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**Explaining the *de facto* Open-access
of Public Property Commons**

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ABSTRACT

Public property common pool resources in many developing countries are often portrayed in dismal states allegedly due to governments inability to manage them in a sustainable manner. While this explanation may have some merit, it is certainly inadequate. Instead, we argue that public property commons degrade partially because governments, in their attempt to obtain an overall societal balance, sometime accord low priority to some resources and bestow their ownership to an apparently unconcerned agency. While this tendency is deliberate, it results for a *de jure* public property commons to exhibit a *de facto* open-access status. Based on policy and institutional analyses of mangrove management in Pakistan, we bring such a case for theoretical debate on the issue and favour partial right regimes as a relatively better way of defining rights regimes for complex resources such as forests and wetlands including mangroves.

□*eywords:* Public Property Commons, Mangroves, Indus Delta, Policy Analysis, Institutional Analysis

1. INTRODUCTION

The intergenerational well-being of humankind requires prudent use of earth's finite resources. Societies often establish property rights institutions for the conservation of important common pool resources (CPR) to fulfil the requirements of both current and future generations. Scholars generally agree that effective CPR conservation requires stewardship [Agrawal, *et al.* (2008); Gibbs and Bromley (1989); Hardin (1968, 1998); Machan (2001); Ostrom (1990)], but noticeably disagree over the effectiveness of different forms of property in this regard.

Since the last few decades, theoretical debate and empirical research had been busy in defining various concepts related to CPR situations [Dietz, *et al.* (2002)] and their outcomes when managed under private, communal or public property arrangements [Berkes and Farvar (1989); Dietz, *et al.* (2002); Schlager and Ostrom (1992)]. The point of departure for this line of research had been an implicit assumption that different owners of a resource (such as individuals, groups or government agencies), pursue a generic objective—i.e. the sustainable use of a resource system for subsistence and/or profit making purposes.

Conceptual models based on this assumption encourage researchers to compare resource outcomes under different property rights arrangements when confronted with similar levels of social and biophysical complexities [e.g., Ostrom (2009); Ostrom, *et al.* (1999); Schlager and Ostrom (1992)]. Following these models, many studies of CPR outcomes under different property arrangements had been undertaken, and conclusions had been drawn about the supremacy of one property regime over the others [e.g., Ahmed, *et al.* (2012); Andersson, *et al.* (2014); Bonilla-Moheno, *et al.* (2013); Sneath (1998); Tang (1991)]. Findings are converging over the point that regardless of any forms of property, successful CPR management largely depends on the effectiveness of compliance mechanism that underlies any property regime [Agrawal, *et al.* (2008); Berkes, *et al.* (1989); Coleman, (2009); Feeny, *et al.* (1990); Ostrom (1992); Regier, *et al.* (1989); Schlager and Ostrom (1992)].

Nonetheless, commendable conceptual, analytical and prescriptive clarity brought in through the application of such models helps until we hold the above-mentioned assumption that different owners pursue a generic objective. We argue that in real world CPR situations, it is not necessary that this assumption always holds. In fact, different owners may have different worldviews of a particular resource implying that there may be variation in their concern for the sustainability of that resource.

Many agreeing with our argument in the first place, may hesitate to extend it for different property rights regimes. It is easy to conceptualise a private forest owner losing his/her interest in forest and favouring other land uses. Examples include the *Doi Moi* policy in Vietnam that gave mangrove parcels to individual households to conserve them. Conversely, this policy furthered the loss of mangroves as many households preferred using forestland for aquaculture [Hong (1993)]. Similar is possible even for common property if community can build such consensus, which may be difficult but certainly not impossible. In case of public property also, similar possibility exists but is not that obvious. This is because scholars often deal with this form of property as a monolith concept. However, our argument is not only valid but also most crucial in the case of public property primarily due to two reasons, which we proceed to explain.

First, the public property is inherently an aggregate concept since it stems from the concept of a government.¹ herefore, under the caption of public or government property, different state agencies may own² different patches of a forest or rangeland. Depending on the primary mandates of such agencies, their actions may complement, overlap or contradict with the national objective of sustainable forest conservation and management. In Thailand for example, despite being under same ministry, the Forest Department was restoring the degraded mangroves, while, the Fisheries Department was granting mangrove concessions for aquaculture development [Huitric, *et al.* (2002)].

Second, the diversity underneath the concept of public property is not only interesting but also important in the case of forest, rangelands and wetlands due to the size of government ownership of these resources. For example, [FAO (2010)] reported that about 80 percent of the global forestlands are state-owned. Given the size of government ownership and multiplicity of its owners/subcontractors, the concerns for public property should be proportionately high.

Although, a general explanation that government in many developing countries lack adequate resources to effectively manage and conserve their CPRs may still hold but is certainly inadequate. Our explanation postulates that

¹ e define government as a systematic array of diverse institutions, organizations and agencies designed to achieve a general societal balance (social, economic and environmental) within and outside country's immediate national boundaries.

