

1. Review of the design principles

The applicability of Ostrom's DPs is reviewed with respect to forestry, fisheries, water resources, game reserve and pastures. The results are arranged according to continents and the types of CPRs.

1.1. Africa

1.1.1. Forestry CPR

The forestry CPR institution of the Duru-Hatiemba forest in Tanzania exhibited a successful community-based forestry management (Kajembe et al., 2003). With the help of the Swedish International Development Agency (SIDA), a regional forestry program was initiated to gazette the woodland. This led to a public discontent resulting in the communities' active exploitation of the resource before it fell in to the government hands. To rectify the situation, gazetting was suspended and the possibility of handing responsibility over to the villagers for managing the woodland was explored. The communities proved ready to cooperate and soon reviewed and identified what was needed to restore and protect the forest. The authors concluded that the formation of a community-based forest management system constituting eight villages led to an effective management at low cost. This transformed the resource into woodland where the boundaries were intact, incursion was controlled and fauna and flora were recovering (Kajembe et al., 2002). They attributed the success of the CPR institution to the presence of all the DPs.

Reynolds et al. (2017) based on the Ostroms DPs examined four Orthodox church community owned forest management systems in northern Ethiopia. Whereas the trees themselves are not hold sacred, the space and benefits the forests provide are considered to be in service to the church and to God. In addition to providing prayer spaces and other cultural benefits, the church forests are valuable repositories of biological diversity, providers of economic benefits such as food, medicine, and sometimes firewood, timber and fodder to communities around them. These Afromontane forest communities existing since 368-1500 A.D (Ethiopian Calendar) are managed by committees headed by priests. The authors stated that the church forests exhibited many of the DPS, including clear rule-making and conflict resolution processes. But regarding clear boundaries, well-defined and locally appropriate rules, monitoring, and enforcement, they claim to have got mixed results. Moreover, they found out that church forest governance institutions may be vulnerable to positive shifts in economic conditions, where an increase in individual wealth and resource access may reduce the desire of community members to enforce longstanding church forest conservation rules. Also there is a tendency to share management responsibilities with the government.

1.1.2. Fishery CPR

Olopade et al. (2008) studied the communal ownership of fishery called Acadja system in the Badagry creek in the Ogun State of Nigeria. Acadja is a physical fish protection method. It is meant to protect juvenile and pregnant fish from harvest, increase long-term productivity and aggregate fish for easier catch. The Acadja systems ownership is based on residence in a defined cluster of villages near the creek embankment or some blood relations with some villagers or on contributions to the implantation of the Acadja. That means there is a clear physical boundary but the social boundary is loose as it includes users from other villages on the basis of blood relationship and participation. There are rules dictating the type of gear to use and where to fish. But financial pressures and lack of alternative livelihoods has created conflicts within the communities that led to breaking the rules-in use (Olopade et al., 2008). In

general, though the Acadja system has proved ecologically sound its popularity is lower within the communities. This seems to arise from differences in perceptions. According to the authors, some of the community members consider the system as beneficial to conserve the fish stock, others consider it simply as their cultural heritage and still others (the minority) think it is a hindrance to their source of livelihood. The community ownership of the Acadja system does not seem to fulfil the requirements for a robust institution mainly due to a mismatch between the physical and the social systems. Furthermore, it appears that perception differences (heterogeneity) and lack of alternative livelihood caused lower social capital that made community rules ineffective.

Two comparative case studies done by Cinner et al. (2009) on Kenya and Madagascar attempted to assess whether or not the marine resources co-management systems in these countries fulfilled the DPs. The authors citing different sources showed that social norms and traditional ecological knowledge used by the Kenyan coastal communities to govern the resource use were replaced by ineffective government management, which led to the collapse of lake and artisanal coral reef fisheries. To rectify this situation, the government took initiative in 1990s to develop a legal framework to share management responsibilities with the resource users for fisheries. These entities were termed Beach Management Units (BMU). The power of the BMUs grew by the government's fisheries regulations of 2006 to have exclusive rights to form partnership with the local communities.

