

Alfredo Ortega-Rubio *Editor*

Socio-ecological Studies in Natural Protected Areas

Linking Community Development and
Conservation in Mexico

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Foreword

In the early 1970s a silent revolution was taking place in UNESCO's central offices at Place de Fontenoy in Paris. An Italian ecologist, Francesco di Castri, had been hired by UNESCO to implement the goals and further the results of the International Biological Program (IBP), which he was a part of in the 1960s. Di Castri, who spent several years as a researcher in Chile and knew South America extremely well, teamed up with a French ecologist, Michel Batisse, and started discussing the accomplishments and shortcomings of the IBP. As a French scientist, Batisse had worked extensively, doing research in Francophone Africa, and had, like di Castri, acquired a serious concern about the social conditions of the underprivileged populations in poor, undeveloped countries. "How are we going to establish nature conservation programs," they wondered, "among people that have been exploited for centuries, have seen their natural resources being stolen from them under colonial regimes, and have very little means to survive and prosper?" Conservation, they realized, is a long-term commitment that can seem contradictory in the face of abject poverty and deprivation.

In order to tackle this challenge they contacted a number of scientists around the World, including two extraordinary Mexican ecologists: Gonzalo Halffter and Arturo Gómez-Pompa. Together, they developed a critique of the "isolated wilderness" paradigm in conservation. In a globalized planet, they argued, no ecosystem is entirely devoid of human influence. The idea of pristine ecosystems for conservation is a myth, argued Arturo Gómez-Pompa in a now famous paper. Conservation must be done with the human populations that live in those diversity-rich ecosystems, and it must be of benefit for them. Otherwise, they argued, it will keep on failing in the poorest nations, as the pressures to extract resources from the often impoverished land keep mounting. In the wake of these discussions, UNESCO's Man and the Biosphere (MAB) program was born, and, soon after, in 1974, the first Biosphere Reserves were created.

The legacy of the creators of the MAB program is remarkable. At a time in which almost no one spoke of global environmental change, the subject was a top priority for their program. They understood that if a significant amount of the planet's biodiversity was to be saved, an international network of reserves should be designed

to cover all the biomes around the planet, the whole of the global biosphere. Lastly, they realized that if conservation in the poorest countries in the world was to be successful, it necessarily had to incorporate a social dimension. Ecological criteria were not enough, Biosphere Reserves had to include the collaborative participation of the communities that lived in, or around, the new model of protected areas. Visionaries, pioneering scientists, the concepts that were discussed and adopted in the UN World Summit at Rio in 1992 were already the driving ideas of the founders of the MAB program 20 years earlier.

Fifty years after the MAB program was established, it is now time to look back and evaluate achievements and disappointments of MAB's socio-ecological approach. In Mexico, we have had undeniable progress, but also some serious obstacles to implement MAB's vision. Many of these obstacles are related to the recalcitrant nature of governmental bureaucracies and the difficulties embedded in trying to implement what essentially should be a grassroots model into a complex and centralized government that has—by its very nature and organization—serious difficulties working with self-governing communities and grassroots organizations. But the other obstacle, I believe, is within our own selves, within the conservation organizations and the mind of conservation scientists. Truly collaborative multi- or transdisciplinary work implies for individual scientists to be able to venture into fields of scientific enquiry that are often not our own. Social scientists need to learn more about ecology and evolution, about the complexities of the flow of life and energy in the biosphere, or the tragic dimension of biological extinction and the risks involved in biodiversity loss. Natural scientists, on the other hand, need a much deeper understanding of how social sciences work, and the patience necessary for the challenging processes involved in recording social data, interacting with local communities, and developing the intellectual flexibility to understand the view of life and cosmos in other cultures.

This book is a very important contribution from a group of Mexican and international scientists to this goal, namely, to build bridges between the social and the ecological sciences, and to promote a new paradigm, that of a new scientific discipline which we can call "Socioecology." In that sense, it is of great and emblematic significance that the primary leader behind this project, Alfredo Ortega-Rubio, is a disciple of one of the founders of the MAB program, Gonzalo Halffter, and was formed as a scientist by Halffter himself under the tenets of the Biosphere Reserve initiative. Contemplating back to the early 1970s, when a handful of researchers got together in UNESCO's Place de Fontenoy headquarters thinking how to change the World, one cannot but feel a certain optimism seeing how much their ideas have taken root in a whole country like Mexico. The social dimension has now taken strong roots in the science of conservation and in the dream for a viable biosphere and a sustainable future.

It is now part of the geography of hope.

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Exequiel Ezcurra

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Chapter 28

Community Water Management and Conservation in Cabo Pulmo National Park (Baja California Sur, Mexico)



Alba E. Gámez, Juan Carlos Graciano, Hitandehui Tovar,
and Miguel Palmeros

Abstract Understanding how social and economic aspects influence the use and management of environmental systems is key to developing long-term approaches to conservation in natural protected areas. Relying on official data about the Cabo Pulmo Aquifer and on-site observation, this chapter explores water management practices in the town established next to Cabo Pulmo National Park (Baja California Sur, Mexico), a region which has been set as an example of community organization for successful conservation. It also elaborates on the social implications that private and community types of water management have in a context of tourism exploitation of natural resources in the Park and the human right to water.

