

Equipping local self governments and development practitioners in managing common pool resources – A case of *Pampa* River in Kerala State, India

K. Sai Dinesh^a , Parameswaran Prajeesh^{b*} , Anil Kumar Nadesapanicker^b, V. Shakeela^b

ABSTRACT

Governments face challenges and constraints in managing Common Pool Resources (CPRs) worldwide. Almost all developing countries have begun to implement decentralised policies and decision-making systems for delivering public services and the management of environmental goods. In any government structure, distributing public goods is difficult as it will be challenging to exclude potential beneficiaries from obtaining the goods. Similarly, it's challenging to exclude potential beneficiaries from obtaining benefits from common pool resources. The phenomenal work 'Governing of Commons' argues that the CPRs can be managed locally, provided there need to be well-defined institutions at the local level. The actors can govern CPRs themselves to obtain mutual benefits from the CPRs by avoiding problems of exclusion of beneficiaries, conflicts and exploitation of resources. For establishing well-defined rules and norms, it is essential to have constant deliberations and participation of various actors for collective action in managing CPRs. However, at the decentralised level, most local governments have given less attention to prompt decision-making in CPRs, especially concerning environmental resources. This article investigates the capacity and role of local-level institutions in managing CPRs by discussing a Training of Trainers (ToT) programme associated with the health of the *Pampa* River in Kerala State, India. The ToT programme has helped 41 development practitioners to change their approach toward river health management. The deliberations have resulted in an alliance of practitioners and a people's framework for action projects. It was also studied that the role of local governments and civil society organisations in influencing the decisions made regarding river health management has to be improved.

^a Jindal School of Government and Public Policy, O.P Jindal Global University, Narela Road, Near Jadishpur Village, Sonapat, Haryana 131001, India

^b M. S. Swaminathan Research Foundation, Third Cross Road, Taramani Institutional Area, Chennai, Tamil Nadu 600113, India

* Corresponding author.

Email: prajeesh@mssrf.res.in



© The authors 2024.

LICENCE This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.

DOI 10.30852/sb.2024.2467

RECEIVED 27 February 2023

PUBLISHED (HTML) 08 March 2024

PUBLISHED (PDF) 08 March 2024

CITATION Sai Dinesh, K., Prajeesh, P., Anil Kumar, N., & Shakeela, V. (2024). Equipping local self governments and development practitioners in managing common pool resources – A case of *Pampa* River in Kerala State, India. *APN Science Bulletin*, 14(1), 1–16. <https://doi.org/10.30852/sb.2024.2467>

KEYWORDS COMMON POOL RESOURCES, RIVER HEALTH, BIOLOGICAL INDICATORS, PAMPA RIVER, LOCAL SELF GOVERNMENTS, DEVELOPMENT PRACTITIONERS

HIGHLIGHTS

- Science-based research should lead to education, public awareness and communication in managing Common Pool Resources.
- Capacity enhancement of the Local Self Governments and development practitioners is crucial in managing Common Pool Resources.
- Deliberations and public participation are crucial for the management of Common Pool Resources.

1. INTRODUCTION: COMMON POOL RESOURCES (CPRS) AND THEIR MANAGEMENT

Common Property/Pool Resources (CPRs) can be generally defined as nonexclusive resources to which the rights of use are distributed among several owners. Magrath (1989, p. 21) also observes that ‘membership in the group of co-owners of CPRs is typically conferred by membership in some other groups, such as a village or a tribe, etc.’. The resources managed as common property can contribute to people’s employment, income and asset accumulation in several direct and indirect ways that are seldom quantified (Jodha, 1994). Worldwide, governments have been facing challenges and constraints in managing such resources. Managing (CPRs) is a significant governance challenge involving different social actors and institutions. The three influential models¹ for the management of the CPRs are:

1. The ‘Tragedy of Commons’ in which Hardin (1968) argues that individuals or communities extract the resources without limit and, thus, natural resources get depleted,
2. The ‘Prisoners’ Dilemma’ where the individuals act for their self-interest and don’t produce an optimal outcome, and
3. The ‘Logic of Collective Action’ by Olson (1965) which argues that an individual has little or no incentives to voluntarily contribute when it is difficult to exclude the individual from getting the benefits of the resources.

Considering these models, many major policy solutions to address the issue of the management of resources are focused on the principles of centralisation and privatisation. In both methods of policy solutions, the primary assumption is that the

governing agency has complete authority in managing the CPRs. However, these institutions may lack accurate information on the available resources and the number of benefiting users and other stakeholders. Another argument is that CPRs could be managed effectively by the community at the local level (Ostrom, 1990). It is also noted that through interaction and deliberation, the actors at the community level collectively develop institutions that identify the availability of resources, issues and conflicts among the actors. Thus, decentralisation provides an institutional mechanism that allows power to resolve issues at the local level through deliberations. However, at a decentralised level, most institutions or local governments will likely have given less attention to prompt decision-making concerning CPRs (Agrawal & Ostrom, 2001). As a classic example, CPRs, such as rivers, can be effectively managed at the local level, but unfortunately, this is not happening as there are hardly any deliberations between the stakeholders. By discussing the case of the River Pampa in the State of Kerala, India, this article aims to investigate the capacity and role of local-level institutions in providing deliberations and public participation for the effective management of River Health Management. The theoretical framework for Managing CPRs, the science and the practice for River Health Assessment (as an example used in the case study) are discussed in Section 2. Section 3 provides a detailed methodology of an independent stakeholder analysis (Section 3.2) and a ToT (Training of Trainers) model project at the mentioned location (Section 3.3). By discussing the results of the analysis and the project, Section 4 discusses the role of local institutions in the effective management of CPRs and Section 5 concludes the paper.