Similarly, socio-cultural institutions were responsible for the governance of marine and terrestrial ecosystems in Madagascar. Though top-down management had the upper hand the local institutions had government recognition. The 1996 regulation allowed the formation of co-management of marine resources between the government and the resource users with an entity known as Gestion Locale Sécurisée (GELOSE).

Ostrom's DPs were observed in these co-management systems to various degrees. In both systems the physical boundaries were not clearly defined, but membership rights were clear. Congruence of rules, collective choice and rights to organize were present. Graduated sanctions, though, not explicit were applied de facto in both cases. Monitoring was poor in Kenya and absent in Madagascar. Nested enterprises were better in Madagascar than in Kenya. For example, international donors often played roles in the initial stages under the GELOSE framework, but not in the BMU framework. On the contrary, minimal recognition of rights to organize was more applicable in Kenya than in Madagascar as evidenced by nominal recognition but poor implementation in the latter. Additionally, flexibility of rules advocated by Ostrom as a prerequisite for enduring institutions was absent in GELOSE. This, according to the authors, sometimes compelled community-based management initiatives to work out of the GELOSE framework. In conclusion, though the authors did not voice their opinion about the status of these management systems, they appeared to be moderately robust, and addressing the gaps could grant them long life.

1.1.3. Multiple CPRs

The other example in Africa, where Ostrom's eight DPs were consciously field tested was in the semi-arid regions of Tanzania. Quinn et al. (2006) examined about 38 CPRs consisting of forests, pastures and water resources in twelve villages. The aim was to compare the eight DPs to the real situation in the study area and to investigate if any of the DPs were CPR specific.

The study was particularly important in that it addressed the situation in which resource availability and resource users are mobile due to climatic factors. Categorizing CPRs as strong, weak and absent depending on the degree of manifestations of the DPs, they found out that 16 out of the 38 CPR institutions were strong relative to Ostrom's DPs. The authors called attention to

the fact that any one of the eight DPs might not be reflected under certain conditions. Two of the DPs appeared to be somewhat dependent on the type of CPR. For example, *congruence of rules* and *graduated sanctions* were manifested in the forest and water CPRs but not in some pastures. But, the authors argued that this was not a strong enough proof to support some researchers' suggestion (e.g. Campbell et al., 2001) that the DPs may only be suitable for certain types of CPRs.

The highlighted institutional weaknesses in the studied sites in general were; state law intervention in the community's minimal rights for self-organization, ineffective conflict resolution mechanisms, poor exercise of graduated sanctions and inability to cope with changes. So, flexibility and developing better conflict resolution mechanisms that enable local actors to negotiate over resource management under changing conditions have been recommended. Finally the authors acknowledged the usefulness of the DPs for examining CPR management and highlighting areas where management might be strengthened.

1.1.4. Game reserve CPR

Contrary to the efficiency of private ownership to prevent commons from inexorably heading towards a tragic end, advocated by several authors (Gordon, 1954, Hardin, 1968, Block 2011), what Schmidtz and Willott (2003) described was a transformation of private ownership into a communal management. The case in point, the Sabi Sand Game reserve, unraveled in South Africa where a large area of patchy ranches was privately owned. The authors described how economic and ecologic forces pushed the ranch owners in to devising a communal management system while the ranches remained privately owned. The economic forces were non-profitability of ranches due to hoof and mouth disease that affected the cattle, poverty of the local customer base, and the expensiveness of transporting products to distant markets. The ecologic force revealed itself in scarcity of water, soil degradation, and abundance of predators. The ranches, merging with the neighboring Kruger national park, were transformed into a Game reserve for ecotourism.

