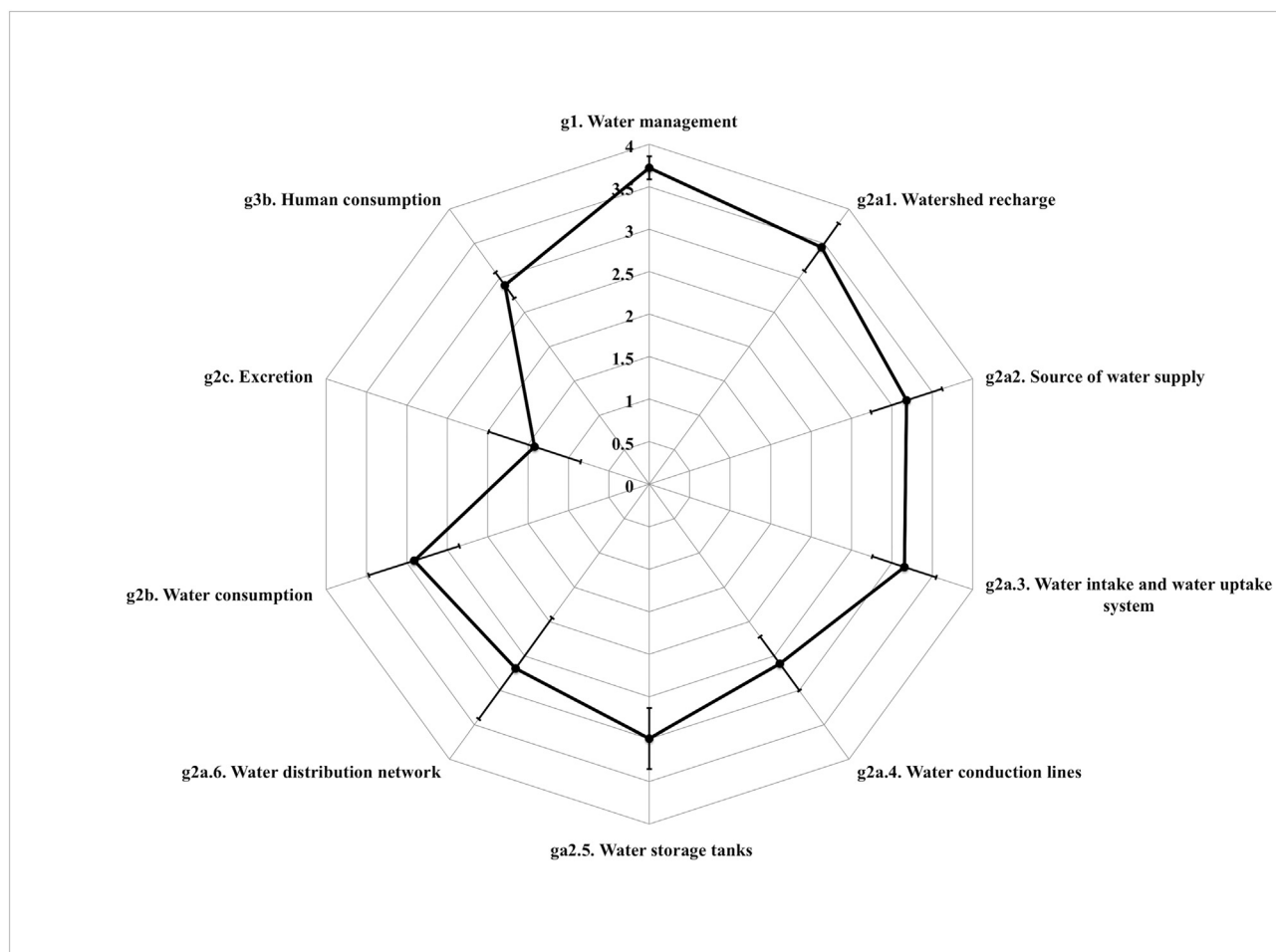


Fig. 3. Levels of Governance in Zapotec communities of the Sierra Juárez, Oaxaca, Mexico.

policies that mandate inappropriate solutions (e.g. replace eco-toilets or latrines with typical toilets that use 3.5 gal per flush, installation of sewerage system in inappropriate sites, etc.).