		Subtractability of use	
		Low	High
Difficulty of excluding potential beneficiaries	Low	Toll Goods	Private Goods
	High	Public Goods	Common Pool Resources

TABLE 1. Types of Goods. Source: Understanding Institutional Diversity (Ostrom, 2005).

2. THE THEORETICAL FRAMEWORK FOR MANAGING COMMON POOL RESOURCES

The phenomenal book “Governing of Commons” (Ostrom, 1990) defines CPRs as a resource system, either artificial or natural resources, where the benefits of resources are shared among a large population, and it is difficult to exclude other beneficiaries from obtaining the use of such resources. Generally, the availability of CPRs will get reduced as it is used by different actor(s), raising the issue of “Subtractability of Use” (Table 1, Ostrom, 2005). This situation of high subtractability and high excludability makes it difficult to manage and govern CPRs. However, access to CPRs can be well managed at individual or community levels who are dependent on the resources. However, the situation in managing CPRs becomes complex as the area of benefit increases and when multiple actors become involved.

In this complex system, where multiple appropriators (the actors who withdraw or use the resources from the resources system) are involved and when the area of benefit is large, these appropriators interact and deliberate with each other to devise rules and norms to manage the CPRs (Ostrom, 1990). These rules and norms could be formal or informal and are enforced collectively to shape individual behaviour in a complex social situation. These rules and norms are defined as institutions (North, 1991). Such institutions evolved through repetitive interactions and deliberations among various actors. Considering the importance of institutions, it is essential to understand how they have evolved and changed, how the actors deliberated these rules and norms, and how they are operationalised. This section discusses the analytical framework of Institutional Analysis and Development (IAD), Decentralisation, Deliberative Public Participation and River Health Management, which are used in this paper to analyse the case of the Pampa River.

2.1. An institutional analysis development framework for managing Common Pool Resources

Institutions are defined as a set of rules, norms and shared values (Kiser & Ostrom, 1982; North, 1991; Ostrom et al., 1994). These institutions are invisible and difficult to identify in the complex social structure. The institutions can be categorised as both formal and informal institutions. Formal institutions are rules, laws and regulations. They are written and found in explicit form at the constitutional or operational level, influencing the decisions taken by participants and organisations. The institutions, such as beliefs, norms and customs, form through the traditional interaction among the people in a society. These institutions are defined as informal institutions (North, 1991). The informal institutions are often unwritten and sometimes shared as implicit knowledge. In collective action situations, these institutions shape individual behaviour by achieving collective interest.

Ostrom et al. (1994) have developed an IAD framework to analyse institutional arrangements. It is a systematic study of how the institutions evolve, interact and influence political, economic and social decisions at the individual or collective level. This framework has been widely used in a collective situation to study the provision management of common resources or goods (McGinnis, 2011). Using the IAD framework, Heikkila et al. (2011) studied the interstate rivers and identified the role of cross-scale institutional linkages in the management of CPRs. The IAD framework classifies the institutional arrangements as rules-in-use and categorises them into three types:

1. **Constitutional choice rules** – At the constitutional level (highest level), through governance, the decisions and collective choice rules can be modified. These modifications can determine who is eligible to participate in developing and changing the collective-choice rules, which can influence outcomes and the operational rules.

2. **Collective choice rules** – At the collective choice level, the activities include – policymaking, management and decision-making. These activities can determine who can participate in decisions and how the rules can be changed. At this level, the people involved in the collective choice situations deliberate and discuss the rules which can influence the activities and outcomes at the operational level.
3. **Operational rules** – At the operational level, monitoring and enforcement occur. It “includes decisions about when, where and how to do something; who should monitor the actions of others; how actions should be monitored; what information should be exchanged or withheld; and what rewards and sanctions will be assigned to combinations of actions and outcomes.” (Ostrom, 1990, p. 52).

2.2. Decentralisation for managing Common Pool Resources

One basic principle of decentralisation is having power, resources and administrative capabilities for the local communities to govern themselves. The role of local governments is to provide accountability and responsiveness to the citizens for their basic needs and wants. The decentralisation of the governance structure enables citizens to redistribute resources through collective actions. Bardhan and Mookherjee (2006) noted that for developing countries, decentralisation has emerged as an effective strategy for providing public goods and services. The transfer of powers to local government in such countries was political and promoted by domestic or external pressures. And the transfer of powers to govern certain matters is reserved for a centralised system. However, decentralisation provides an institutional arrangement to govern themselves, allowing the citizens to communicate their preferences to elected officials through public participation. These actions are aimed at minimal intervention by the centralised government system. In *Governing of Commons*, Ostrom et al. (1994) argue that CPRs can be effectively managed locally. The institutional arrangement of decentralisation is essential to manage CPRs and the delegation of powers to the local level significantly impacts outcomes related to resource management (Ostrom, 1990). This process of decentralisation affects actions at collective choice and operational level institutions. In India, the transfer of powers was due to domestic pressures. The 73rd and 74th Amendment

acts enabled the decentralisation process. The constitutional level rules gave the local governments the power to distribute and allocate public goods. The Gram Sabha, legislative at the local level, acts as the collective-choice rules, and the deliberation at the collective-choice level affects the actions at the operational level. The Gram Sabha provides an institutional mechanism for deliberation and public participation.