The existence of Ostrom's DPs in the communal management system was not explicitly examined. But the existence of most of them could be seen. For example, not only the boundary of the whole game reserve was defined, but also the boundaries of individual parcels. There were restrictions with respect to the number of guests each resort would accommodate, the minimum size of a parcel and the type of business engagement undertaken. Moreover, maintaining individual parcels produced more profit for the owner, so there was an incentive to invest time and energy on preservation. Each owner, represented in the management in proportion to the size of parcel he/she owned, respected the communal law and at the same time harvested well-earned profit. Monitoring system was in place. Offences which were really a threat to the thriving ecotourism industry were subject to sanctions. The communal management was in full swing without any report of government impedance attesting to the fact that self-organization was allowed. Since the organization of properties was of a manageable size the presence of nested enterprises may have not been necessary. This communal management executed by a committee consisting of elected members representing each property, was a true example of cooperation, characterized by mutual respect, non-rivalry relations, concern for one another and where free-riding was eliminated.

1.2. Asia

1.2.1. Forestry CPR

Gautam and Shivakoti (2005) evaluated the management systems of Dhulikhel and Jyalachitti forest CPRs in Nepal through Ostrom's DPs, in order to determine their robustness. The CPRs, despite their location under the same socio-economic conditions, differed in their physical size, the nature and size of user groups and management arrangements. Dhulikhel's larger user group is not organized and was characterized by conflicts of interests between the town residents who wanted to protect the forest for water conservation and non consumptive use, whereas the villagers wanted it actively managed for household use. The CPR was larger and legally belonged to the national government but was subject to a *de facto* control by the municipality. Jyalachitti had an organized forest user group (FUG) consisting of subsistence agriculturalists with the same management objectives. It had been formally handed over in 1992 to the local community and was managed by FUG with technical assistance from the government. Subjected to examination through the lens of the DPs, it was found that Dhulikhel failed in most of the principles. This failure was accompanied by the deterioration of the forest resource. On the other hand most of the DPs were present in Jyalachitti, which contributed to its recovery after years of degradation in the past. Finally in similar vein as some of the previous case studies, the authors attempted to expand the second, the fourth and the seventh principles according to what they thought were appropriate for the cases.

Six community-based forest management case studies in Vietnam presented in the manuscript by Vien (2007) show varied management objectives. The community forestry in Na tong village, for example, was established to provide farmers with timber and non-timber forest products and was managed by Veterans' Union. Management rules had been transformed through time, but the system sustained since before 1964. The Bong stream forest community management system run by the village convention was created to protect irrigation water sources for paddy fields and to provide timber for houses constructions. Ruled by verbal customary laws, it is in existence since 1960. Similarly, the Hoc Stream Forest in Dong Tien village has a community-based management system with the purpose of protecting valuable trees and irrigation water sources for paddy fields. Despite its relatively recent creation in 1990, the author attests to the efficiency of the community management system run by the village authorities. The other three cases are the Ta Bo Canh, Mo Tom and Lam River forests. Ta Bo Canh involves a religious belief by the villagers who consider the forest and the nearby Nuoc-moc stream holy. No tree is cut from the forest and no fish is caught nor is bathing allowed in the stream. Though this belief persisted for a 100 years guarantying the preservation of the forest, new settlers are beginning to stealthily fell trees. Mo Tom forest is managed to prevent soil erosion and provide forest products to the subsistence use of the community, forbidding the sale of harvests. Seasonal shrimp catch from the stream is allowed. The third community-based forestry established some 50 years back has also the aim of preventing alluvial soil erosion of the Lam River. The village convention ensures that trees are planted each spring in this flood prone area and no forest products are collected. The author lists without directly referring to the DPs the criteria characterizing robust institutions and concludes that the forests are protected owing to the community-based management. From this and the life span of the institutions it can be concluded that generally these community-based forest management systems are efficient and mostly long-existing.