Keywords Community water management · Conservation · Cabo Pulmo National Park · Baja California Sur · Mexico

28.1 Introduction

This chapter explores water management in the community established off Cabo Pulmo National Park (Baja California Sur, Mexico), which has been set as an example of social organization for successful marine conservation (Cariño et al. 2008; CONANP-GIZ 2017) in the form of a natural protected area (NPA). The town of Cabo Pulmo is located on the Tropic of Cancer, 169 kilometers (km) away from La Paz, capital of the state, and 108 km by road and 57 km by a dirt road from San José

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del Cabo, one of the cities that form the Los Cabos Corridor, which constitutes one of the main sun-beach tourist destinations in Mexico.

Over a century, Cabo Pulmo had suffered intense overexploitation of its various resources due to disorderly commercial fishing. Poverty predominated in the community, and its inhabitants realized that fishing resources were running out, because each time they had to go further into the sea and often returned without fish (Castro 2014). In 1995, the government declared Cabo Pulmo a NPA due to the environmental value of its coral reef, the scientific research carried out by local academics, the support government as well as national and international nongovernmental agencies provided, and the organizational willingness local inhabitants displayed to achieve such an end. Scuba diving, snorkeling, and other aquatic tourism activities replaced fisheries, and community members of Cabo Pulmo even became involved in the conservation monitoring developed by the government, academics, and civil society organizations.

The Cabo Pulmo reef is home to a variety of species converging from the Pangeic, Californian, and Indo-Pacific biogeographic provinces, which makes it one of the areas of highest biological diversity in the Mexican Pacific Coast. It is the northernmost coral reef in the Americas, the only hard reef in the entire peninsula of Baja California, and one of the only three living reefs left in all of North America, with an estimated age of more than 20,000 years (Glynn and McIntyre 1977; SEGOB 1995; CONANP 2006).

25 years after the NPA decree, Cabo Pulmo (both community and Park) remains a site of interest for conservation agencies that, in many cases, keep a permanent office in the area. Regarding its ecological success, in a period of 14 years since its creation, biomass increased by more than 460%, which made it, at the time, the most successful marine reserve in the world (Aburto-Oropeza et al. 2011; Cosío 2015). Key to this has been the commitment to refrain from fishing within the NPA, even for family consumption purposes. The accompaniment of environmental authorities and about 20 civil society organizations (Niparaja 2019) has also been relevant, as well as the abovementioned national and foreign collaboration networks against proposals for the establishment of massive tourism projects (mega developments) in La Ribera, in the immediate vicinity of Cabo Pulmo (AIDA 2013; Cosío 2015).

Alternative tourism and lodging activities have flourished with the active participation of community members. A recent estimate valued in USD 3.73 million the direct benefit for Cabo Pulmo inhabitants, while overall visitor expenditures (8638 people a year) in the amount of USD 5.8 million remained in the region (CONANP-GIZ 2017). Other studies even account for nearly 19,500 registered tourists and USD 1.7 million but just for Scuba diving and snorkeling services in 2017 (Niparajá 2019). An economic and lifestyle transformation has occurred that is represented in the number of business and improvement of some services and life conditions.

At present, the fishing community became a tourist community, where 91 businesses operate providing tourism aquatic services, lodging, souvenirs, meals, and beverages (Niparajá 2019). However, this has not implied the elimination of conflict or challenges stemming from an increasingly socially diverse Cabopulmeño

community, in spite of its still small size. Those conflicts and challenges are mostly related to land tenure, since property rights are not fully established, as well as to intracommunity power relations regarding the use and access to natural resources (Barrera 2018; Anderson 2015; Menares 2008). Contributing factors may be that the creation of the 71.11-square-kilometer (27.46 sq. mi) NPA was 99% marine, thus providing little guidance about the management and conservation of adjacent land to the Park; also, current tourism and urban growth was not clearly foreseeable at the time the process of formal conservation started. In any case, the massive growth of tourism and real-estate investment in the municipality of Los Cabos (a model which is expanding across the state) add pressure to natural resources and people in Cabo Pulmo (Graciano et al. 2019).

There is a clear social divide in Cabo Pulmo represented by the distribution and type of households. Original fishermen and their families share their space with a significant expatriate community, as well as with Mexicans from other regions who arrive searching for jobs and the rustic lifestyle developed in this rural town, which lacks paved roads, urban planning, connections to the grid, and health or educational services. On the one hand, 117 *locals* (Cabo Pulmo's original inhabitants and their subsequent offspring) plus some foreigners and other Mexicans long ago integrated into the community account for 35 scattered houses. On the other, The Resort, a gated community on the beach whose managers also offer dive and lodging packages to tourists, accommodates 154 expatriates mostly from the United States and Canada, who enjoy sun-powered water service and electricity, as well as other amenities. In addition, 56 foreigners lease properties to up to 215 occupants (Niparajá 2019). During the high season, from autumn to spring, Cabo Pulmo becomes a busy community, a situation that leaves official government population census data (generally gathered in May) far behind.