2.3. Deliberation and public participation in managing Common Pool Resources

Deliberation is an ability to have consensus in the distribution of resources, resolve conflicts, improve knowledge and establish coordination among the community members, which shapes their identity and preferences. In a complex society, collective choice decisions are made through discussions, debates and critical analysis of the problems through repetitive discussions to have a collective consensus among community members. In other words, it is a governance in which “free and equal citizens (or their representatives) justify decisions in a process in which they give one other reason that is mutually acceptable and generally accessible with the aim of reaching the conclusion that is binding in the present on all citizens but opens to challenge in future” (Padvetnaya, 2017, p. 63). It is a continuous and ongoing process that constitutes a public sphere enabling public participation to achieve sustained success.

Theories such as political philosophy (Rawls, 1999), democracy (Elster, 1998) and participatory governance (Fung, 2006) provide a related conceptual framework for public participation for effective deliberation. In public participation, power, knowledge, interest and influence of the stakeholders affect the process of deliberation. For effective decisions through participation in river basin management, Carr (2015) discusses the three overlapping mechanisms: (1) consensus building and space for deliberation should be provided, (2) “mobilising and developing human and social capital”, and (3) improving the legitimacy. Democratic participation of the stakeholders through deliberation is crucial for river basin management. Wester et al. (2003) discuss how stakeholder representation is lacking in Mexico and South Africa, affecting the river basin management and argue that stakeholders in the river basin management, such as water users, etc., should be involved in deliberation and have the capacity to influence decision-making.

2.4. River health management: The science and the practice

Rivers are the main sources of freshwater that not only support human beings but also provide a home to a wide range of flora and fauna. They have many vital ecological values while providing cultural, social and economic benefits to communities. Extensive human interventions cause fast shifting of river systems from healthy, sustainable entities to unsustainable units. The Commonwealth Scientific and Industrial Research Organisation of the Australian Government [CSIRO] (1992) listed eight direct causes of changes to rivers, which are (1) manipulating stream channels, (2) damming watercourses, (3) manipulating streamflow, (4) draining wetlands, (5) transferring water to urban and industrial consumers, (6) disposing of waste, (7) extracting groundwater and 8) irrigating agricultural land. Karr (1991) defined river health as the degree to which three main physical and chemical attributes of a river (its energy source, water quality and flow regime), plus its biota and their habitats, match the natural condition at all scales. This five-component definition of river health implies a need for comprehensive, sensitive and quantitative tools (or indicators) for integrating and assessing the condition of each of the components. An effective river-health indicator must also be ecologically based, efficient and rapid, and reveal the condition of ecosystems rather than narrowly defined components of ecosystems (Harris & Silveira, 1999).

An important precursor to improving river health is establishing a framework to assess river health through community participation. It can help people better understand and communicate the current state of local watercourses and take appropriate remediation measures for effective waterway management. The concept of River Health Assessment (RHA) has emerged as an attempt to measure the health of rivers using reliable protocols and tools. For a long time, RHA protocols have focused on water quality alone, which covered analysing the physicochemical properties of the water through periodic sampling and analysis. The approach offered a record of water quality over time and identified the situations where plant and animal life were put at risk but did not provide inclusive information on the actual damage done. In other words, the nature and magnitude of impacts of disturbances on life forms and habitats were seldom considered in such attempts. In fact, the

health of a river depends on its ability to sustain its structure and function, maintain key processes such as sediment transport, nutrient cycling and energy exchange, recover after disturbances, support local biota, and perform as an undisturbed ecosystem. Currently, RHA protocols emphasise factors that contribute to the ecological fitness of the river, such as catchment health, floodplain health, channel health, flow health, quality health and biotic health indicators.

Biological indicators for river health monitoring: In general, a number of physical, chemical and biological assessments are carried out, individually or in combination, to understand the health conditions of a river system. For example, the assessment of land use change coupled with soil erosion status indicates the health of the catchment area. Similarly, physicochemical and biological analysis of river water with respect to pH, electrical conductivity, salinity, dissolved Oxygen (DO), suspended solids (SS), chemical oxygen demand (COD), biochemical oxygen demand (BOD), total phosphorus (TP), total nitrogen (TN), ammonia, *E. coli*, total coliform, etc. indicates water quality health. Since changes in hydrology are rapid and often difficult to estimate in running waters, such measurements cannot reflect the integration of various environmental factors, including life forms and the long-term sustainability of river ecosystems. The use of biological indicators has been proven to be supplementary to conventional monitoring techniques. Aquatic and amphibious organisms, such as diatoms and other periphytons, benthic micro- and macroinvertebrates, fishes, amphibians, reptiles, birds, riparian vegetation, etc., can serve as biological indicators to integrate the total river system and their responses to complex environmental conditions. In short, they offer the possibility to obtain an ecological overview of the status of streams or rivers. The species composition, diversity and distribution pattern of these bio-indicators change from river to river or even from different stretches of an individual river depending on various environmental and climatic factors. Therefore, the geographical location of a river or given river segment is of relative importance and location/basin-specific studies must be carried out to evolve an effective framework. Such comprehensive RHA frameworks, which are scientifically sound, reflect local conditions, easy to use and scalable, will identify rivers or river stretches that are in poor health, recognise their causes, help prioritise river restoration and