4.1.3. (g.3): Social justice

Social justice as measured by water availability (human consumption) appears to be important (2.9 ± 0.18). Water service is available, with few interruptions. Water quality in general is good because the water and healthcare committees are quite effective. Special attention is devoted to the more vulnerable (sick or elderly) and to communal institutions (schools, health care centres, canteens, municipal agencies). The biggest problem in the communities is the cultural rejection of purification with chlorine, due to its unpleasant taste.

4.2. Qualitative results

A qualitative application of the social metabolism framework was enriched by incorporating Illich's model of conviviality (Barkin, 2018), which facilitates a deeper understanding of the role of *comunalidad* as a movement for environmental justice that integrates austerity. Our research identified the following elements of the governance-water system:

a) The communities identified some potential problems because of the declining availability of water. There are ample evidence of physical limits as well as the potential of greater variability in supplies that create the threat of “water vulnerability”. The problems are being addressed in community meetings (*asambleas*) with the aim of identifying solutions

b) In Mexico, the prevailing response to a water shortage is to search for additional supplies. This generally occurs by requesting that the State water authority (and the National Water Commission) drill additional wells or permit water transfers from other watersheds.

c) In contrast to this paradigm, the communities are developing their own approaches, based on local traditions and cosmovision. These included:

- i. Convening the assembly to explore alternatives. This process is very important and time-consuming, requiring a consensus for any decision.
- ii. Rejecting the search for new sources of water as a solution. Since the water supply problem is intensifying everywhere, using new sources will only postpone the day of reckoning and create problems elsewhere.
- iii. The search for local solutions that the community itself could implement. Government programs often take a great deal of time to implement. While the community does not reject such assistance in principle, it has refused some programs such as paving of streets (that prevents the land from ‘breathing’) and a sewage system that only concentrates wastewaters without eliminating contamination.
- iv. The search for local solutions, includes: 1) caring for water sources (natural springs); 2) assuring that the water pipes from the spring to the community are well maintained; 3) identifying the ‘tools’ required for caring for the water and avoiding waste; and 4) implementing measures to reduce the volumes needed without sacrificing basic needs.

In this context, the experience |of one of the communities (Benito

Juárez) exemplifies the relationship between democratic control of “tools” and the notion of austerity. The community identified a potential problem because of the declining availability of water. It decided to replace various socio-technical solutions that were currently in vogue. Two of these are particularly noteworthy: 1) the very convenient system of water delivery to each household was replaced by community “hydrants” located within each neighbourhood, thus reducing disparities in consumption and overall water use; and 2) a prohibition on the use of “English” toilets (or water closets) within the home (Hernández, 2017). The hydrants are sources of water located at intervals of 50 m along the community streets. This decision obviously required an additional effort by all families: they have to carry water from the closest hydrant to their home. The substitution of toilets for composting latrines also requires new behaviours while moving the community to reduce consumption. This experience, grounded in the local cosmovision, served to integrate the goals of environmental justice and austerity.

As part of the process, the neighbourhood committees and the local administration were obliged to improve their coordination in order to effectively implement the *Asamblea's* decisions and assure social control over the process. In this way, the community continued to manage its own affairs, avoiding external (governmental) intrusion. This appropriation of control and ‘ownership’ of the social ‘tools’ by the community unleashed a number of other positive dynamics that improved the quality of life. There was an explicit recognition of the importance of caring for the water sources and of the use of water; there was a change in patterns of water use with a measurable reduction in requirements, everyone developed new and more effective means to store and reuse water within the home. In sum, these actions, based on control of social tools, produced radical changes in the social metabolism of water.