Understanding how social and economic aspects influence the use and management of environmental systems is key to developing long-term approaches to conservation, especially in natural protected areas. This is particularly so in cases of relatively isolated communities in water scarce regions, such as Cabo Pulmo, which are subject to a growing tourism interest. Relying on official data on the aquifer, on-site interaction with locals and observation in October and November 2019,¹ we analyze water management in a context of tourism exploitation of natural resources in the Park and the notion of human right to water. Systematic content analysis (López 2002) produced a water management diagram for Cabo Pulmo, later presented in the text, which gives a glance at the complex social consequences of the lack of clear water regulations and accountability, but also at the opportunities for the local community to include water in its processes of conservation awareness. This would imply debating rights and sustainability with an approach that goes beyond the environment.

¹We are grateful to Sociedad de Historia Natural Niparajá, SC, for facilitating access to their documents and to the community of Cabo Pulmo. The analysis and views expressed in this text belong solely to us.

Water management in conditions of scarcity becomes more important especially in arid or semi-arid regions. Focusing on the case study on Cabo Pulmo allows analyzing the forms of water management in place when the State does not intervene and how this affects ecosystem and social dynamics. Although there have been multiple studies about the use and management of the Cabo Pulmo National Park resources for conservation, the problem of water supply and its forms of management have barely been addressed in depth, with possibly the exception of Niparajá, a civil society organization that later in 2020 is to present the results of an ongoing research on that matter and about which Tovar (2019) provides some insight.

This chapter is organized in four parts after this introduction. The first refers to the debate about water as a human right or commodity in order to contextualize inequality in water access in Cabo Pulmo. The second shows the extent of the over-exploitation of the Cabo Pulmo aquifer, on which Cabo Pulmo's inhabitants depend. The third deals with the community's forms of water management in Cabo Pulmo. Finally, the fourth section offers some considerations about the consequences of private water management in Cabo Pulmo and the need to better address equal access to such a key public good.

28.2 Water: A Human Right or Commodity?

The declaration of Human Right to Water and Sanitation (HRWS) by the United Nations Organization in 2010 has led to new controversies about water management and uses, in a context of various environmental, economic, and social crises derived from improper water use, management, and appropriation. On the one hand, the United Nations (2002) proclaims that water for human consumption should override any other use; but, on the other, international organizations such as the Inter-American Development Bank argue that water supply must be market-led, under the idea that it is a scarce commodity. In addition, in this latter position, it is proposed that State administration of natural or common-use resources causes market failures, while the assignment of an economic value allows them to be profitably used and managed (Moreno 2012).

According to the World Water Association (GWP 2008), Integrated Water Resources Management (IWRM) is a process that promotes the coordinated management and development of water, soil, and other related resources; and its purpose is to maximize economic results and social welfare in an equitable manner, but without compromising the sustainability of vital ecosystems. This institution was founded in 1996 by the World Bank, the United Nations Development Program, and the Swedish Agency for International Development Cooperation (GWP 2017). According to its definition, IWRM is an empirical concept that has been under construction since its Global Conference of Mar del Plata in 1977. However, it was not until after Agenda 21 and the World Summit on Sustainable Development in 1992, in Rio de Janeiro, when the concept of IWRM was subject of deep debates that included its practical implications (GWP 2015).

Water management is provided by public institutions and by the market. The former refers to formal (state) and informal (tradition, ministries, and communal councils) institutions. Market water management includes all those actors that operate under a logic of economic gain. A debate surrounds which of the two is the most “efficient” way to manage water and guarantee HRWS. A current of thought states that water is so important that its allocation should not be left to the forces of supply and demand (Bakker 2007; Veraza 2007; Arrojo 2017). The other holds that the absence of prices leads to excessive consumption (Hanley et al. 2002; Moreno 2012). In either case, there are pros and cons. On the side of public institutions, equitable distributions can be achieved by preventing abuse, in addition to preserving sustainable community traditions; however, their distribution can be manipulated by powerful political or economic actors, thus depleting the resource, which would represent a State failure.

On the other side, the market can achieve efficient distribution and generate income to maintain the resource, but (like public institutions) it can be manipulated by powerful political or economic actors and generate failures that would deplete the resource (Ostrom 2000). Key to this is how the two alternatives can live together. Water requires balancing all forms of management in a creative way.

Benavides (2015) calls for analyzing market mechanisms in depth regarding water due to the social consequences of its operation. The market paradigm considers water scarcity as the result of the lack of proper free market water transfer and distribution: had the latter prevailed, water would be transferred to regions with scarcity, and the rise in prices would lead to conservation (Shiva 2003). It is important to underline that capital exploits and appropriates common goods: the common becomes private property and, as private, deprives or excludes other members of the productive community from the right to decide (Dussel 2014). Therefore, HRWS cannot be subject to market logics because it would cease to be a human right.

28.3 Water Availability in Cabo Pulmo: An Overexploited Aquifer

As mentioned above, Cabo Pulmo is located in the Mexican state of Baja California Sur’s southeast. It borders the Gulf of California to the north, the Pacific Ocean to the south, the town of La Ribera to the northwest, while the city of San José del Cabo can be reached to the southwest (Fig. 28.1).