1.2.2. Fishery CPR

Pinkerton and Weinstein (1995) in their report on fisheries featured, among others, three South Korean coastal fishing zones. Kagodo Island, one of the fishing zones is selected as an example. It consists of three villages whose main economic activity is based on seaweed fishery. Ownership of a seaweed fishing territories is based on residence criteria. Entitlement is given to a household if it is permanent, has lived for more than 5 years, and can contribute labour to

harvesting the seaweed *Undaria pinnatifida*. The harvesting is done in groups where it is distributed equitably following some formulae. The Island is governed by a government appointee helped by a 5 member council elected from the villages. All the fishery management activities are supervised by a village legal entity that is recognized by the state law and has linkages with the Islands authority. For the protection of the overall fishing territories from encroachment and for organizing seaweed harvest, each village elects its own fishery head. Annual village meeting is held to elect representatives, discuss collective actions regarding all aspects of the villages including fishing. Traditional social sanctions and conflict resolution mechanisms are used rather than reverting to national laws. According to the authors the socio-economic outcome of the fishery has been good as indicated by the relatively higher living standard of the fishermen. In fact the presence of the DPs is apparent. In addition to the rules mentioned above, the territories are defined; users are required to contribute in order to receive their shares of seaweed, and harvesting is organized only communally, probably in synchronization with the growth cycle of the seaweed *Undaria pinnatifida*.

1.2.3. Water resources CPR

One of the Japanese Irrigation CPRs is found in Nishikanbara Land Improvement District (LID) in Niigata prefecture. It is a good representative of Japan's irrigation policy. Sarker and Itoh (2001) examined the CPRs with respect to the existence of Ostrom's DPs and proved that all of them were present in this efficient and sustainable regime. The authors slightly modified the seventh principle by adding a phrase "non-interventionary investment in the solicited physical capital entrusted to appropriators organizations." This was to indicate that despite the substantial involvement of the government in setting these CPRs, it did not interfere with their self-governance. The irrigation systems, as all the others in Japan, were organized in a LID which was not necessarily a geographic area but water users association. The authors, concluding that the CPR institutions are robust, attributed the success to the non-coercive presence of the government (with its large contribution of physical capital) and the high social capital manifested in strong group consciousness, mutual trust, reciprocity and high moral standard of the society. This had made the monitoring system low-cost and graduated sanction incidents almost absent. The government, according to the authors, did not interfere with the LID because it recognized the congruency of these institutions with the local conditions and admitted the likelihood of its own incompatibility with internal characteristics of the system.

Bastakoti and Shivakoti (2009) examined about a 100 irrigation schemes in Nepal and Thailand to assess the presence/absence of the eight DPs in the management of these schemes. They found out that all of the principles were applicable to various levels in both countries. Their applicability, according to the authors, depended on the particular characteristics of the SES such as size, number of users and type of management. With the exception of the first DP- *clearly defined boundaries*, which was fully present in both countries irrespective of the size of the SES, the number of users and the type of management, the rest were only partially present. All the relevant principles were present in the smaller irrigation schemes with the relatively smaller number of users indicating that these were more sustainable than the larger systems. These systems were locally managed by farmers. The advantage of smaller resource system appears to be the relative easiness of defining both the physical and the social boundaries and making communications (and consultation) among members, a prelude to self organizing, which would be more costly in the larger systems as noted by Ostrom (2009). Moreover, the larger size of the CPRs in Thailand impeded monitoring efforts.

Karman and Shivakoti (2009) compared four community managed spate irrigation systems in Punjab, Pakistan, located in the lowlands where the British guidelines of irrigation systems are mainly followed, and the uplands where the governance is based on traditional customs.

According to the researchers, the lowland irrigation systems had some government intervention as they were supervised by revenue department, whereas the upland systems were independent. The authors attested to the presence of seven of Ostrom's DPs in the upland systems. In the lowland systems, however, one or two DPs were lacking. So, the absence of the DPs was attributed to the government intervention, which weakened the communal initiatives. Therefore, the conclusion was that the upland systems, with no government intervention were robust while the lowlands were weak to average in their sustainability.