5. Contributions of *comunalidad* to social metabolism: the convergence of the environmental justice and austerity movements

This discussion of the case study of water management in an indigenous community in Oaxaca reflects ways in which the approach of ecological economics from below, along with the conceptions of Illich and Marx, can expand our appreciation of the importance of the *comunalidad* as a movement to resist the onslaught of capitalist expansion. The prevalent concept of “environmental justice movement” is of “spontaneous movements and organizations that resist extractive industries and organize against pollution and climate change” (Martínez-Alier, 2002: 153). In our study, we emphasize the importance of connecting the concept of environmental justice with austerity. By integrating the matter of governance into the social metabolism framework, we show that they can articulate three key components of the metabolic process for the social appropriation of nature: a) local policymaking (with participatory democracy); b) reduction of water vulnerability (by adapting to environmental limits); and c) social justice (by assuring an inclusive and equitable distribution of water).

In this regard, both Illich and Marx coincide in observing the significance of social control of productive systems (tools, in Illich; means and processes of production, in Marx) as the foundation for a restructuring of society and the social metabolism. These formulations coincide with one of the most important contributions of Georgescu-Roegen to the construction of the transdisciplinary field of ecological economics: the evolution of exosomatic instruments “brought down upon the human species two fundamental and irrevocable changes” the irreducible social conflict between social classes and people’s addiction to the exosomatic instruments. He went on to say this addiction presents a unique problem that “is neither only biological nor only economic. It is bioeconomic” (Georgescu-Roegen, 1975: 369). To advance towards this objective, our experience reveals the need for: 1) the collective (social) ownership of the means of production; 2) social control over the means by which needs are satisfied; and 3) a collective

agreement about limiting some technological aspects of production (e.g., scale) and consumption.

Concretely, these tools (means of production; social constructions; and exosomatic bodies) offer a continuum between two extremes: as imposing instruments of alienated production and as convivial tools. The latter are transformed into a social structure that makes it possible to advance towards the practice of justice. In this process, a multi-dimensional equilibrium of the social organization emerges that integrates people with their tools. Of course, this equilibrium is strongly constrained by natural forces. When social activity transgresses a threshold defined by these forces, it becomes a destructive process, threatening to erode the social structure as a whole. It is essential to identify these limits with care and understand the thresholds that allow for a comfortable scale of human existence.

Continuing, Illich adds another contribution, important for ecological economics: the tools for conviviality are in fact social processes that facilitate people’s interaction while defining their impacts on each other and on the environment. In this way, people train themselves to engage in concrete actions to reshape their institutions, the mechanisms for providing for their needs, and their alliances with others to safeguard their natural patrimony. For this reason, we are convinced that the analysis of the impact of water management on the social metabolism examined in this article can readily be extended to other parts of the natural environment.¹⁰

With this understanding, it becomes clear that *comunalidad* is significant as an institution for forging a model of governance and social well-being. It opens spaces for collaboration among members and facilitates debate about collective proposals for management of natural patrimony and local infrastructure as tools for conviviality. In this way, the group generates the possibility of moving beyond the competitive dynamics of “resource allocation” to construct a new consensus, based on a common agreement about what is possible with the means at its disposal and the goals it seeks to achieve. Thus, “*comunalidad*” is an important new political and economic project, moving beyond the profound crises plaguing global and national societies to generate a “joyful” form of austerity, understood as “a virtue which does not exclude all enjoyments, but only those which are distracting from or destructive of personal relatedness” (Illich, 1973:xxv). These communities are producing new forms of environmental justice, “social arrangements that guarantee for each member the most ample and free access to the tools of the community and limit this freedom only in favour of another member’s equal freedom” (Illich, 1973: 12), as well as the sustainability of the ecosystems on which they depend.

Comunalidad contributes an expanded appreciation of the on-going process to transcend the confines of “remedial” social welfare and ethnic integration policies (based on market models of rationality) by creating autonomous societies with their own visions of the future (Porto-Gonçalves and Leff, 2015). Together with myriad other communities in Latin America, the activities we examine are part of a process of forging “post-capitalist” societies (Chaguaceda and Brancaleone, 2012; Barkin and Lemus, 2016; Beling et al., 2018; Carlson, 2018).