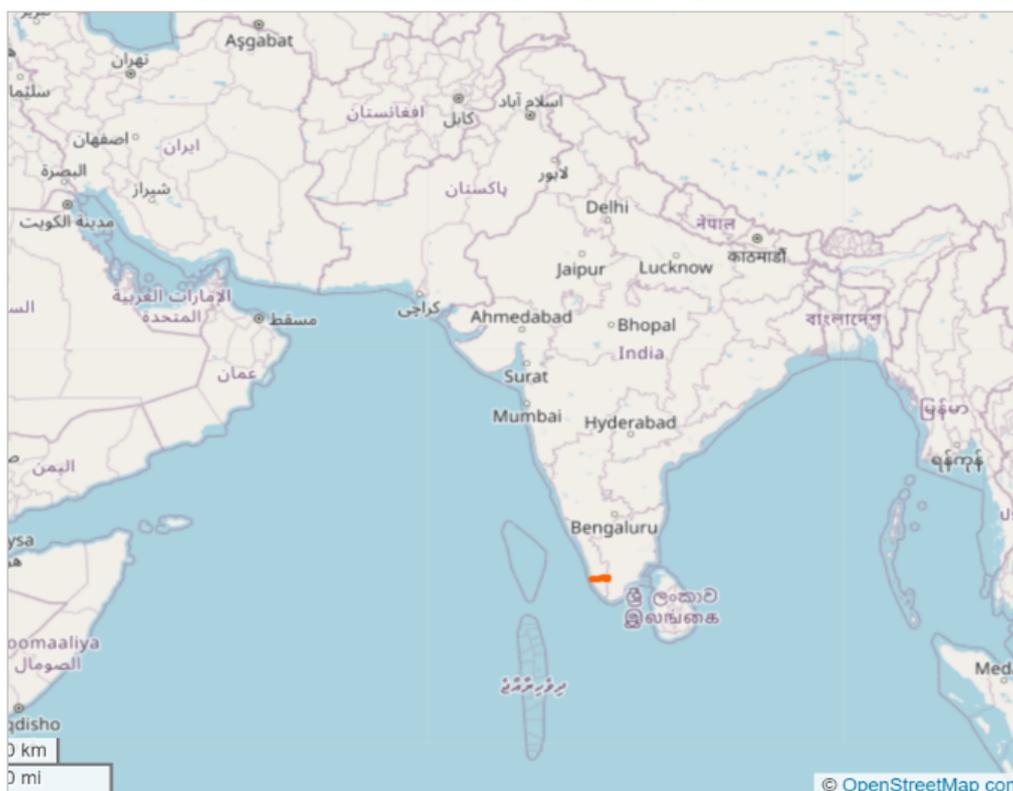


FIGURE 1. Pampa River, Kerala State, India – The red mark indicates the position (A detailed map is available at: <https://www.openstreetmap.org/relation/15461371#map=4/19.08/83.23>).

management and evaluate the effectiveness of subsequent management actions.

3. METHODOLOGY

3.1. A brief of River Pampa and the challenges

Pampa is the third-longest river in Kerala, India, after River Periyar. The river spans about 176 km in total length and is enriched by 13 tributary streams. The river, which emanates from Pulachimala on Peerumedu upper plateau of the Idukki district (1830 m above mean sea level) and flows through the midlands of the Pathanamthitta district, enriches the lowlands of Alappuzha district—the Kuttanad² region, and eventually drains into the Vembanad Lake,³ which joins the Arabian Sea (Figures 1 and 2). The river flows through 36 Local Self Governments⁴ in four districts (KSBB, 2020). The river is famous mainly for its sacredness associated with pilgrimages to the Sabarimala Hindu Temple and the Maramon Christian Church. Millions of devotees visit Sabarimala Hindu Temple to carry out the ultimate ritual, ‘The Holy Dip,’ every year by disposing of their clothes in the flowing river and tainting it significantly. Due to modern agricultural practices along the river basin and floodplain regions from

the midstream to downstream areas, excess pesticides, herbicides and fertiliser effluents are being discharged into the river, eventually resulting in heavy metal accumulation, eutrophication and algal blooms. A substantial degree of sand mining has happened from the riverbanks of Pampa (KSBB, 2020).

3.2. Management of River Pampa: An institutional and stakeholder analysis

The first step involved identifying relevant institutions and stakeholders with a direct or indirect influence on the River Pampa. Initially, data collection relied on content analysis of websites, research articles, and reports related to the river. Subsequently, a sample questionnaire was designed and distributed to 37 Grama Panchayats, with a 15-day response period. Due to unsatisfactory results, the data collection method shifted to semi-structured key-person interviews, group discussions, field conversations and observations during the Training of Trainers programme (refer to Section 3.3). Key-person interviews included farmers, ex-panchayat representatives involved in the Pampa River management project, researchers specialising in river health parameters, represen-



FIGURE 2. Pampa River - Views from different locations.