1.3. Australia/ Oceania

1.3.1. Fishery CPR

Yandle (2003) examined the market-based fisheries co-management regime in New Zealand and assessed it in relation to Ostrom's DPS. The co-management system was formed between the government and the commercial stakeholder organizations at the exclusion of other concerned stakeholders such as recreational fishers, environmentally concerned entities and the indigenous communities of Maori people. The co-management regime showed a considerable deficiency as seen under the lens of the DPs. The neglect of the important stakeholders such as the Maori people which affected the definition of the social boundary and collective choice arrangement, and hesitation to apply graduated sanctions seriously undermined the robustness of this co-management regime. The author showed that the co-management started with the 1999 fisheries amendment act passed by the New Zealand government. Therefore, Ostrom's seventh principle: *minimal recognition of rights to organize* was manifested to the full. Conflict resolution and nested enterprises gave modest success. In conclusion, the researcher classified the co-management regime as fragile. She attributed this to the formative stage of the management regime, but overlooked its non-inclusive nature as evidenced by the neglect to the Maori community. This might be an equally valid reason for the failure.

1.3.2. Water resources CPR

The relevance of the DPs for a ground water management in the comparative study of the Murray Darling Basin of Australia was examined by Ross and Martinez-Santos (2010). The New South Wales` (NSW) Water Act 2000 established a water sharing plan to divide water among domestic uses, livestock, the environment, irrigation and industry, which reduced water entitlement. Because it was challenged by the Namoi communities, a revised water entitlement reduction formula was later developed and introduced. Learning from experience, the water entitlement reduction process exercised in the lower Muray groundwater sources was based on consultation and then was accepted.

Against this background, Ross and Martinez-Santos (2010) imply that this case shows a resonance with Ostrom's DPs. This is shown in the first, third and eighth DPs, namely; *clearly defined boundaries*, *collective choice arrangement*, and *nested enterprises*. Concluding that the DPs are relevant, they emphasized the importance of the government's cooperation with the community. Further, the authors stress the need for collaboration among scientists, policy makers, water companies and users to establishing a sustainable groundwater management.

1.4. Europe

1.4.1. Forestry CPR

Chobotova and Oravska (2011) presented a forestry management case in Slovakia. The forest co-

ownership system known as Urbar in which the users were co-owners of the resource dates back to the 17th century. Users had variable shares of the forest resources. The traditional forest management system exhibited the presence of Ostroms second, third and fourth DPs. Clear boundaries were not apparent. But the mismatch between the Urbar and ecosystem boundaries, according to the authors, provided an incentive for cooperation across Urbars. Practice of graduated sanction was also evident in the management. Except for mentioning the involvement of the government in rule enforcement, local conflict resolution mechanism was not mentioned by the authors. But equitable distribution of benefits based on the sizes of the shares was evident. Generally these Forest CPR institutions were considered robust by the authors before the ownership rights were transferred to the state under socialism.

Though the ownership rights were transferred back to the owners after 40 years of interlude of socialism, the forest management institutions never regained their robustness due to lack of effective collective action. The authors listed several causes that made the SES vulnerable, and deprived the institutions of their robustness. After a long interruption of practicing collective action, the users were less interested to participate in management due to changed life style and economic diversification. Moreover, mismatch between the rules of forest use and protection, high number and heterogeneity of users, government involvement in management, external market pressure, and profit-driven non-sustainable harvesting practice by the younger generation worked against collective action.