²In view of the bundle of rights associated with different positions [see, Schlager and Ostrom (1992)], using the term proprietor would be appropriate particularly for a government agency retaining a public property. However, practically in many developing countries government agencies and ministries exercise significant power, often beyond their official mandates, to control different type of resources. See Sabatier (1987) and Staudt (1991) for their argument that not only private but government agencies and ministries also compete each other for resources and jurisdictions in the pursuit of meeting their vested interests. herefore, we prefer the term owner over the term proprietor while referring to the control of resource in hands of a government agency.

public property commons are in a dismal state partially because governments, in their attempt to obtain an overall societal balance, sometime accord them low priority and bestow their ownership to an apparently unconcerned agency. This is particularly true for land-based resources such as forests including mangroves, rangelands and wetlands where many agencies would be interested in owning the land but not necessarily caring about the grass, trees and mangroves or other features of such resources. In such cases, the *de facto* open-access status of public property commons is deliberate and conceptually different from management failure, which is a case only when an agency or owner officially subscribes to the objective of sustainable conservation and management of a CPR.

Accepting our explanation of the *de facto* open-access of *de jure* public property commons implies letting in a great deal of complexity into our analyses because it goes beyond conviction of specificity and poses broader research questions. One of such questions is why some governments are able to bring better outcomes for their CPRs than the others while attempting a balance among social, economic and environmental choices. Normally our narrow disciplinary views and trainings do not allow holistic but messy analyses required for answering such broader questions.

To deal with this problem, we propose an analysis of institutional appropriateness for public property CPRs under the jurisdictions of different government agencies and their operations within the broader policy framework of a nation state. We test the validity of our proposal by using the case of the Indus Delta mangroves in Pakistan. This case is considered appropriate as the mangrove commons are under the jurisdiction of multiple agencies, each having its own primary mandate.

We will begin with the elaboration of our methodological approach (Section 2), and present the results of our policy and institutional analyses of the conservation and management of Indus Delta mangroves (Section 3). Based on our results, we will discuss our findings in a broader theoretical perspective and will draw conclusions of theoretical and empirical importance (Section 4).

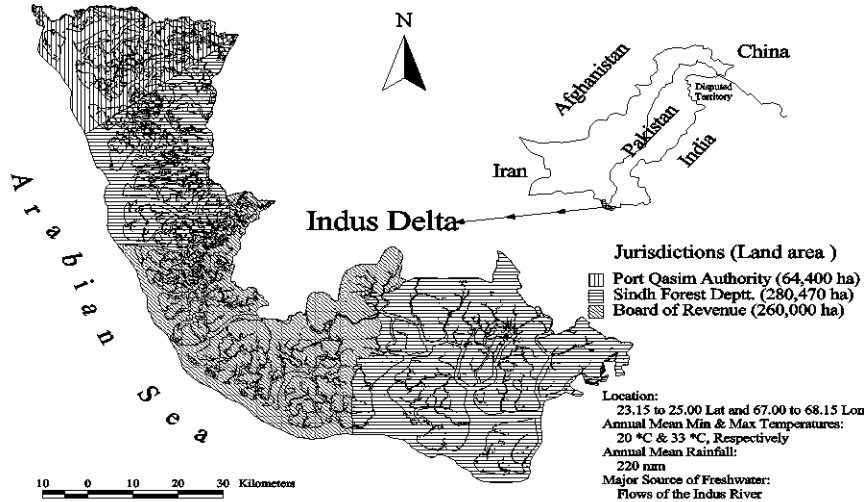
2. RESEARCH METHODS

2.1. Location and Selection of Study Area

Indus is the most prominent trans-Himalayan river system in South Asia. It originates from Lake Manassarovar near Mount Kailash, runs about 3,180 kilometers southwestward through China and India, and enters in Pakistan, where it makes a 250 kilometers wide delta along the Arabian Sea (Fig. 1.). The Indus Delta constitutes about one fourth of Pakistan s coastline but harbours more than 90 percent of its mangrove cover [IUCN-Pakistan (2005)].

Since the ownership of Indus Delta region rests with multiple agencies, we selected it as our study area. Nevertheless, we did not cover the entire Indus Delta region particularly in our institutional analysis. This was because, the excluded area either did not contain any mangroves (such as in the Badin District), or, their share was negligible (such as Karachi Port Trust (KPT) housing less than one percent of the mangroves). Finally, we considered only three government and quasi-government agencies namely: PQA, SFD and SBR altogether claiming 90 percent of mangroves in Pakistan (Fig. 1.).