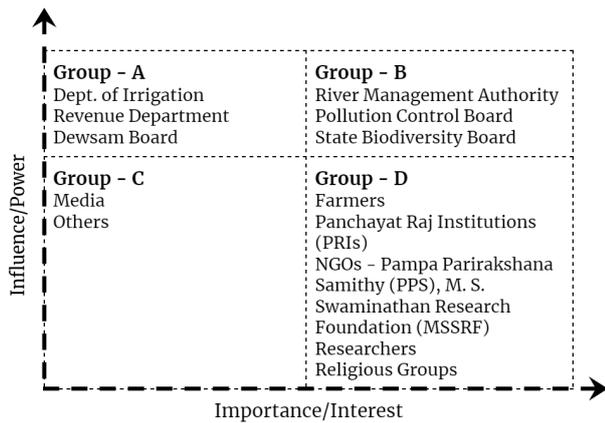


FIGURE 3. Stakeholder Analysis for Pampa River Management (Source: Authors’ analysis).^{7b}

tatives of non-governmental organisations actively involved in river protection and monitoring events, and local residents. Group discussions involved residents, farmers, students and researchers, focusing on their challenges in using and managing the river, as well as actions taken for river protection and management by various stakeholders. Respondents were selected using snowball sampling based on their roles in river management.

3.3. Training of Trainers (ToT) in river health assessment, monitoring and management

The project supported by the Asia-Pacific Network for Global Change Research (APN) and implemented by the M. S. Swaminathan Research Foundation (MSSRF) was titled ‘The health and restoration of economically and culturally important rivers of India in the context of climate change impacts and sustainable development: A project for the capacity enhancement of practitioners and for devising restoration plans.’ Through two sessions conducted in Kerala, India, the project has trained 41 development practitioners consisting of scientists, researchers, students and grassroots level actors in River Health Assessment and Monitoring (RHA&M).

The River *Pampa* was taken as a case for field observations and hands-on training. The training titled ‘River Health Monitoring and Restoration: The use of Biological Indicators for River Health and Restoration’ was conducted in two cohorts—one from 14–16 March 2022 and another from 18–22 April 2022, covering 8-day theory classes and field visits to three hotspots of the *Pampa* River basin, followed by the formation of an active discussion platform. The participants were given lectures by eminent experts in the field, covering the river health assessment parameters focusing on the health of catchment, biota, flood plains, environmental flow and channel. The module included a theoretical framework and field-level methodologies for assessing river health from a system perspective.⁵ The hands-on activities included transect studies in the hilly watershed, populated mid-plains and the lower portion of the *Pampa* River, where it merges with the Arabian Sea (Figures 4–6).⁶ Key-person interviews and focus group discussions were also conducted to propose an action alliance for river health needs and a people’s framework for action.

4. RESULTS AND DISCUSSION

4.1. Institutional analysis

The institutions were identified and analysed in the context of the *Pampa* River by using the analytical framework discussed before. The three rules in use in the management of the *Pampa* River are discussed below.

1. **Constitutional level** – Article 21 of the Indian Constitution states that every human has the right to live in a healthy environment and Article 51-A states that everyone is responsible for protecting and managing the environment. The rules to manage the rivers at the constitutional level identify that the power of regulation and development of the interstate rivers and river



FIGURE 4. Participants at the State and National level training sessions.



FIGURE 5. Panel discussion and hands-on training session.



FIGURE 6. Participants in the two-tier training sessions.

valleys are under the Government of India’s control and Parliament can declare it by law. The rules for managing interstate rivers are

mentioned in the Interstate River Water Disputes Act 1956 and issues are managed at collective choice rules through an interstate river management board. Meanwhile, at the constitutional level, the state government can regulate and develop rivers that follow within the state boundaries (Seventh Schedule, Article-246, List-I, 56, The Constitution of India). In the case of *Pampa* River, the state government has complete authority to manage the rules in use at the collective choice and operational level (Table 2).

The 73rd and 74th constitutional amendment acts give local governments the power to provide water resources to citizens as public goods. At the state government level, the government has enacted the *Kerala Panchayati Raj Act 1994*. This act provides the power to manage local water resources and water supply. The act, through its rules, makes Gram Sabha and panchayats responsible for the management of water resources and supply and sanitation. However, the act and the amendment give less attention

Articles	Key features
Article 21	“Every individual has the right to live in a healthy environment.”
Article 51-A (g)	Casts a fundamental duty on every citizen of India “to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures.”
Article 246, List-I, 56	“Regulation and development of interstate rivers and river valleys to the extent to which Parliament declares such regulation and development under the control of the Union to be expedient in the public interest.”
Article 246, List-II, 17	“Water, that is to say, water supplies, irrigation and canals, drainage and embankments, water storage and waterpower subject to the provisions of entry 56 of List I.”
Part IX & IX-A (73 rd and 74 th Amendment Act)	Establishing Local Governments in States: Amendments 73 rd and 74 th gave powers to the state governments to establish <i>Grama Panchayats</i> and Municipalities.

TABLE 2. The Constitutional Rules with regard to Water and Environment (Authors’ compilation).

Source: The Constitution of India.

to prompt decentralised decision-making in matters of CPRs, especially concerning environmental resources.

2. **Collective-choice rules** – The Government of India enacted the Water (Prevention and Control of Pollution) Act of 1974 (amended in 1988) to protect rivers from pollution. The act directs the central and state governments to establish central and state Pollution Control boards. The Water (Prevention and Control of Pollution) Cess Act 1977 and Environmental Protection Act 1986 were enacted by the Government of India to protect the environment from anthropogenic activities. These acts have come after much deliberation and public participation at the constitutional level through the legislative process. To manage and protect the river from sand mining, the Kerala State government has enacted the Kerala Protection of Riverbanks and Regulations of Removal of Sand Act 2001. It provides rules and regulations for “Protecting the riverbanks and riverbeds from large-scale dredging of river sand” by regulating indiscriminate sand mining. Later, in 2009, the Kerala state government enacted “The *Pampa* River Basin Authority Act 2009” to address the issues concerning water resources and pollution. The act provides arrangements for managing activities connected with water resource conservation in the *Pampa* River basin. These rules and regulations determine who can participate in decisions and influence actions and outcomes at the operational level

(Table 3). However, these rules don’t provide any information on the parameters of the RHM.