1.4.2. Water resources CPR

In sharp contrast to the Japanese case, Theesfeld (2003) showed how irrigation CPRs in three regions of Bulgaria failed to apply a collective action due to lack of social capital resulting from distrust and envy, opportunistic behavior and corruption. The author conducted an overview study on seventeen villages in the northern, central and southern Bulgaria. The government attempted to enable the rural communities develop self-governance and sustainable water management systems. This was done by enacting the Bulgarian Water Law in January 2000 and Water Users Association Act in March 2001. Despite the efforts of the government to pave the way for collective action, the author lamented the absence of a fertile ground for collective action to grow. She traced these shortcomings back mainly to the old socialist system which bequeathed distrust and corruption to the emergent transitional economic system. "During socialism, Bulgaria was a country in which the system of corruption encompassed a particularly large proportion of the population" (Theesfeld, 2003, p 255). Based upon in-depth studies of four villages of the southern region, the researcher claimed to have identified four major features that attested to the absence of conducive conditions for collective action. These were: incongruity between formal and informal rules, information asymmetry, power abuse and deteriorating social capital. Thus, Ostrom's DPs were virtually absent in these CPRs, which were almost open access due to the absence of coherent management.

Ross and M-Santos (2010) presented the Spanish case study of water resources management at two sites, namely; Western Mancha and Campo de Montiel. The Spanish government declared in 1985 that ground water belonged to the public, thereby depriving individuals of the right to own private wells. This created a conflict between the water users and the basin authorities in the Western Mancha Aquifer. In contrast, better cooperation was observed between the basin authorities and the Campo de Montiel aquifer. According to the authors, this was due to the low number of users, traditional tendency of the community to denounce illegal use, and strong leadership of water users' association system. Therefore, in Campo de Montiel

1.5. North America

1.5.1. Forestry CPR

Berry (2006) pointed out two types of forest ownership in Canada: area-based tenure and volume-based tenure. The former involved a long-term area-based tenure which conferred significant management responsibilities including planning, monitoring and reforestation but restricted logging in specific areas. The latter involved a short-term tenure with fewer management responsibilities and allocated specified amount of timber without restricting the location of harvests.

One of the three community based forest management systems the author identified was Westwind Forest Stewardship. Following the restructuring in 1966 of the tenure system by the State of Ontario, management responsibilities were shifted from the provincial government to tenure holders. This non-profit, community-based forest management organization was created as a result. Its tenure was area-based. The organization, whose objective was to run a sustainable timber production and environmental protection, was directed by a local board composed of the community and industrial representatives. It included a diverse individuals and groups. The organization carried out forestry that was ecologically, socially and economically sustainable (Berry, 2006). As a non-profit body it was supported by willing donors and some governmental subsidies.

Though the presence of the DPs was not explicit, they were discernible in the area-based tenure system as explained above. Even if no detail was given, the planning phase could encompass many aspects of management such as participation and making rules of sanctions. *Minimum recognition of rights to self-organize* was evident in the shifting of management responsibilities from the provincial government to the community.

1.5.2. Fishery CPR

Charles (2006) presented the community fishery case study of the Micmaq First Nations of Lennox Island and Abegweit, in the province of Prince Edward Island, Canada. The Micmaq people occupy the Atlantic coast of Eastern Canada organized in clan-based Bands and depend 90% on ocean resources for food (Milley and Charles, 2001). The authors further explained that fishery constituted an important part of their migratory life cycle (hunting, collecting, and trade) and they have developed a rich culture based on the environmental resources.

With the arrival of the Europeans, the culture-based resources management regime that was harmonized with natural cycles was eroded to a point where this indigenous people's livelihood was threatened. Two court cases arose; one in 1990 and the other in 1999 (Milley and Charles, 2001) involving fisher men, which shaped the fishing rights of the natives. The first court case was concluded with the Canadian Supreme Court's decision (known as Sparrow Decision) recognizing the rights of the Micmaqis to fishing for food, social and ceremonial purposes. The second case led to the Marshall's Decision by the Supreme court of Canada in favour of the defendant (Donald Marshall Jr.) recognizing the community rights of the Micmaqi people to commercial fishing (Milley and Charles, 2001; Charles ,2006).