Fig. 1. Location of the Study Area Showing the Bes of PQA, SFD and SBR



2.2. Study Approach, and Data

For our policy and institutional analyses, we relied on published sources (such as mangrove management plans, forest and forest related policy documents), in-depth interviews with key governmental and non-governmental officials, and group discussions with local people. We carried out 18 in-depth interviews, of which 12 were with the officials working for the three government agencies, three with the representatives of two environmental INGOs, and three with the representatives of local NGOs involved in mangrove conservation. Government officials included the conservator, divisional and range forest officers, forest guards, officials of the Environment and Safety (E&S) Division of PQA, and the local revenue officials of Thatta district.

We conducted most of these interviews in privacy. Although, the in-depth interviews mostly served the institutional analysis, the policy analysis also benefited from this exercise as it helped us to understand the linkages between policies and their impact the management of mangroves. We also interviewed

nine arbitrarily selected communities, three from the jurisdiction of each agency. We used Sindhi and Urdu languages in all official and community interviews.

2.3. Policy and Institutional Analyses Criteria and Indicators

Contrary to the contemporary thinking of mangroves as complex ecosystems, policymakers in Pakistan still deal these ecosystems primarily as a type of forest. Thus, the forest policies always have had a major influence on the management of mangroves. However, the National Conservation Strategy, and Environment and Climate Change Policies also have some explicit concerns about mangroves. Thus, we analysed all these policies based on four indicators: (1) broader policy objectives and their emphasis on mangrove conservation, (2) preferred management regimes to achieve the intended objectives, (3) attitude towards the forest dependent communities, and (4) state of policy implementation.

We conceptualised our institutional analysis based on the work of Agrawal (2002) and Agrawal *et al.* (2008) who systematically reviewed the published research to enlist the factors influencing CPR governance under common property arrangements. Considering that not the entire list of factors is universally applicable to diverse CPR situations, [Agrawal (2002); Gautam and Shivakoti (2005); Nightingale (2011)], and particularly in the case of public property commons, we considered only four criteria for the institutional analysis. The criteria were: (1) boundary and property rights issues; (2) efforts made in the restoration and conservation of mangroves; (3) the mechanism for monitoring the use and status of mangroves; and, (4) mechanism to ensure local communities participation in the management of mangroves. Each of these criteria comprised several indicators as reflected in Table 1.

Table 1

Framework for the Institutional Analysis of Mangrove Management

Parameters and Indicators	Data Type and Sources
1. Boundary and property rights in mangrove areas <ul style="list-style-type: none"> – Delineation of boundaries – Managerial staff s familiarity with the boundaries – ield staff s familiarity with the boundaries – Stipulation of property rights in mangrove areas – Stipulation of access and withdrawal rights of local communities 	Qualitative data from field observation, interviews, policy documents
2. Capacity to monitor local activity in mangroves <ul style="list-style-type: none"> – Provision of field staff for monitoring – Enforcement of the laws on the use of mangroves – Authority to take legal action against violators of the rules 	Qualitative data obtained through interviews and FGDs
3. Restoration and conservation of mangroves <ul style="list-style-type: none"> – Efforts taken for restoration and conservation – In-house expertise in plantation and restoration – Partnership with other agencies for mangrove conservation 	Qualitative and Quantitative data from interviews, field visits & project documents
4. Community participation initiatives <ul style="list-style-type: none"> – Community participation in mangroves management – Community participation in mangroves restoration – Community awareness-raising on the importance of mangroves 	Qualitative data from interviews and FGDs

Note: FGDs stands for Focus Group Discussions.

3. RESULTS

3.1. Evolving Policy Concerns

The scientific management of forests in South Asia roots in the revenue seeking policies of the British colonial rulers during 1858-1947. They declared the Sunderbans (now Bangladesh and India) and Matang-Malaysia mangroves as reserve forests, which were to be managed through silvicultural system [Gan (1995); Iftekhar (2008)]. The Indus Delta region as a whole did not attract the British, apparently because of its perceived low economic value. Except in Kharo Chan and Keti Bandar sub-districts where flood recession agriculture was possible, the remaining deltaic lands were unsuitable for agriculture, but had extensive natural growth of mangroves. Therefore, the British rulers designated the non-cultivable deltaic lands, including mangrove forests, as wasteland. Since the cultivated lands were sources of revenue, the entire area comprising both cultivable and non-cultivable lands came under the administrative jurisdiction of the then Board of Revenue. In 1946, one of the colonial foresters proposed the scientific management of the Indus Delta mangroves [SFD (1985)] but his proposal went unnoticed as it came at the time when the colonial rule in the Indian subcontinent was about to end.

After independence in 1947, Pakistan continued the British-Indian Forest Policy (1894) for seven years until the policymakers realised that the country needed forest expansion to meet the domestic demand for forest products. By 1954, it was already clear that the colonial policy would not help in forest expansion as it primarily sought the preservation of the existing forests (Table 2). Therefore, there was an urgent need for a policy having provisions for forest expansion.

In response, the Government announced National Forest Policy (1955) that emphasised the plantation of fast growing exotic species along roads, railways and canals, and on wastelands (Table 2). This policy was a watershed for the management of Indus Delta mangroves, as it facilitated the Sindh Forest Department to demand the ownership of the deltaic wastelands which were already covered with mangrove forests.