6. Conclusions

Mexico today enjoys an extraordinary diversity of grassroots proposals for confronting the problems of its many social groups, heavily impacted by globalization and neoliberal economic policies. In this article, we explored just one line of action: the response of communities

¹⁰ This is confirmed by the summary of numerous analyses of community management of forest resources in Mexico (Stevens et al., 2014) and the numerous struggles to defend their territories from degradation by companies granted concessions for mining, wind energy, fracking, and commercial agriculture (see Rodríguez, 2016).

in a mountainous region in Oaxaca that reorganized their water management system in response to the perceived threat of declining availability.

By examining the social process of community governance (*comunalidad*), shaped by indigenous narratives and praxis, we point to ways in which a new model of society is emerging (Esteve, 2014).¹¹ Faced with insufficient water supplies, the community case study we described decided to restrict consumption in line with its commitment to environmental justice and convivial austerity, assuring adequate supplies to all members. The collective deliberations that preceded the changes reflected an explicit internalization of the need to reconfigure the social metabolism to conform to the changing conditions in their watershed. These processes are similar to the ones formulated by Gual and Norgaard (2010) on ecological and social systems coevolution.

The cultural context of this analysis demonstrated the profound commitment to conserving and enhancing the community's natural patrimony without succumbing to the continuing overtures by the national government and international agencies for the group to participate in programs of conventional urban services; these services involve using greater volumes of water for consumption and social organization. The collective process of deliberation that led to the dramatic transformation with regard to the social organization of water use is not only of academic interest, but also of ethical and political importance. It offers a stark contrast to the technical solutions offered by the neoliberal governance model; for example, in 2018 the President decreed the lifting of a ban on using water reserves in more than 50% of the

national territory, opening the possibility of granting concessions for its use in privately controlled energy and mining projects).¹²

The advance towards constructing a balance between societies and their ecosystems that is at the core of the social metabolism framework highlights the importance of the bottom-up model of governance inherent in the praxis of *comunalidad*. The research project from which this article emerged is based on a dual dialogue: one that is transdisciplinary between academics (biology, ecology, economy, sociology) and another that is intercultural, engaging communal stakeholders (Fuente et al., 2018).

Comunalidad is a dynamic process of evolving governance mechanisms. The autonomous spaces generated by this cosmivision require continuing renegotiation, within the community and with the state and the marketplace. The case studies of water management in 15 indigenous communities offer a particularly poignant example: being an essential element for life, and for social cohesion, in many settings, the availability of water is threatened by the profitability of diverting supplies for ecotourism or bottled water, both of which are impoverishing other communities. This is the challenge foreseen by Illich in “*Tools for Conviviality*.”

This analysis explains that the underlying tenets of “EE from below” are elegantly achieved with the internalization of a sustainable model of social metabolism implemented within the governance structure of *comunalidad*. This democratic system is assuring improvements in their quality of life (social justice) within the biophysical limits imposed by their ecosystem.

Appendix A

Table 1
Water management indicators.

Level	Components	Indicators
Local policy making	g1. Water management	1. Administrative support unit 2. Water law and the regulations 3. Gender equity 4. Support and training for local authorities 5. Board Meetings: quality and frequency 6. Community water associations 7. Availability of tools, equipment and materials.
Water vulnerability reduction	g2a.1. Watershed recharge	8. Percentage of forest cover 9. Forest land use 10. Watershed control system
	3.g2a.2. Source of water supply	11. Territorial planning 12. Territorial control 13. Watershed protection 14. Sources of pollution*
	g2a.3. Water intake and water uptake system	15. Natural threats to water supply* 16. Natural threats to the water system 17. Availability of accessories and spare parts 18. Condition of water collection works 19. Maintenance frequency
	g2a.4. Primary water distribution network	20. Natural threats to distribution lines* 21. Availability of spare parts and components 22. Pipeline condition 23. Maintenance frequency 24. Prevention, mitigation and recovery measures
	g2a.5. Water storage tanks	25. Availability of spare parts and components for the storage tanks 26. Tank condition 27. Maintenance frequency to storage tanks 28. Natural threats to storage tanks*

(continued on next page)

¹¹ The governance systems to which we are referring include the whole panoply of institutional and resource challenges confronting the communities. Forest management (cf. Stevens et al., 2014) and agroecology (Pérez Rodríguez, 2016) are other areas of resource management that reflect the alternative social model grounded in the indigenous cosmivision analysed in this article. The production and distribution of physical and monetary surpluses is also an important matter for collective decision-making designed to reduce social and economic disparities within the communities (Barkin et al., 2019).