Encouraged by the Sparrow decision, the communities made tremendous efforts to preserve their traditional rights for fishing. After a complicated process of lobbying and bureaucracy, the Micmaq fishery and Wild life Commission was established by the chiefs of Nova Scotia (Milley

and Charles, 2001). Even after the Marshall Decision, there was a continuous fight for fishing rights among the indigenous and the non-indigenous commercial fishers which pressured the Canadian government.

Nevertheless, with the government's financial involvement, fishing licenses were bought from non-indigenous and transferred to the indigenous fishermen (Charles, 2006). As examples of the expansion and growth of the indigenous commercial fishing, the author presents the communities of Lennox Island and Abegweit. In these two communities, community-based fishery management was practiced. The rules included restrictions on who fishes, when, how and how much. Collective decisions were made at the whole community level and rules enforcement was done through traditional methods.

1.6. South America

1.6.1. Forestry CPR

Morrow and Hull (1996) examined the donor initiated forestry management cooperative of the Yanasha people in Peru. The aim of the study was to test the system if it fulfilled the characteristics of an enduring institution through the DPs and to expand some of them to fit in the particular features of the situation. The cooperative, named COFYAL was undertaken with funding by the United States Agency for International Development (USAID), later by World Wildlife Fund (WWF) and the Peruvian Government. So, it was only a partially self-organized institution for collective action. As a partially self-organized institution it was subject to pressures from the outside groups such as colonists, Franciscan mission, loggers, traders and of course the USAID (later WWF) and the government.

According to the authors, COFYAL fulfilled only two of the DPs: the first and the seventh principles. Finally, COFYAL, established in 1986 was dissolved around 1994 after eight years of existence. Morrow and Hull (1996) assert that the cooperative failed because it tried to create a multi-community institution out of communities with neither economic association nor strong social bond. Moreover, its organizational structure was incongruent with the social norms of the Yanasha people, participation was low and leaders were appointed from the outside. Considering the particular characteristics of this case, the authors attempted to expand some of the DPs, namely the first, the second, the seventh and the eighth.

The forest CPR on mountainous area of western Honduras, La Campa, exhibits the presence of the DPs. But the poor implementation of some of these principles, according to Tucker (1999) who conducted the study, could eventually compromise the sustainability of the CPR. The author especially blames the weakness of *congruence of rules*, *monitoring* and *graduated sanction* to the uncertain future of the forest resources with the detrimental implications for La Campa's population, and supports her argument with the following explanations. The residents of La Campa have delineated rights and obligations with respect to appropriation of forest resources and provision to the community. Most of the community members consider this arrangement appropriate. But they are more prone to capturing benefits than fulfilling duties. Apart from some patrol duties by community members, there is no regular and organized monitoring system, and usually very serious transgressions are the ones which attract attention. Graduated sanctions are nominally present but rarely applied.

The community forestry management case studies in Mexico done by Klooster (2000) consist of

both success and failure stories. The failure stories are cases where at first the narrow selfish interests of state-owned and private logging firms hindered local community management of forests in some communities of Oaxaca, Mexico. The author explained that the careless activities of these firms undermined the income of the forest owners, which eventually created dissatisfaction in the communities, manifested in peasant unrest. Absence of restrictions on timber smuggling due to corruption resulted in forest degradation. The failure illustrated what Ostrom (1990) described as an opportunistic act of individuals who ignore norms of behavior when given a chance. In fact, the author partly attributed the failure to the ethnic heterogeneity of the scattered villages, which hindered them from sharing common values, necessary to form cohesive organizations. This also corresponds to what Ostrom (2010b) argues that face-to-face communication in a heterogeneous group may lead to exacerbated conflict rather than reduction in conflict and agreement on new sets of rules. On the contrary, other communities in the states of Oaxaca and Michoacan are examples of successful community forest management mentioned by Klooster (2000) for their victory over corruption and mismanagement, and for their effective control over individual uses of forest products. The author asserted that these communities were successful because they possessed features the failed communities lacked. For example, vigorous, regular, and well-attended community assemblies were standard features of the successful communities. Furthermore, effective control of individual use of forests, control of corruption and mismanagement, exercising fining, auditing and government policy allowing communities to organize favored the community management.