In 1958, the Forestry Section of the West Pakistan Food and Agriculture Department declared these mangroves as protected forest. This decision bestowed SFD with the ownership and management of 344,870 hectares (out of a total of 604,870 hectares) of deltaic land area. The land transferred to SFD comprised of two blocks, namely, Keti Bandar Block and Shah Bandar Block, and in between these two was the cultivable part of the delta that still rests with the then Board of Revenue, now called Sindh Board of Revenue (SBR) (Fig. 1.).

Table 2

Salient Features of Forestry Related National Policies in Pakistan

Policy	Salient Features and Emphasis	Implementation
British-Indian Forest Policy 1894 (continued until 1955)	<ul style="list-style-type: none"> – Function based classification of forests ^[1] – Forest as source of revenue for the State ^[2, 3] – Permanent agriculture superior to forests ^[3] – Community rights confined to second class forests ^[3, 4] – Forest preservation rather than expansion ^[4] – FD to determine what local communities could collect from forests ^[6] 	Implemented effectively due to strict command and control of colonial foresters ^[2, 4]
Forestry Policy Resolution, 1955	<ul style="list-style-type: none"> – Forests as contributors in economic development ^[2, 3, 5, 6] – Utility based classification of forests ^[2, 3] – Forest management through Working Plans ^[2, 3, 5] – Afforestation of wastelands, road and canal sides ^[2, 4, 5, 6] – Integrated forest, wildlife and soil conservation ^[3] 	Ineffective due to lack of funds and reluctant bureaucrats ^[2, 4]
Directives on Forestry, Watershed, Range Management and Soil Conservation, 1962	<ul style="list-style-type: none"> – Intensive forest management ^[2, 3, 5] – Transfer of wastelands to FD for afforestation ^[3, 5] – Research on fast growing exotic species ^[2, 3, 4] – Farmlands to plant minimum number of trees ^[4, 5, 6] – Forest fencing and evacuation of the local people ^[2, 4, 5, 6] – Forest Act 1927 extended to area earlier excluded ^[2, 5] – Provision of penalties for forest offenses ^[2, 5] – Extensive mangroves re-plantation ^[5] 	Policy remained ineffective Idea of the evacuation was abandoned as resettlement issues were not addressed ^[4, 6]
Decision of the Council of Common Interest, 1975	<ul style="list-style-type: none"> – Exotic species to enhance forest productivity ^[2, 5] – Protection of forests and woody areas ^[2, 6] – Limited community rights to use forests ^[2, 5, 6] – Deforestation control through education and awareness; adoption of punitive measures only as a last resort ^[4] – Private Forest Owners cooperatives ^[4, 5, 6] – D's authority to harvest timber from both public & private forests ^[4, 5, 6] 	Became redundant due to coup d'etat in 19 ^[4]
National Agricultural Policy, 1980	<ul style="list-style-type: none"> – Afforestation of wastelands with exotic species ^[4, 5, 6] – Monopoly of FDs on timber harvesting ^[4, 5] – Community participation in afforestation ^[4, 5, 6] – Creation of national parks ^[4] 	Ineffective due to lack of concrete initiatives ^[6]

Continued—

National Forest Policy, 1991	<ul style="list-style-type: none"> – Social forestry linked with bio-diversity, forest conservation and habitat improvement ^[2, 4] – NGO intervention in participatory forest management ^[2] – Lease of the public lands for private forestry ^[2] – Artificial regeneration of forests with high quality seed ^[2] – Vast discretionary powers to FD to determine what local communities could collect from forests ^[4] 	Ineffective due to vague prescription for achieving the policy objectives ^[4, 6]
Executive Order 1993	<ul style="list-style-type: none"> – Two year ban on commercial logging companies to check uncontrolled tree felling ^[5,6,7] 	Ban was extended until 2001 ^[6,7] Illegal feeling increased ^[5,6,7]
National Conservation Strategy (NCS), 1992	<ul style="list-style-type: none"> – Mangroves conservation emphasised in two of the 14 priority areas ^[11] – Community Forestry for second class forests ^[2, 11] – FD to control Reserve Forests till communities get that foresight ^[2] 	Successful in awareness raising but ineffective in implementation due to unrealistic prescriptions ^[2, 12]
National Forest Policies 2001-02 and 2007 (Drafts)	<ul style="list-style-type: none"> – Sustainable development of Renewable Natural Resources (RNR) ^[8, 9] – Provinces to decide commercial logging ^[8, 9] – Substitutes to forest products to lessen stress on forests ^[8] – Banned conversion of forests into other land uses ^[9] – Provision of RNR management institutions ^[8, 9] – Community participation in RNR management ^[8, 9] – Conservation of fragile ecosystems like mangroves ^[8, 9] 	Awaiting approval by the Parliament ^[10]
National Environmental Policy, 2005	<ul style="list-style-type: none"> – NCS as basis for environmental management ^[13] – Coastal pollution and deforestation as key problems ^[13] – Effective implementation of forest policies ^[13] – Community participation in mangrove rehabilitation ^[13] 	Ineffective due to weak institutional support ^[14]
National Climate Change Policy 2012	<ul style="list-style-type: none"> – Mangroves primarily as a type of forest ^[15] – Restoration of mangroves for carbon sequestration and coastal protection ^[15] – Adaptive forest management with greater participation of communities ^[15] – Environmental flows downstream for healthy mangrove ecosystem ^[15] 	Still unknown