A desert climate prevails in the locality, according to the Köppen climate classification chart, modified by E. García for Mexico (1964). Although Cabo Pulmo does not have a weather-monitoring station, with data from nearby stations (Las Barrancas, Boca del Salado and San José del Cabo), CONAGUA estimated that average temperatures range between 18 °C and 23.7 °C. The summer rain regime varies from approximately 200 mm to 250 mm on average; however, during the months of August and September, temperatures can reach 40 °C (CONAGUA 2018).



Fig. 28.1 Cabo Pulmo location. Juan Carlos Graciano, 2019

Clear or partly cloudy skies are observed during nearly 80% of the year; the tropical and cyclonic rainy season in the North Pacific goes from the second half of May to the second half of October, with different fluctuations due to El Niño and La Niña (INEGI 1996; Romero et al. 2007). However, almost half of the rains come from hurricanes and tropical storms, which tend to facilitate the recharge of aquifers (Wurl and Martínez 2006). Aquifers are the main source of water availability in the state. The area under study depends on the Cabo Pulmo aquifer, which is subject to the decree of ban zones, type III, that allows limited extractions for domestic, industrial, irrigation, and other uses. According to the Mexican Federal Law on Water Rights of 2013 (MFLWR), CONAGUA is obliged to make the availability of groundwater by aquifer public and update the data at least every 3 years.

The NOM-011-CONAGUA-2000 Official Mexican Standard (NOM) demands that the capacity of extraction or concession of an aquifer must be established according to the estimated annual average recharge, less the amount demanded by the ecosystems. However, some hydrology specialists point out that this norm is obsolete when calculating availability, given that it presents several inconsistencies and margins of error (Hernández-Morales and Wurl 2017). Article 22, Second Paragraph of MFLWR, demands that the extraction and use of water resources follow sustainability principles, but this is not always the case. The latest update on water availability in the Cabo Pulmo aquifer published by CONAGUA (2018) estimates an annual recharge of 2.2 Mm³ and a deficit of 1.76 Mm³ (Table 28.1).

Table 28.1 Cabo Pulmo aquifer. Average annual water availability

Code	Aquifer	Recharge	DNCOM	VCAS	VAPTYR	DAS	DEFICIT
0318	Cabo Pulmo	2.20	2.00	0.888570	1.080500	0.00	-1.769070

Abbreviations in Spanish: *DNCOM* compromised natural discharge, *VCAS* groundwater licensed volume, *VAPTYR* volume of groundwater extraction pending titration or registration in the Public Registry of Water Rights, *DAS* average annual groundwater availability

Source: Developed with data from CONAGUA (2018)

Table 28.2 Concession volumes by type of use for the Cabo Pulmo aquifer

Type of use	Number of concessions	Licensed volumes m ³ /year
Agricultural	1	10,000
Multiple	9	40,660
Domestic	6	11,350
Livestock	31	70,500
Service	15	756,110
Total	62	888,620

Source: Estimations developed from PRWR data corresponding to 2019

Each water concession title must be duly accredited in the Public Registry of Water Rights (PRWR) to show the name of the concessionaire, the water volume the title covers, the type of use, the name of the aquifer to which it belongs, and its geographical location. However, CONAGUA recognizes that there are 1.08 Mm³ pending or in the process of titling. It should be noted that this volume is greater than what is already registered, which denotes an over-concession and therefore an overexploitation of the aquifer. Similarly, 43 uses are reported but without specifying their specific types; in contrast, PRWR reports 62 concessions, mostly for *Livestock* use but, in terms of volume, *Services* use² accounts for 85% (Table 28.2).

The town of Cabo Pulmo has at least six wells: three are in the hands of real-estate companies, each with a water concession permit; one is managed by the local community; and two more belong to local residents; although whether they have a water title is unknown. Official data show water over-concession in the context of clearly limited water resources. Improper handling of concessions sharpens the crisis of water resources and ecosystems associated with the basin. In other words, the overexploitation of water resources in arid conditions produces less availability as well as a qualitative and quantitative water loss.

²The use of water for Services is defined by the NWL as the use of national water for services other than those indicated in Sections XVI to XXV of Article number 2 of that Law (which are agricultural, agroindustrial, domestic, aquaculture, industrial, ecological conservation, livestock, urban public, and others). As noted, the law is unclear about what *Services use* entails.

28.4 Private and Community Water Management in Cabo Pulmo

In Mexico, municipal governments have the constitutional mandate to supply water to urban and conurbation areas. However, an informal private market tends to operate in places where water services do not arrive or do so poorly; less frequently, social or community management becomes another means of water supply. In the community of Cabo Pulmo, these two latter “atypical” forms for water management coexist: the first or main one (due to its volume and operating capacity) rests on a private actor (Promotora Pelicano SA de CV), which is constituted as a Mexican company with direct foreign investment of US capital according to the National Registry of Foreign Investment (2019). Given the inability of the municipal government to serve this small remote community, this real-estate company operates under a profit logic and has at its disposal a captive market composed entirely of expatriates of high purchasing power. The second form is managed by the local community, whose members are organized to directly use a communal well or are supplied by a modest water system.