1.6.2. Fishery CPR

The community-based fishery in the village of Pranha do Canto Verde located in the State of Ceara, Brazil was studied by Schärer and Schärer (2006). The authors attested to the well-organized nature of the village as a local government, which dealt with social and economic issues. Lobster fishing during the open season, and deep sea, pelagic and reef species catches during the closed season constituted a major economic activity. The small scale artisanal fishery in the village is practiced using locally crafted boats called *Jangada*. Therefore, the artisanal fishermen, by extension were called *Jangadeiros*. Lobster fishery started in the mid 1950s, following the purchase of catches from *Jangadeiros* by fishing companies for industrial processing and export (Schärer and Schärer, 2006). The profitability of the business attracted larger industrial fleet of vessels which consequently depleted the resource. Conflicts arose between the artisanal and the industrial fishermen. Consequently, supported by development workers and environment-friendly NGOs, the *Jangadeiros* made a stronger association to combat illegal and unsustainable fishing as well as the lethargy of government agencies responsible for fishery management. Local fishery school was established in the village to build the capacity of the *Jangadeiros*. In addition to the traditional ecological knowledge, the fishery school nurtured self confidence in those graduating from it.

Beginning 1995, recognized by the higher authorities, the village maintained local fishing regulations on the fishing area (50 nautical square miles), which included restrictions on when and what to fish; the type of gear to use; patrolling and penalties. Though the ecological status of the lobster did not recover to the desired level due to a long-time damage, the authors expressed optimism for its improvement, especially; if a status of Marine Extractive Reserve for which the village had requested were given not only to Pranha do Canto Verde but also to the neighboring coastal villages.

Table of Values of the coded frequency of the DPs and range of scores for outcomes

Code for DPs frequency	Value	Score	Outcome
Absent (A)	0	0 - 2.9	Failed
Rarely Present (RP)	0.25	3 - 3.9	Fragile
Sometimes Present (SP)	0.5	4 - 4.9	Weak
Mostly Present	0.75	5 - 8	Successful
Present	1		

Examples of determining a CPR as successful or failed

Case	DP1	DP2	DP3	DP4	DP5	DP6	DP7	DP8	Frequency	product	Sum of Scores	Conclusion	Interpretation
1	MP	MP	P	MP	MP	P	P	RP	RP=1	$1 \times 0.25 = 0.25$	$0.25 + 3 + 3 = \mathbf{6.25}$	Successful (original authors)	Successful (present authors)
									MP=4	$4 \times 0.75 = 3$			
									P=3	$3 \times 1 = 3$			
2	P	P	A	RP	RP	A	A	N/A	A = 3	$0 \times 3 = 0$	$0 + 0.5 + 2 = \mathbf{2.5}$	Failed (present authors)	Failed (present authors)
									RP = 2	$0.25 \times 2 = 0.5$			
									P = 2	$1 \times 2 = 2$			
3	RP	RP	RP	RP	A	P	P	SP	A = 1	$0 \times 1 = 0$	$0 + 1 + 0.5 + 2 = \mathbf{3.5}$	Fragile (original authors)	Fragile (present authors)
									RP = 4	$0.25 \times 4 = 1$			
									SP = 1	$0.5 \times 1 = 0.5$			

									P= 2	1 X 2= 2			
4	P	P	SP	RP	SP	P	P	SP	RP = 1	0.25 X 1 = 0.25	0.25+1.5+4= 5.75	Average (original authors)	Successful (Present authors)
									SP = 3	0.5 X 3 = 1.5			
									P = 4	1 X 4 = 4			