Sources: [Balaji (2002)¹; Ali (2009)²; Millat e MUSTAFA (2002)³; Babar, *et al.*(2007)⁴; Nizamani and Shah (2004)⁵; Suleri (2003)⁶; Aftab and Hickey (2010)⁷; MOELGRD (2001)⁸; Raza Asif (2007)⁹; Personal Communication with Babar Shahabaz, Forest Policy Analyst at Agriculture University, Faisalabad ¹⁰; Starke (1992)¹¹ ; Hanson, *et al.* (2001)¹²; MOELGRD (2005)¹³; TEI (2008)¹⁴; MCC (2012)].¹⁵

For effective management of mangroves, SFD established a Coastal Zone Afforestation Division (CZAD) with three main objectives. The first objective was to take over the full control of mangroves, which were the main source of firewood and fodder for local communities, and generate revenue from them. With a little agitation, the local communities conceded the ownership of mangroves to SFD and agreed to pay a nominal fee for the materials collected from mangroves. The second objective was the plantation of mangroves on fallow mudflats, and the third and most important objective was to collect the information it required to prepare a scientific management plan for mangroves in compliance with the forest policy (Table 2).

The AD introduced D's first mangroves management plan for twenty years valid from 1963 to 1983. With scant in-house knowledge on mangroves and their management, the plan relied substantially on experiences gained from the management of Sunderbans of the then East Pakistan (Bangladesh since 1971). Following the Forest Policies of 1962 (Table 2) during this period, SFD primarily sought the plantation of commercially valuable exotic mangroves species on empty mudflats. Other objective of the plan was to keep a healthy mangrove cover for the protection of coastline, inland agriculture and human settlements from cyclones and saline water intrusion [SFD (1964)].

Still half way through its implementation, the plan failed to fulfil the main policy objective viewing forests as a source of national income (Table 2). Hitherto, SFD was auctioning the standing mangrove trees on a condition that the bidder would bear all costs associated with timber harvest and transportation. Soon the department realised that the dominant *Avicennia marina* species (making more than 90 percent the vegetation in their area) could produce only a poor quality firewood and had no other direct economic value [see the mangrove wood classification by Becking, *et al.* (1922) in Chapman (1976)].

Besides, the transportation of wood from creeks through boats was also uneconomical. In some cases, the cost of tree felling and transportation was twice the revenue. Obviously, no one was enthusiastic to bid for mangroves, resulting in abolition of the CZAD in 1975 [SFD (1985)]. As a last resort, the department established a Mangrove Forest Utilisation Wing for absolute departmental exploitation that too proved futile on the economic grounds. Ultimately, the idea of commercial exploitation of mangroves was abandoned [SFD (1985)].

During the 1970s, the government created Port Muhammad Bin Qasim Authority (PQA) to foster the naval trade and asked SFD to handover 64,000 hectares of mangroves covered area to the Authority. Given the low direct economic benefit from mangroves, SFD lacked justification for not making this decision. Besides, the perpetuation of the British-Indian Forest Policy (1894) considering forests subordinate to other valuable land uses such as agriculture (Table 2) tacitly facilitated the transfer of mangroves to PQA (Fig. 1.).

Apparently, at that time there was virtually no serious policy concern about the ecological, aesthetic and social values of mangroves. PQA cleared a few thousand hectares of mangroves for the construction of basic port infrastructure and facilities. Occasionally, they still clear mangroves, albeit at a small scale each time, for the construction of new jetties. However, the remaining standing mangroves under the jurisdiction of PQA still hold the status of protected forests.

SFD did virtually nothing for the management of mangroves until it prepared second working plan for mangroves, also valid for twenty years (1985-2005). It also created a Coastal Forest Division (CFD) for the smooth implementation of the plan. Henceforth, the management envisaged the expansion of mangrove cover. Although, the key objectives of this plan were similar to its predecessor, it explicitly acknowledged the protective and productive values of mangroves [SFD (1985)]. Besides, the department also considered raising public awareness on the indirect benefits of mangroves. The plan was also concerned about the sustained supply of firewood and fodder to the local communities. Following the plan, plantation of mangroves was carried out [IUCN-Pakistan (2005)]. Since the expiry of the second working plan in 2005, SFD has not made any new plan yet.