¹² Diario Oficial de la Federación (June 6, 2018). This precipitous move by a lame-duck executive is a reaction to the militant resistance by Mexican civil society to the egregious abuse of power; it was subsequently reversed by the courts. A reformed legal framework for water management subject to citizen control will be enacted by the new congress with the change in political forces.

Table 1 (continued)

Level	Components	Indicators
	g2a.6. Community water distribution network	29. Prevention, mitigation and restoration measures 30. Pipelines and valves condition 31. Distribution system condition 32. Pipeline maintenance 33. Natural and human threats types*
	g2b. Water consumption (water use and management)	34. Restoration, prevention and mitigation measures 35. Quality, condition and pipeline maintenance 36. Percentage of household water storage tanks 37. Quality of the storage tank 38. Training on house wastewater treatment and reuse 39. Users' awareness on water conservation*
	g2c. Excretion (wastewater management)	40. Users' energy consumption for pumping water 41. Percentage of the population that requires sewerage or sanitary equivalent services 42. Types and sources of wastewater 43. Percentages of wastewater under treated 44. Wastewater treatment level 45. Sewerage or excreta disposal services 46. Wastewater discharge site 47. Evolution of excreta disposal system 48. Cultural preferences for a sanitation system*
Social justice	g3b. Human consumption (water allocation)	49. Percentage of traditional knowledge-base for adequate wastewater management 50. Energy used for wastewater treatment 51. Service coverage 52. Service continuity 53. Potable water treatment 54. Potable water treatment frequency* 55. Water supply to vulnerable people 56. Water supply to social sectors

*Asterisks denote indicators based on consumer perceptions. For example: the perception of water quality, if it is clear then it is healthy and safe. Based on [Mendoza \(2008\)](#).