Promotora Pelicano SA de CV owns two water concessions registered in the PRWR, which provide it with 10,000 and 15,000 m³/year, respectively, for the *Services* use that allows it to profit from groundwater extraction. With these concessions, it sells water exclusively to the foreign community living in The Resort, a gated community in Cabo Pulmo, through a private hydraulic network supported by hydraulic equipment and a solar cell system, as well as storage tanks that allow it to supply almost uninterrupted service to just over 50 residences (Fig. 28.2). The monthly water service fee ranges from USD 250 to USD 1000 which, according to the residents themselves, are deposited in a bank account abroad.

For their part, local community members depend on a well that was initially a CONAGUA exploration site. The Mexican local community, through its own



Fig. 28.2 Promotora Pelicano SA de CV's hydraulic infrastructure

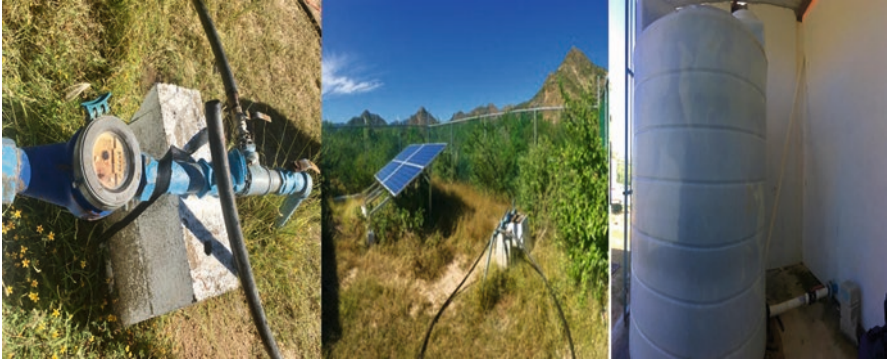


Fig. 28.3 The community's water infrastructure

means and with governmental aid, managed to install a pumping equipment powered by solar panels (Fig. 28.3); it has a smaller capacity storage tank (10,000 liters), which allows water to be distributed at least twice a week to about 20 families and about 30 small businesses through the abovementioned independent water network (Tovar 2019). Both families and businesses pay a monthly fee of 200 pesos (about USD 20).

Some businesses are not directly connected to the network, but they usually gather water directly from the community's tank (Fig. 28.4), which often leads to decompensations in the fragile community water network, forcing local residents to use considerable hours of their time (and resources) to store and/or carry the water they need for their various activities. This opens the door to another form of informal water market through the sale of water in pipes, which complements water provision (at a higher price) when demand exceeds the limited local supply.

Considering the expansion of tourism, new actors begin to gradually show up, causing disputes over land and water use in Cabo Pulmo. Such is the case of Cragar Desarrollos, SA de CV, which in 2007 was accused of destroying houses and performing acts of intimidation against the inhabitants of Cabo Pulmo (Progreso 2007). This real-estate developer has a concession of 500 m³ per year for *Services* use in Cabo Pulmo. Another firm, Hansa Baja Investments, SA de CV, proposed in 2008 a huge tourism/residential project in an area adjacent to the Cabo Pulmo National Park that would have severely impacted the local ecosystem. This was denounced by international organizations, among them Greenpeace (Magaña and Guzmán 2015), and received such opposition that the project was canceled by presidential decree. The successful process of resistance importantly rested on a sense of sustainability on the part of local inhabitants (Anderson 2015). Yet, Costa Palmas, another megaproject located in the nearby La Ribera (previously Cabo Riviera), has sparked old debates about the desirability of changes caused by tourism (Niparajá 2011) and the likely adverse impacts their establishment will have on water access.



Fig. 28.4 Water supply for business use from the community's well

28.5 Social Implications of Water Management in Cabo Pulmo

Private and community forms of management have diverse implications that are important to analyze (Fig. 28.5) in a community so small and totally dependent on tourism activity such as Cabo Pulmo. In the first place, these forms of water management show the municipal government is not meeting the responsibilities or using the powers granted by the Mexican Constitution in Article 115, which could be translated even as a loss of sovereignty, nor fulfilling international commitments to guarantee access to water as a human right.

Privatizing a common good becomes what David Harvey calls “accumulation by dispossession” (Harvey 2004), that is, the process by which those who lack the means to pay are excluded from the enjoyment of such a good. Therefore, HRWS is defined in terms of income. Regarding Cabo Pulmo, a flexible water policy encourages the definition of scarcity in terms of the resource's physical limitation; scarcity, thus, becomes purely a technical issue and a source of opportunism that produces social unrest among those who are disadvantaged.