Meanwhile, Pakistan was busy in developing the world's largest irrigation network on the Indus River. The network was so huge that by the 1970s it diverted most of the river water into the upstream canals and reduced the floods regimes to the downstream delta region [Memon and Thapa (2011)]. Consequently, the agricultural mudflats of the central delta (Keti Bandar and Kharo Chan sub-districts) could no more support the cultivation of red paddy and large-scale livestock herding and were eventually abandoned [Memon and Thapa (2011)]. In the absence of freshwater, the sea intruded into these lands and facilitated the natural growth of mangroves. These newly emerged mangroves by default came under the jurisdiction of SBR (Fig. 1.).

It is pertinent to note that throughout the evolution of forestry policies in Pakistan, mangroves received explicit attention first in 1962, almost overlooked during interim period until NCS 1992 and are continuously a concern thereafter (Table 2). The revitalised interest in the mangrove conservation is due to the increasing public concern about biodiversity conservation as a natural heritage, and, partly due to better realisation of their productive and protective roles in recent times.

The most recent policies, such as the draft Forest Policies 2001 and 2007, Environmental Policy 2005, and the Climate Change Policy 2012, have also emphasised the conservation of mangroves in view of their ecological, social and economic significance (Table 2). Nevertheless, the then governments could not take any solid meaningful action due to the draft status of 2001 and 2007 forest policies. While, the Environmental Climate Change Policies provide an

overarching framework for conservation of mangroves, any meaningful actions pertinent to these policies have not been taken yet (Table 2).

3.2. Institutional Arrangements

3.2.1. *Boundary and Property Rights Issues in Mangrove Areas*

The demarcation of mangrove areas under the jurisdictions of PQA, SFD and SBR was clear, as most of the times creeks served as a boundary. In areas where creeks were absent, SFD had installed concrete pillars in 1962 to prevent any encroachment for agriculture and human settlements. Later when the department realised that encroachment was unlikely due to the unavailability of freshwater in mangrove areas, it stopped maintaining the pillars, which now have almost entirely disappeared from the scene.

In the SBR area, besides creeks various manmade features such as canals and roads also served as boundaries. Not only the SBR officials, but also many local people could easily identify such boundaries. However, the headquarters based PQA and SFD officials were unclear on boundaries. Particularly SFD officials could identify only those boundaries where the demarcating feature was one of the 17 major creeks of the Indus Delta, but they were unsure where it was a minor or unnamed creek. Moreover, the frequent transfer and postings in these agencies hinder the familiarity of their managerial staff with boundaries in a conventional way.

Land rights in SFD and PQA areas were straightforward as land there was a public property without any private claim. However, the land rights in the SBR area were somewhat complex. It was gathered [based on ZDA (2011) and Memon (2012)] that about 25 percent of the lands in Keti Bandar and Kharo Chan sub-districts were private property (locally called *Qabooli* land) owned by individuals. Five percent of the land accounted for settlements, roads and canals. The remaining two thirds of the land was public property (locally called *Na-Qabooli* land).

Local communities' access and withdrawal rights in the SBR and PQA claimed mangroves areas were clear due to their status as protected forests. In a protected or second-class forest, local people could legally collect forest products for their subsistence but not for commercial purposes. However, an official of the Coastal Forest Division (SFD) mentioned that:

. . . In reality, it is difficult to protect a second-class forest [mangroves]. We [SFD] simply cannot stop local people even from extremely harmful practices such as reckless camel browsing on mangroves done in the name of their local people's subsistence. This is happening because the mangroves are protected forests where we have limited control. I would rather propose to declare these mangroves as reserve forests . . .

Regarding the mangroves in SBR area, there was virtually no concern about access and use rights as the management of mangroves was not a primary responsibility of this agency. Despite such limitation, the local communities do not collect wood from these mangroves, as reportedly, these mangroves were still young lacking required amount of dead wood. The communities living in SBR area were collecting firewood from the mangroves located along Dabbo, Chan and Kajhar Creeks area that belong to SFD. While the departmental boundaries were meaningless for local people, SFD could not strictly enforce rules protecting its mangroves.

3.2.2. Institutional Capacity to Monitor Mangroves

All three agencies had field staffs, but except SFD, none had held them specifically responsible for the monitoring and managing mangroves. Reportedly, SFD also could not monitor mangroves effectively due to inadequate number of field staffs and logistics such as patrolling boats.

There were legal provisions of fines and sanctions on the prohibited use of mangroves, but the cases of arrest and prosecutions of violators were rare even in the case of SFD. The group discussions held with the local communities revealed that there was a tacit consensus that herders will avoid grazing their camels in the planted mangroves, whereas, SFD will not strictly prohibit their activities in the naturally grown mangroves.