3. **Operational rules** – The monitoring and enforcement of the rules/acts are carried out at this level. The concerned local government and District Collectors/District Magistrates decide when and whom to act, who should monitor the actions of others and the monitoring method. The findings of the discussions with *Grama Panchayats* helped to identify the different rules in action. Multiple stakeholders, such as communities, local groups, and non-governmental organisations, are involved at this level. The combination of actions through different stakeholders led to outcomes in rejuvenating the river project. However, at this level, conflict of interest between various stakeholders and a lack of technical knowledge challenged implementation of activities related to RHM.

4.1.1. Stakeholder analysis⁷

The primary stakeholders have direct positive or adverse effects. From the findings and literature, the primary stakeholders are identified as farmers and local residents, three important departments of the Kerala Government (Major & Minor Irrigation, Kerala Water Authority), Local Self Governments (the *Panchayati Raj* Institutions), the Kerala state agencies like Centre for Water Resources Development and Management (CWRDM), religious groups, the *Pampa* River Management Authority, etc. The secondary stakeholders are those indirectly affected by the programs and actions. From the findings and

Acts/Rules	Key features
Water (Prevention and Control of Pollution) Act, 1974, amended in 1988	Prevention and control of water pollution and establishment of boards. Chapter 3.3 directs the central government to establish the Central Pollution Control Board (constituted in 1974). Chapter 3.4 directs the state governments to establish State Pollution Control Boards.
Water (Prevention and Control of Pollution) Cess Act, 1977	“The Act is to provide for the levy and collection of a cess on water consumed by persons carrying on certain industries and by local authorities, to augment the resources of the Central Board and the State Boards for the prevention and control of water pollution constituted under the Water (Prevention and Control of Pollution) Act, 1974.”
Environment (Protection) Act, 1986	“The Act is to provide for the protection and improvement of the environment, the prevention of hazards to human beings, other living creatures, plants and property.”
Biodiversity Act 2002	The act is for the conservation of biodiversity. A National Authority and State Boards are there to restrict certain activities that violate conservation objectives and develop strategies/plans for conserving biological diversity.
Kerala Panchayati Raj Act, 1994	The act provides particular provisions on Gram Panchayat’s responsibility and powers to manage local water resources and supply. The Standing Committees at the village, block and district levels have the power to deal with sanitation and water supply.
Kerala Protection of Riverbanks and Regulation of Removal of Sand Act, 2001	The act provides provisions for protecting riverbanks and riverbeds from large-scale dredging of river sand, protecting their biophysical environment system and regulating indiscriminate mining of river sand. The District Collector and the concerned local governments can regulate sand mining.
The Pampa River Basin Authority Act, 2009	The act is the first of its kind constituted in Kerala state. It provides arrangements for managing activities connected with water resource conservation in the Pampa River Basin.

TABLE 3. The Collective Choice Rules with regard to the Pampa River, Kerala, India (Authors’ compilation).

literature, the Secondary stakeholders are identified as non-governmental organisations like *Pampa Parirakshana Samithy*, the M. S. Swaminathan Research Foundation, etc., media, researchers and the Kerala Institute of Local Administration. Detailed characteristics of the stakeholders are given in Table 4 and Figure 3.

4.1.2. Institutional changes through public deliberation

The institution changes and evolves with constant interactions and deliberations between the actors at various levels. In a collective action situation where multiple actors are involved in deliberating their preferences and conflicts, it is essential to identify who is participating in the deliberations and whose power influences the decision-making. In the case of the Pampa River management focusing on water pollution and sand mining, the collective choice rules were enacted with considerable deliberation and the institutions have evolved to protect the river. The significant institutional changes were the

Kerala Sand Mining Act (2001) and the Pampa River Protection Act (2009). Another collective action among people has led to the establishment of a civil society organisation called *Pampa Parirakshana Samithy*.⁸ This group, along with a few stakeholders, established the collective choice rules for preventing sand mining in the river basin.

At the operational level, the sand mining by certain actors led to conflicts among the farmers, fishing community and environmental protectors, as it affected the river ecosystem. However, the above mentioned institutions did not influence the actions at the operational level. Water pollution and sand mining have been consistent over the years. The studies found that the water quality of the river upstream has been affected due to the Sabarimala Hindu temple pilgrimage. The pilgrimage season is from October to February every year. During the months of December and January, there could be an increase in the number of devotees. Many studies conducted during these months have found

Sl. no	Stakeholder	Power	Knowledge	Influence	Interest
1.	Farmers	Low	Low	Low	High
2.	Grama Panchayats (Local Self Governments)	Medium	Low	Medium	Medium
3.	Researchers	Low	High	Medium	High
4.	<i>Pampa Parirakshana Samithy</i> (Non-Government Organisation)	Medium	Medium	Medium	High
5.	Department of Irrigation, Govt of Kerala	High	Medium	Medium	Low
6.	<i>Pampa River Management Authority</i> (State Agency)	High	High	High	High
7.	M. S. Swaminathan Research Foundation (Research Organisation, Non-Government Organisation)	Low	High	Medium	High

TABLE 4. Stakeholders' Capacity on River Management. Source: Authors' analysis.⁷

a decrease in water quality. Krishna and Kumar (2014), Mayaja and Srinivasa (2016), and Narayan (2021) examined the water quality of the river during the pilgrimage season in 2011 and 2012 and found increased pollution. Narayan's study (2021) on seasonal pollution concludes that the pollution rates were higher in the *Pampa* River basin during pre-monsoon and winter.