On the other hand, the provision of community service in Cabo Pulmo lacks sufficient infrastructure to guarantee equitable and quality access to water. As mentioned above, current water distribution patterns reflect on a poor-quality service to which the population has to allocate an important part of its time. This issue is exacerbated by some community members who go directly to the source of water supply mainly for commercial activities and not for domestic use. In both cases, a

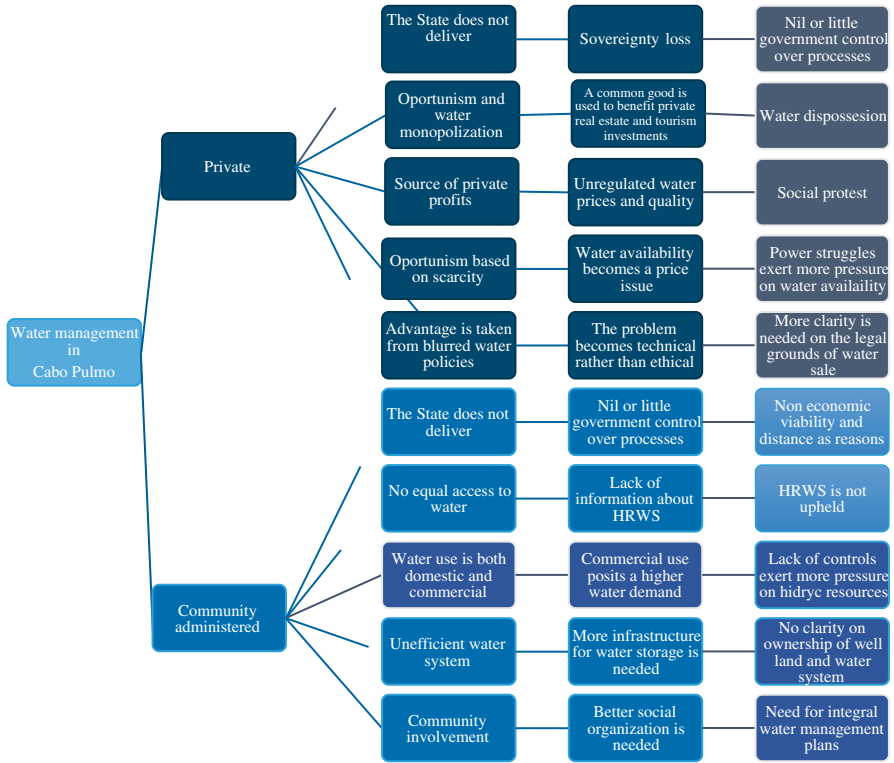


Fig. 28.5 Social implications of water management in Cabo Pulmo

comprehensive water management plan for the community is much needed. The increasing coexistence of these forms of distribution has been accompanied by a gradual process of appropriation by water dispossession. Water and its current forms of distribution have rested on a discourse that normalizes the status quo and hides the social interactions and power dynamics that turn water appropriation into a commodity.

Figure 28.5 represents a diagram of the various implications involving both forms of management. Private management highlights the monopolization of water services and the appropriation of a common good converted into merchandise to seek a profit, and expatriate residents are forced to pay high water prices. On its side, community water management shows unequal access to water that prevents the fulfillment of the human right to water, making local community members the most vulnerable social group insofar as they are forced to dedicate long hours to water provision, purification, and distribution. Both forms of management also express the municipal government’s inability to perform its constitutional responsibility insofar as it has little or no control over the forms of management. This contributes to disputes over water between power groups and to make the human right to water a price issue.

28.6 Final Considerations: The Need for a Socio-ecological Approach to Water Management in Cabo Pulmo

The coexistence of community and private forms of water management has important social and environmental implications. In the first place, in Cabo Pulmo, it has encouraged a binary discourse of “they against us,” between “nationals and foreigners,” that little helps cooperation to achieve better infrastructure and financing to increase technical water access capacity for all in Cabo Pulmo. Secondly, tourist activity has implied an increased (permanent and floating) population growth and therefore a greater demand for water under both forms of management, thus contributing to the aquifer overexploitation. Third, overexploitation combined with the lack of further studies on the quality and quantity of water in the aquifer results in a qualitative and quantitative degradation of the aquifer’s “committed water natural discharge”, which must be conserved in adequate limits to prevent a negative and irreversible environmental impact to the fragile ecosystem of the Cabo Pulmo aquifer itself.

A central issue in Cabo Pulmo is how to maintain the positive results of collective action for conservation both in the Park and town amidst the challenges posed by global climate change, the pressures of mass tourism in the vicinity, internal social tensions, and economic and population growth in the coastal Cabopulmeño area. Undoubtedly, it is relevant to establish and enforce regulatory frameworks that favor opportunities for economic growth, but also for environmental conservation within a framework of social equity. Such an approach would mean considering regulations on the Park’s adjoining area, where residential and tourist constructions and developments are carried out if terrestrial resources, among them potable water towers, are to be conserved.

In this regard, after so many years of community commitment to the Park’s conservation, as well as some government and civil society intervention to favor locals’ welfare, a lesson to be learned may be to extend to the terrestrial zone the positive results to protect Cabo Pulmo National Park’s marine biodiversity and the ecosystem services it provides; that is, to explicitly recognize in actions the links between terrestrial and marine biodiversity. Nowadays, with commendable exceptions, attention mostly focuses on the NPA environmental conservation and, although social cohesion in Cabo Pulmo has proven strong against external impacts, much is needed to deal with internal social imbalances within the community as a whole. It is not appropriate to ignore the negative effects of human and tourist settlements and relationships on community life, as well as the current rate of water extraction from aquifers on biodiversity. Tending to this could help in solving the problems associated with water management for human and economic uses, thus contributing to stronger sustainability.