Both PQA and SBR did not report any professional forestry staff. In case of PQA, the concerned official reported that although they did not appoint anybody to monitor the use and status of mangroves, their security guards were doing the needed task while routinely watching ports assets and infrastructure. The fact was, however, not consistent with what the officials said, as reflected in the following expression from a group discussion in the PQA area:

. . . Every day, I collect fodder from [PQA] mangroves for my cattle . . .
I do not collect much [☺] . . . The security guards [of PQA] never stop me or any other villagers no matter what amount of fodder or firewood we collect. They stop us only when we approach the designated danger zone .

Since SBR had not specified any set of rules and regulations on the use of mangroves primarily because their mandate was to collect revenue from the private land, the local communities had free access to mangroves in the areas governed by them.

3.2.3. Restoration and Conservation of Mangroves

SFD had pioneered the restoration and conservation of mangroves in the Indus Delta. They had planted nearly 20,000 hectares of mangrove in discrete locations [IUCN-Pakistan (2003)]. Although at a smaller scale, PQA had also

supported the plantation of at least 1,200 hectares of mangroves [IUCN Pakistan (2000); WWF Pakistan (2003)]. Most plantations were the replacement of mangrove cleared for the development of additional port facilities. However, mangrove plantation was not a matter of concern for SBR.

With an underlying objective of enhancing the financial viability of mangroves, SFD had made significant attempts to propagate the extinct and exotic mangrove species in the Indus Delta. To some extent, the agency had been successful in the reintroduction of *Rhizophora mucronata*. In the past, SFD introduced various commercially important exotic species such as *Excoecaria agallocha* and *Nypa fruticans*, but did not continue with them because of their low survival rates. Therefore, currently only *Rhizophora mucronata* species is planted in the Indus Delta.

SFD has built in-house capacity for mangrove plantation through long trials and errors, while PQA and SBR lack such capacity. PQA had tried to overcome such difficulty by seeking the needed technical assistance from the relevant local and international NGOs. None of the agencies, including SFD, had made any systematic efforts for building institutional capacity in conservation and restoration of mangroves through professional trainings and exposure trips. SFD realised such need but reportedly lacked the required financial resources, while, PQA and SBR had no concern about this aspect of mangrove management.

SFD had accomplished almost all mangrove plantations in collaboration with regional and international agencies such as the World Bank, the United Nations, IUCN and WWF. It had a long-established partnership with the aforementioned agencies while pursuing mangrove conservation and restoration [IUCN-Pakistan (2005)]. PQA had also collaborated with NGOs like Shirkat-Gah, WWF and IUCN for mangrove plantation. However, SBR had not carried out any such activity either independently or in collaboration with other agencies. It neither encourages nor discourages any agency for launching a plantation scheme in their jurisdiction, as this agency lacks concern for the deltaic land, which it considers as wasteland.

3.2.4. Community Participation in Mangrove Management and Conservation

None of the three agencies had any kind of arrangement for mustering local participation in the conservation and management of mangroves. Obviously, PQA and SBR were unconcerned with mangroves due to the lack of their formal mandate for it. However, despite being appropriately mandated for the conservation and management of mangroves but lacking the needed institutional capacity, SFD also did not mobilise local communities to accomplish its mandate. It simply had prepared a list of mangrove dependent communities for the entire Indus Delta region in 1998 [Shah (1998)]. This list

had become outdated and the department never utilised it for any demonstrable purpose.

Contrary to the ground reality, SFD and PQA officials claimed that they were involving the local communities in mangrove restoration and plantation. A follow-up discussion revealed that the so-called community participation was limited to the local people's engagement as wage labourers for mangrove plantation. Beyond this, none of the agencies had made any institutional arrangement to facilitate true community participation in the conservation of mangroves that requires active involvement of local communities in decision-making, planning and implementation of various management and conservation activities. All three agencies lacked serious interest in participatory mangrove management system that the National Conservation Strategy, 1992 advocates at least for protected forests such as mangroves (Table 2).

4. DISCUSSION AND THEORETICAL IMPLICATIONS

The above analyses of policy and institutional arrangements for the management of Indus Delta mangroves exemplify our argument that public property is an aggregate concept underneath a diversity of government and quasi-government agencies with their specialised mandates. Depending on the differences in their mandates, one can expect variation in their concern over the sustainability of a public property resource and possibility to choose anything along a continuum ranging from effective management to open-access for such resources.

One may misperceive our institutional analysis as a comparison of different agencies and argue that given the differences of their mandates, these agencies are incommensurable. Therefore, blaming any of them for not managing mangroves is unjustified. While accepting the impossibility of comparison without common criteria, we contend that we neither compare nor propose as such. Indeed, for situations similar to the one in the Indus Delta, we even do not subscribe to the conventional question asking who manages resource in a better way? Instead, we ask if the management of any particular public property resource, such as the mangroves, is appropriately institutionalised. We understand that until resource management is not in the hands of seriously concerned owners, societal desire for their intergenerational sustainability is mere daydreaming.