At collective choice, the actors, through constant deliberation, established institutions at the operational level to protect and manage rivers. At the operational level, these non-governmental organisations and other environmental pressure groups were able to influence the people to check river pollution and sand mining through social policing. The power to influence the decisions and the knowledge of actors were analysed using stakeholder analysis. Based on the constitutional and collective choice rules, the power to influence the discussion is high among government institutions such as the Department of Irrigation, Kerala and the *Pampa* River Management Authority. The local institutions and non-governmental organisations have medium power to influence the decisions at the collective choice level (Table 4).

4.2. Results and discussion: Building capacity of development practitioners in river health management

The water quality of our rivers is getting tainted over time, along with increased demand for potable water. There is ample time to act to preserve our rivers before the pinnacle point of destruction. Monitoring rivers using bio-indicators provides the most integrative view of river health. With increasing industrialisation, population growth, land-use

changes and developmental challenges, the natural ability of rivers to provide goods and services has been severely curtailed. In this context, a training project was planned by the MSSRF, India, with the support of APN. This Training of Trainers (ToT) model project was aimed at intensively training its stakeholders at different power levels in monitoring the comprehensive health and longevity of culturally and economically far-reaching rivers. The fact to consider is that we need more well-trained individuals with good reflexes to rectify the fluctuating health of the river and riverine resources.

The project results are detailed in Table 5. Two key results are (1) An action alliance for river health needs, and (2) A people's framework for action.

4.2.1. Kerala River System Health Needs Assessment and Action Alliance (KRISHNA)¹⁰

KRISHNA has emerged as a platform for organisations, youth, and local community leaders dedicated to River System Health Services and Management in Kerala. This open platform includes researchers, teachers, students, practitioners and community-level user groups. They are committed to taking action steps based on needs, utilising science-based tools and skills in river health management and reporting. The team adopts a comprehensive approach to river health, incorporating rejuvenation actions based on facts, values of Restoration Biology, and community/socio-cultural/ecological dynamics. Many rivers in Kerala are ailing, evidenced by declining ecosystem services, including polluted water, narrowing flow channels, loss of floodplains, degradation of catchment areas and riparian vegetation, and loss of freshwater biodiversity. If these trends persist and

Outputs	Outcomes	Impacts
Forty-one (41) trained practitioners in all aspects of River Health Assessment and Monitoring (RHA&M); some have initiated follow-up actions (Mahajan, 2023).	<i>Kerala River System Health Needs Assessment and Action Alliance</i> (Krishna), a river protection platform to facilitate need-based actions using science-based tools and skills in River Health Assessment and Monitoring (RHA&M).	Improved stakeholder skills, awareness and commitment, especially of those who associate with the River Health Assessment and Monitoring (RHA&M).
The collation of content and first-hand knowledge documentation pertains to river health assessment, monitoring and restoration science, techniques and tools.	A Guidebook for River Health Assessment and Monitoring (RHA&M).	Opportunity for designing more training for new stakeholders interested in river health management.
Mother plant materials of 22 riparian tree species ready, apart from documentation of species of instream river biota.	A Plant Nursery to raise and distribute riparian tree species.	Community efforts in restoring a degraded riparian patch of the <i>Pampa</i> River.
A discussion group for follow-up actions and monitoring of River health aspects.	A Platform for RHA of Kerala Rivers and a Plan of Action Framework for Rejuvenating the <i>Pampa</i> River.	Adequate pressure from citizen groups and detailed project proposals are expected from the sub-national and local governments for RHA&M.
Six short videos covering expert interviews on the importance of RHA&M. ⁹	A Web Portal ¹⁰ for River Health Assessment science, innovations and techniques covering a good amount of scientific content and rejuvenating stories.	A science-based action in campaign mode is expected in river health assessment and rejuvenation action.
Manuscripts for two publications, including a Training Manual on RHA&M on the <i>Pampa</i> River restoration.	The expected Peer-reviewed publications will increase the team's self-esteem and help sensitise people widely on the holistic River health assessment.	More rational decisions are expected on the part of policymakers and enforcement officials in river health management and climate resilience building.

TABLE 5. The RHA&M Project Results.

worsen due to climate catastrophes, many rivers in Kerala may become lifeless channels or critically polluted water bodies dominated by invasive species.

KRISHNA aims to research, rejuvenate and report river health locally and empower the eco-restoration movement globally with the following objectives.

- (i) Cross-disciplinary and participatory assessment and rejuvenation of River Ecosystem Services (RES);
- (ii) Policy Advocacy in sustainable management of RES, notably riparian forests, river catchment

and floodplain ecosystems and river basin agricultural landscapes;

- (iii) Practical Actions for RES management like the Payment for Ecosystem Services for local community members and their institutions for protecting the river in their geographic boundaries; and
- (iv) Capacity development activities at grassroots-level institutions on sustainable and equitable management of Rivers and River Ecosystem Services and reporting.