References

- Akbulut, B., Demaria, F., Julien-François, G., Martínez-Alier, J., 2019. Five theses on the relationships between degrowth and the Environmental Justice movement. *Ecol. Econ.* (forthcoming, submitted).
- Allen, T.F.H., Tainter, J.A., Hoekstra, T.W., 2003. *Supply-Side Sustainability*. Columbia University Press, New York.
- Arias, A., 2018. From indigenous literatures to Native American and indigenous theorists: the makings of a grassroots decoloniality. *Lat. Am. Res. Rev.* 53 (3), 613–626. <https://doi.org/10.25222/larr.181>.
- Barkin, D., 2016. Violence, inequality and development. *J. Aust. Polit. Econ.* 78, 115–131.
- Barkin, D., 2018. Conviviality. In: Escobar, A., Kothari, A., Salleh, A., Acosta, A., Demaria, F. (Eds.), *Pluriverse: A Post-Development Dictionary*. AuthorsUpFront and Columbia University Press, New Delhi, New York.
- Barkin, D., Klooster, D., 2006. Estrategias de la gestión del agua urbana en México: Un análisis de su evolución y las limitaciones del debate para su privatización. In: Barkin, D. (Ed.), *La Gestión del Agua Urbana en México*. Universidad de Guadalajara, Guadalajara, Mexico, pp. 1–45.
- Barkin, D., Lemus, B., 2016. Third world alternatives for building post-capitalist worlds. *Rev. Radic. Polit. Econ.* 48 (4), 569–576. <https://doi.org/10.1177/0486613416665828>.
- Barkin, D., Fuente, M., Tagle, D.A., 2012. La significación de una Economía Ecológica Radical. *Rev. Iberoam. Econ. Ecol.* 19, 1–14. <https://redibec.org/ojs/index.php/revibec/article/view/194/84>.
- Barkin, D., Suárez, A., Esquivel, A., Armenta, W., 2019. The communitarian revolutionary subject. *Third World Q.* (in press).
- Being, A.E., Vanhulst, J., Demaria, F., Rabi, V., Carballo, A.E., Pelenc, J., 2018. Discursive synergies for a 'Great Transformation' towards sustainability: pragmatic contributions to a necessary dialogue between human development, degrowth, and buen vivir. *Ecol. Econ.* 144 (1), 304–313. <https://doi.org/10.1016/j.ecolecon.2017.08.025>.
- Bustos, A., Leyva, G., 2017. Towards a more realistic estimate of the income distribution in Mexico. *Latin Am. Policy.* 8 (1), 114–126. <https://doi.org/10.1111/lamp.12114>.
- Caldera, A.R., 2015. Gobernanza y proyectos políticos: una revisión crítica desde la teoría normativa de la democracia. *Cuestiones Políticas* 31 (55), 14–29. https://www.researchgate.net/publication/301552946_Gobernanza_y_proyectos_politicos_una_revision_critica_desde_la_teor%C3%ADa_normativa_de_la_democracia.
- Carlson, C., 2018. Rethinking the agrarian question: agriculture and underdevelopment in the global South. *J. Agrar. Chang.* 18 (4), 703–721. <https://doi.org/10.1111/joac.12258>.
- Chaguaceda, A., Brancaleone, C., 2012. Sociabilidades Emergentes y Movilizaciones Sociales en América Latina. CLACLO, Universidad Veracruzana, Xalapa, Mexico. <http://bvdsce.org.ni/clasco/publicaciones/Sociabilidadesemergentes.pdf> (Coords.).