Ignoring social tensions does little favor to either conservation goals or the continuation of economic profits: in Cabo Pulmo, a community effort to deal with land tenure and water rights is in place aided by civil society organization intervention, but the absence of municipal government responsibilities must also be addressed.

As an anticipated response to what can be expected from the increase in environmental pressures that global climate change and tourism trends imply, tending to social inequalities in access to key natural resources, such as water, is required for the conservation of this NPA's biodiversity and the community members' full enjoyment of their human rights.

References

- Aburto-Oropeza O, Erisman B, Galland GR, Mascareñas-Osorio I, Sala E, Ezcurra E (2011) Large recovery of fish biomass in a no-take marine reserve. *PLoS One* (August 12). <https://doi.org/10.1371/journal.pone.0023601>
- AIDA. Asociación Interamericana para la Defensa del Ambiente (2013) Coalición internacional denuncia incumplimiento de la legislación ambiental en la autorización de cuatro megaproyectos turísticos en el Golfo de California, April 11. <http://www.aida-americas.org/es/coalici%C3%B3n-internacional-denuncia-incumplimiento-de-la-legislaci%C3%B3n-ambiental-en-la-autorizaci%C3%B3n-de>
- Anderson R (2015) Sustainability, ideology, and the politics of development in Cabo Pulmo, Baja California Sur, Mexico. *J Pol Ecol* 22(1). <https://doi.org/10.2458/v22i1.21107>
- Arrojo Agudo P (2017) Privatización del agua y corrupción, *Dominio Publicoes*, 22 March. <http://blogs.publico.es/dominiopublico/19468/privatizacion-del-agua-y-corrupcion/>
- Bakker K (2007) The “commons” versus the “commodity”: Alter-globalization, anti-privatization and the human right to water in the global south. *Antipode J Compilation*:430–455
- Barrera Osuna FA (2018) Los conflictos socioterritoriales y ambientales en Cabo Pulmo, Baja California Sur: el dilema entre la conservación y el turismo, Masters dissertation, Colegio de la Frontera Norte, Tijuana, B. C
- Benavides JM (2015) Agua en América Latina. Abundancia en medio de la escasez. Bogotá: Banco Interamericano de Desarrollo-Universidad de los Andes de Colombia
- Cariño M, Valle E, Monteforte M, Arizpe C, Aceves J (2008) La creación del área natural protegida: actores, procesos y retos. Gámez AE (ed.) *Turismo y sustentabilidad en Cabo Pulmo*, Baja California Sur. San Diego: SDSU
- Castro J (2014) Historia de Cabo Pulmo. Amigos para la Conservación de Cabo Pulmo. http://www.oceanhealthindex.org/news/Historia_de_Cabo_Pulmo
- CONAGUA. Comisión Nacional del Agua (2018) Actualización de la Disponibilidad media anual en el acuífero de Cabo Pulmo (0318). *Diario Oficial de la Federación*, 20 April 2015
- CONANP. Comisión Nacional de Áreas Naturales Protegidas (2006) Programa de Conservación y Manejo Parque Nacional Cabo Pulmo. CONANP, México
- CONANP-GIZ (2017) Valoración de los Servicios Ecosistémicos del Parque Nacional Cabo Pulmo. Ciudad de México. Proyecto de Valoración de Servicios Ecosistémicos de Áreas Naturales Protegidas Federales de México: una herramienta innovadora para el financiamiento de biodiversidad y cambio climático (EcoValor MX). CONANP-GIZ: Ciudad de México. https://www.conservation-strategy.org/sites/default/files/field-file/CONANP_GIZ_17_-_valoracion_cabo_pulmo.pdf
- Cosío J (2015) La exitosa recuperación ecológica de Cabo Pulmo, La Paz, Baja California Sur. Agencia Informativa Conacyt, 3 December. <http://www.conacytprensa.mx/index.php/ciencia/ambiente/4311-arque-nacional-cabo-pulmo-referente-de-la-conservacion-en-mexico>
- Dussel E (2014) 16 tesis sobre Economía Política: Interpretación Filosófica. Siglo XXI, Mexico
- Glynn PW, Macintyre IG (1977) Growth rate and age of coral reefs on the Pacific coast of Panama. D.L. Taylor (ed.) *Proceedings of Third International Coral Reef Symposium Vol. 2: Geology*. Miami: Rosenstiel School of Marine and Atmospheric Science, pp 251–259