Therefore, for whatever reasons, if an entity claims the ownership of an ecologically important resource, it is in the best interest of that resource and society to ask if its beholder is interested in and capable of managing it sustainably. Answering this question would enable us to determine what is and what is not reasonable to expect from the institutions in place for a particular resource.

Once permitted, our case of the Indus Delta mangroves highlights that each of the three agencies, claiming the ownership of deltaic lands, had different level of concern for mangroves under their possession. While SFD was primarily concerned with mangroves, it also required land rights to protect them. Quite opposite, PQA was primarily interested in some land and creeks to facilitate its naval operations, but as such was unconcerned with mangroves. Nevertheless, the PQA's showcased concern for mangroves was clearly strategic, as without being in the coastal region, where mangroves also coexist, this agency cannot perform its operations. By adopting a rhetoric of concern for mangroves and carrying out replacement plantation, this agency preempts the possibility of civil society's criticism against occasional clearance of mangroves [see, Hagler-Baily (2009)]. Among all, SBR was the least concerned agency in relation to mangroves because currently area covered with mangroves does not provide them any revenue. Therefore, SBR treats these areas as wastelands.

As PQA and SBR have clearly a lack of concern about mangroves, the existence of mangroves under their jurisdiction is just a matter of time until the deltaic lands, where they stand, do not find any economically more attractive use. Upon emergence of lucrative opportunities, these agencies will not hesitate to sacrifice their mangroves. According to Memon (2011, 2012), various government agencies, including PQA and SBR, frequently express their interest in the urban expansion in these areas, among which, a latest attempt could clear at least 50 percent mangroves in Pakistan.

However, SFD may control any future encroachment of mangroves if it has strong commitment towards the conservation of these resources. Despite demonstrated failure to protect its mangroves in the past, the optimism with SFD is because of current socio-ecological scenario in which the ecosystems such as mangroves have a broad-base support from several national and international agencies, biodiversity conservation groups and civil society organisations. However, the degree to which the department would succeed depends on its seriousness to lobby against encroachers. On the pessimistic side, it may once again connive with encroachers and let them fulfill their vested commercial interest by destroying mangroves.

While it seems easy to theorise governments for their inability to manage resources sustainably, we must not forget the conflicting societal objectives (social, economic and environmental) they strive to achieve simultaneously. No doubt, there are problems with governments' ability for resource stewardship [Danielson (1995)], part of it is due to our naïve policy prescription to them based on oversimplified models of society and its natural resources. This is due to the ignorance of two highly commonplace observations, which together deserve a centre-place in any theoretical deliberation on society and its natural resources.

First, resources systems like forests have multiple functions such as providing timber and other forest products, regulating hydrological and atmospheric regimes, and maintaining biodiversity. Second, societies also have multiple objectives and aspirations associated with such resource systems. However, in between these two, our theory remains incompatible because while theorising societies and their natural resources, often than not, we treat forest just for its land and trees, wetlands just for land water and fish, and so on. We also treat societies just for pursuing a generic objective of resource stewardship. Thus, often implicitly, we prescribe combining all associated property rights into a single package of ownership bestowed on exclusive owners, which can be an individual, a community or a government entity.

In reality however, both complex resource systems (such as forests, rangelands and wetlands), and multiple objectives of the society from these resource systems are compatible with each other, albeit not with our theoretical models promoting exclusive ownership. In our attempt to implement these models in real world situations, at the very first place, we implicitly choose open-access to all the components of a resource system in which the potential candidate for exclusive ownership might lack interest.

This view of societal relationship with its natural resources invites attention towards the potential of partial rights. It has been relatively recently that the western scholarship could observe the economic and environmental potential of partial rights in a property such as land [Bromley (1997); Meinzen-Dick and Mwangi (2009); Wiebe and Meinzen-Dick (1998)] and see some of its merit over the institution of exclusive ownership.

However, throughout the developing world, such as in South Asia [Gadgil and Iyer (1989)], South Pacific islands [Baines (1989)] and Africa [Moorehead (1989)], the indigenous tenure system of partial rights, promoting occupational specialisation over different components of a resource system have long-endured. Nevertheless, as [Wiebe and Meinzen-Dick (1998)] argued, the partial rights also require complex institutional arrangements not only to reconcile who possesses which right, but also to ensure continuous monitoring, and enforcement to maintain their long-term effectiveness.

Our support to partial rights for their potential to avoid open-access status of various resources systems does not discard the earlier theoretical evolution on commons. Instead, we suggest the horizontal expansion of these conceptualisations of the bundle of rights as a set individually designed sticks of different rights bestowed on different owners. This is indeed crucial if we desire to reduce the gap between the real world situation of society, its natural resources and our theories of sustainable natural resources management. To achieve this objective, research should attempt to study traditional and contemporary manifests of partial rights to understand how societies could economise these complex and seemingly costly rights regimes to increase their wider acceptability in the modern era.

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