- Clark-Tapia, R., Ramos, M., Alfonso-Corradó, C., Mendoza, M., Fuente, M. (Eds.), 2016. *Recursos Hídricos de la Sierra Norte de Oaxaca, Caracterización, Diagnóstico y Gestión*. Universidad de la Sierra Juárez y Consejo de Ciencia e Investigación de Oaxaca, México.
- Daly, H., 1992. Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable. *Ecol. Econ.* 6 (3), 185–193. [https://doi.org/10.1016/0921-8009\(92\)90024-M](https://doi.org/10.1016/0921-8009(92)90024-M).
- Delgado, G.C., 2017. Del extractivismo minero en México, la defensa del territorio y las alternativas. Voces en el Fenix 60, 72–79. http://www.vocesenelfenix.com/sites/default/files/pdf/8_24.pdf.
- Demaria, F., Kothari, A., 2017. The post-development dictionary agenda: paths to the pluriverse. *Third World Q.* 38 (12), 2588–2599. <https://doi.org/10.1080/01436597.2017.1350821>.
- Díaz, F., 2007. Comunidad y comunalidad (Comps.) In: Robles, S., Cardoso, R., Díaz, Floriberto (Eds.), *Comunalidad, Energía Viva del Pensamiento*. UNAM, Mexico, pp. 34–50.
- Escobar, A., 2011. Sustainability: design for the pluriverse. *Development* 54, 137–140. <https://doi.org/10.1057/dev.2011.28>.
- Espinosa Pineda, G., 1996. El Medio Natural como Estructurador de la cosmovisión: El caso mexicana. *Cuicuilco.* 2 (6), 51–74. http://www.academia.edu/10756095/El_medio_natural_como_estructurador_de_la_cosmovisi%C3%B3n_el_caso_mexicana.
- Esteva, G., 2014. Communing in the new society. *Community Dev. J.* 49 (1), 144–159. <https://doi.org/10.1093/cdj/bsu016>.
- Farrell, K.N., Silva-Macher, J.C., 2017. Exploring futures for Amazonia's Sierra del divisor: an environmental valuation Triadics approach to analyzing ecological economic decision choices in the context of major shifts in boundary conditions. *Ecol. Econ.* 141, 166–179. <https://doi.org/10.1016/j.ecolecon.2017.04.015>.
- Foster, J.B., Clark, B., York, R., 2010. *The Ecological Rift: Capitalism's War on the Planet*. Monthly Review, New York.
- Fuente, M.E., 2009. Nueva ruralidad comunitaria y sustentabilidad: Contribuciones al campo emergente de la economía-ecológica. *Rev. Iberoam. Econ. Ecol.* 13, 41–55. http://redibec.org/wp-content/uploads/2017/03/rev13_04.pdf.
- Fuente, M.E., Barkin, D., Esquivel, A., Ramos, F., 2018. La co-investigación en comunidades zapotecas de Oaxaca. *Sinéctica* (50), 1–15. Available at: <https://sinectica.iteso.mx/index.php/SINECTICA/article/view/793>.
- Funtowicz, S.O., Ravetz, J.R., 1994. The worth of a songbird - ecological economics as a post-normal science. *Ecol. Econ.* 10, 197–207. [https://doi.org/10.1016/0921-8009\(94\)90108-2](https://doi.org/10.1016/0921-8009(94)90108-2).
- Georgescu-Roegen, N., 1975. Energy and economic myths. *South. Econ. J.* 41 (3), 347–381.
- González de Molina, M., Toledo, V.M., 2014. *The Social Metabolism: A Socio-Ecological Theory of Historical Change*. vol. 3 Springer, Basel.
- Gual, M.A., Norgaard, R.B., 2010. Bridging ecological and social systems coevolution: a review and proposal. *Ecol. Econ.* 69 (4), 707–717. <https://doi.org/10.1016/j.ecolecon.2008.07.020>.
- Harvey, D., 2010. *The Enigma of Capital: And the Crises of Capitalism*. Oxford University