- Godínez C, Gámez AE, Arizpe O, Aburto O, Reyes Bonilla H (2015, coords.). Simposio sobre los 20 años de Cabo Pulmo. La Paz, BCS: CONANP
- GPD. Global Water Partnership (2017) History. <http://www.gwp.org/en/About/who/History/>
- Graciano JC, Ángeles M, Gámez AE (2019) A critical geography approach to land and water use in the tourism economy in Los Cabos, Baja California Sur, Mexico. *J Land Use Sci*, <https://doi.org/10.1080/1747423X.2019.1699613>
- GWP. Global Water Partnership (2008) Principios de Gestión Integrada de los Recursos Hídricos. Bases para el desarrollo de planes nacionales, Global Water Partnership. http://www.gwp.org/globalassets/global/gwp-sam_files/publicaciones/sobre-girh/2008-principios-de-girh-base-para-el-desarrollo-de-planes-nacionales.pdf
- Hanley N, Shogren JF, White B (2002) Environmental economics in theory and practice. Palgrave Macmillan, Nueva York
- Harvey D (2004) The 'new' imperialism: accumulation by dispossession. *The Socialist Register*, 4. <https://socialistregister.com/index.php/srv/article/view/5811/2707>
- Hernández-Morales P, Wurl J (2017) Hydrogeochemical characterization of the thermal springs in northeastern of Los Cabos Block, Baja California Sur, México. *Environmental Science and Pollution Research* 24 (15):13184-13202. <https://doi.org/10.1007/s11356-016-8087-x>
- INEGI. Instituto Nacional de Geografía e Informática (1996) Estudio Hidrológico. Estado de Baja California Sur. Edición 1996. Aguascalientes: INEGI
- López Noguero F (2002) El análisis de contenido como método de investigación. *XXI Rev de Educ* 4:167-179
- Masse Magana MV, Guzmán Hernandez C (2015) The state and the touristic megaprojects: the case of Cabo Pulmo, Baja California Sur, Mexico. *Teoría y Praxis* 11(18):101-129
- Menares B (2008) Construcción y usos de los espacios sociales en la localidad de Cabo Pulmo. Gámez AE (ed.) *Turismo y sustentabilidad en Cabo Pulmo*, Baja California Sur. San Diego: SDSU, 277-292
- Moreno SR (2012) Incentivos económicos para la conservación. Un marco conceptual. Lima: Sociedad Peruana de Derecho Ambiental
- Niparáj (2011) Alcances del proyecto y aspectos de biodiversidad. Campaña de Orgullo para la Conservación de los Recursos Naturales de La Ribera. La Paz, BCS: Sociedad de Historia Natural Niparáj, A.C.,
- Niparáj (2019) Síntesis de resultados del diagnóstico social de la comunidad de Cabo Pulmo. La Paz, BCS: Niparáj
- Ostrom E (2000) Diseños complejos para manejos complejos. *Gaceta Ecológica* <http://www.redalyc.org/articulo.oa?id=53905404>
- Proceso (2007) Inmobiliaria, acusada de destruir casas e intimidar a una comunidad de pescadores, en Los Cabos. <https://www.proceso.com.mx/208919/inmobiliaria-acusada-de-destruir-casas-e-intimidar-a-una-comunidad-de-pescadores-en-los-cabos>
- Romero-Vadillo E, Zaytsev O, Morales-Pérez R (2007) Tropical cyclone statistics in the northeastern Pacific. *Atmósfera* 20(2):197-213. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0187-62362007000200005&lng=es&tlng=en
- Sauvage A, Gámez AE (2013) Introducción. Los usos del patrimonio cultural en Sudcalifornia. A. Sauvage y A. E. Gámez (eds.). La Paz, BCS: Instituto Sudcaliforniano de Cultura, 7-18
- SEGOB. Secretaría de Gobernación (1995) Decreto por el que se declara área natural protegida con el carácter de Parque Marino Nacional, la zona conocida como Cabo Pulmo, ubicada frente a las costas del Municipio de Los Cabos, B.C.S., con una superficie de 7,111-01-00 hectáreas. *Diario Oficial de la Federación*, Tomo DI, 5. http://dof.gob.mx/nota_detalle.php?codigo=4875024andfecha=06/06/1995
- Shiva V (2003) *Las Guerras del Agua. Privatización, Contaminación y Lucro*. Mexico: Siglo Veintiuno Editores
- Tovar H (2019) *Diagnóstico Social de Cabo Pulmo*. Sociedad de Historia Natural Niparaja, AC, La Paz

- United Nations (2002) Organización de las Naciones Unidas (2002) Observación General No. 15. El derecho al agua (artículos 11 y 12 del Pacto Internacional de Derechos Económicos, Sociales y Culturales). Nueva York: Naciones Unidas. http://www.solidaritat.ub.edu/observatori/general/docugral/ONU_comentariogeneralagua.pdf
- Vanderplank S, Wilder BT, Ezcurra E (2014) Descubriendo la biodiversidad terrestre en la región de Cabo Pulmo. Botanical Research Institute of Texas. http://nextgensd.com/wp-content/uploads/2014/04/Cabo-Pulmo-Report_Final.pdf
- Veraza J (2007) Economía y política del agua. El agua que te vendo primero te la robé. Mexico, Editorial Itaca
- Wurl J, Martínez Gutiérrez G (2006) El efecto de ciclones tropicales sobre el clima en la cuenca de Santiago, Baja California Sur, México. III Simposio Internacional en Ingeniería y Ciencias para la Sustentabilidad Ambiental y Semana del Ambiente, 5–6 June, Mexico, DF