- Press, Oxford.
- Hernández, M.E., 2017. Procesos de gobernanza comunitaria frente a la vulnerabilidad hídrica (Tesis Master). Universidad de la Sierra Juárez, Oaxaca, México.
- Illich, I., 1973. Tools for Conviviality. Calder and Bacon, London Available in: <http://www.preservenet.com/theory/illich/illichTools.html> (The page references in the text are to the electronic version).
- Kallis, G., Demaria, F., D'Alisa, G., 2014. Introduction. In: D'Alisa, G., Kallis, G. (Eds.), *Degrowth: A Vocabulary for a New Era*. Routledge, London, pp. 29–45.
- Martínez Luna, J., 2010. *Eso que Llamam Comunalidad*. CONACULTA-CAMPO, Fundación Harp Helú-Secretaría de Cultura-Oaxaca, México.
- Martínez-Alier, J., 2002. *The Environmentalism of the Poor: A Study of Ecological Conflicts and Valuation*. Edward Elgar Publishing, Cheltenham.
- Martínez-Alier, J., 2009. Social metabolism, ecological distribution conflicts, and languages of valuation. *Capital. Nat. Social.* 20 (1), 58–87. <https://doi.org/10.1080/10455750902727378>.
- Martínez-Alier, J., 2012. Environmental justice and economic degrowth: an alliance between two movements. *Capital. Nat. Social.* 23 (1), 51–73. <https://doi.org/10.1080/10455752.2011.648839>.
- Martínez-Alier, J., Kallis, G., Veuthey, S., Walter, M., Temper, L., 2010. Social metabolism, ecological distribution conflicts, and valuation languages. *Ecol. Econ.* 70 (2), 153–158. <https://doi.org/10.1016/j.ecolecon.2010.09.02>.
- Martínez-Alier, J., Anguelovski, I., Bond, P., Del Bene, D., Demaria, F., Gerber, J.F., Grey, L., Haas, W., Healy, H., Marín-Burgos, V., Ojo, G., Firpo, P.M., Rijnhout, L., Rodríguez-Labajos, B., Spangenberg, J., Temper, L., Warlenius, R., Yáñez, I., 2014. Between activism and science: grassroots concepts for sustainability coined by environmental justice organizations. *J. Pol. Ecol.* 21, 19–60. <https://doi.org/10.2458/v21i1.21124>.
- Martínez-Alier, J., Temper, L., Del Bene, D., Scheidel, A., 2016. Is there a global environmental justice movement? *J. Peasant Stud.* 43 (3), 731–755. <https://doi.org/10.1080/03066150.2016.1141198>.
- Marx, K., 1875. Critique of the Gotha Programme. 1970 In: Marx, K., Engels, F. (Eds.), *Selected Works*. vol. three. Progress Publishers, Moscow, pp. 13–30. https://www.marxists.org/archive/marx/works/download/Marx_Critique_of_the_Gotha_Programme.pdf.
- McGinnis, M.D., Ostrom, E., 2014. Social-ecological system framework: initial changes and continuing challenges. *Ecol. Soc.* 19 (2), 30. <https://doi.org/10.5751/ES-06387-190230>.
- Mendoza, M., 2008. Metodología para el análisis de vulnerabilidad del recurso hídrico para consumo humano; aplicación y determinación de medidas de adaptación en la subcuenca del río Copán, Honduras. Tesis Mag. Sc. Turrialba, Costa Rica, CATIE.
- Mora, M., 2018. Kuxlejal Politics: Indigenous Autonomy, Race, and Decolonizing Research in Zapatista Communities. University of Texas Press, Austin.
- Munda, G., Paruccini, M., Rossi, G., 1998. Multicriteria evaluation methods in renewable resource management: the case of integrated water management under drought conditions. In: Beinat, E., Nijkamp, P. (Eds.), *Multicriteria Evaluation in Land-Use Management: Methodologies and Case Studies*. Kluwer Academic Publisher, Dordrecht, pp. 79–94. https://link.springer.com/chapter/10.1007/978-94-015-9058-7_6.
- O'Connor, M., 2000. Pathways for environmental evaluation: a walk in the (Hanging) Gardens of Babylon. *Ecol. Econ.* 34 (2), 175–193. [https://doi.org/10.1016/S0921-8009\(00\)00157-9](https://doi.org/10.1016/S0921-8009(00)00157-9).
- Odum, H.T., Odum, E.P., 2000. The energetic basis for valuation of ecosystem services. *Ecosystems* 3, 21–23. <https://doi.org/10.1007/s100210000005>.
- Ostrom, E., 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press, Cambridge, UK.
- Pauliuk, S., Hertwich, E.G., 2015. Socioeconomic metabolism as paradigm for studying the biophysical basis of human societies. *Ecol. Econ.* 119, 83–93. <https://doi.org/10.1016/j.ecolecon.2015.08.012>.
- Pérez Rodríguez, V., 2016. Terrace agriculture in the Mixteca Alta Region, Oaxaca, Mexico: ethnographic and archeological insights on terrace construction and labor organization. *Cult. Agric. Food Environ.* 38 (1), 18–27. <http://dx.doi.org/10.1111/cuag.12062>.
- Polanyi, K., 2001. *The Great Transformation: The Political and Economic Origins of Our Time*. Beacon Press, Boston [1944].
- Porto-Gonçalves, C.W., Leff, E., 2015. Political ecology in Latin America: the social re-appropriation of nature, the reinvention of territories and the construction of an environmental rationality. *Desenvolv. e Meio Ambiente.* 35, 65–88. <https://doi.org/10.5380/dma.v35i0.43543>.
- Rodríguez, W.C.A., 2016. *Geopolítica del Desarrollo Local*. UAM-X, Itaca, México.
- Schmidt, A., 2013. *The Concept of Nature in Marx*. Verso Books, London [1962].
- Scott, J.C., 1985. *Weapons of the Weak: Everyday Forms of Peasant Resistance*. Yale University Press, New Haven.
- Spash, C.L., 2013. The shallow or the deep ecological economics movement? *Ecol. Econ.* 93, 351–362. <http://epub.wu.ac.at/4024/>.
- Stevens, C., Winterbottom, R., Reynter, K., Springer, J., 2014. *Securing Rights, Combating Climate Change: How Strengthening Community Forest Rights Mitigates Climate Change*. (Washington, D.C).
- Sundaram, J.K., Chowdhury, A., 2012. *Is Good Governance Good for Development?* Bloomsbury Publishing, New York.
- Temper, L., Demaria, F., Scheidel, A., Del Bene, D., Martínez-Alier, J., 2018. The global environmental justice atlas (EJAtlas): ecological distribution conflicts as forces for sustainability. *Sustain. Sci.* 1–12. <https://doi.org/10.1007/s11625-018-0563-4>.
- Villoro, 2009. *Tres retos de la sociedad por venir: Justicia, democracia, pluralidad*. Siglo XXI Editores, México.