4.2.2. A People's Framework for Action Projects

4.2.2.1. The background & the purpose

The *Pampa* River in Kerala is sick to the extent that most of its vital ecological services are in a continuous state of decline. Despite several attempts from government and non-government actors to restore its health, the *Pampa* River is experiencing increasing pollution. The feeding flow channels and floodplains are progressively narrowing, becoming choked, or assuming an altered state. The present Action Framework has been formulated through consultations and meetings conducted at various levels with stakeholders, mainly local community men and women engaged daily in *Pampa* River utilisation. The plan sets out several strategies for practical actions that balance the *Pampa* River's multiple roles and objectives relating to specific human needs and natural river functions. This plan provides insights and on-ground action targets based on a strategic system-based approach by recognising the river's physical, ecological, socioeconomic, cultural and political aspects. The strategies proposed will help identify and respond to various links in the river system restoration portfolio for this river between external drivers, catchment and river functions, river health, ecosystem services and societal priorities. The plan also contributes to formulating specific action steps required to align and synergise various policies, strategies and projects already available in the state to restore the river. It also facilitates explicitly executing the powers and the critical functions outlined in the *Pampa* River Basin Authority Act, 2009.

4.2.2.2. The Targets 2030

A set of 11 action-oriented restoration targets are identified and suggested by covering 14 river ecosystem health components (Table 6). Specific detailed actions in a mission mode that are required to synergise other relevant plans of the state-specific bodies and the Local Self Governments must be formulated to reach these targets.

- Target 1. Practice science-based Catchment Area Land use-land cover management of River *Pampa*.
- Target 2. Maintain an optimum level for the *Pampa* River Environmental Flow regime.
- Target 3. Ensure improved Floodplain functions of *Pampa*.
- Target 4. Protect the geomorphology and hydrology of the *Pampa* River channel.

- Target 5. Maintain a scientific portfolio for *Pampa* riparian vegetation management.
- Target 6. Ensure a rich river biota is maintained across the *Pampa* riverine ecosystem.
- Target 7. Ensure water quality and reduced chemicals and particulate load to *Pampa*.
- Target 8. Revive and enhance the cultural heritage functions of *Pampa*.
- Target 9. Revive the socioeconomic development role of *Pampa*.
- Target 10. Research, Education, Public Awareness and Communication around *Pampa*.
- Target 11. The Resource mobilisation and Implementation support mechanisms.

5. CONCLUSION

Deliberations and public participation are crucial for the management of the CPRs. Through such constant interaction between the actors, institutions evolve and change. In the case of the *Pampa* River, the institutions at the collective choice level have developed majorly for the supply of drinking/irrigation water and the protection of the river. At the collective choice level, the local bodies, non-government organisations, and other civil society organisations have deliberated and taken actions at the operational level to address the issues of water pollution and illegal sand mining. However, the power of these organisations to influence the decisions made at the collective choice and operational level has remained weak. To address these issues at the collective choice level, the mechanism at the local self-governments should focus on decision-making on CPRs at the grassroots level. It is suggested to campaign among individuals, regional households, Local Self Governments, the Kerala State Government, the Government of India and Civil Society Organisations to mobilise necessary resource support for implementing the plan devised for River Health Management. A healthy CPR, like a river, can benefit the community through its ecological, social, cultural and economic values. The strategic targets built upon understanding the complexity of the relationship between river health and social benefits will help to formulate scale-specific projects for reviving the river. If we fail to see the system perspective, it can only lead to further degradation and destruction of this riverine system. This may significantly impact vulnerable communities such as smallholder farm families, the indigenous people and those multi-user groups who depend on this ecosystem. The involvement of these

River Ecosystem component	River restoration measures	Resultant changes
<i>Catchment area</i>	Catchment area land use–land cover management	<ul style="list-style-type: none"> • Water percolation and recharge capacity of the ground improved. • The quantity and quality of water and other matter that enter the river channel changed.
<i>Flow regime</i>	Flow modification Stormwater management Dam removal/retrofit	<ul style="list-style-type: none"> • Flow volume, timing, frequency and duration changed. • Flow pattern and storage of runoff water changed. • Movement of sediments, flow pattern and biodiversity functions like breeding behaviour of species improved.
<i>Flood plain</i>	Land reconnection Land acquisition	<ul style="list-style-type: none"> • Reduced flood risks. • Increase assimilation of pollutants. • Movement of sediments, other matter and biota between the channel and floodplain improved. • Acquired the encroached floodplain land to improve the floodplain functions.
<i>River channel</i>	River bank protection Channel re-configuration In-stream habitat improvement	<ul style="list-style-type: none"> • Reduced erosion and slumping off bank material into the river. • Increased hydraulic diversity, habitat heterogeneity and decreased river channel slope. • Enhanced biodiversity-friendly habitats.
<i>Riparian habitat</i>	Riparian species management	<ul style="list-style-type: none"> • Improved diversity and richness of the Keystone riparian species.
<i>Biodiversity</i>	Instream species management Removal of invasive species	<ul style="list-style-type: none"> • Improved species diversity and richness. • Improved native species diversity and water quality.
<i>Water quality</i>	Water quality management	<ul style="list-style-type: none"> • Improved water quality and reduced chemicals and particulate load.
<i>Other (eg. Cultural)</i>	Aesthetics and Recreation management and education	<ul style="list-style-type: none"> • Increased community value, access to and knowledge of the river and riverine ecosystem.

TABLE 6. The typology of measures suggested for the *Pampa* River restoration (Speed et al., 2016).

vulnerable communities in deliberations for managing the CPRs is important. The ToT programme has helped 41 development practitioners change their approach toward River Health Management, and the deliberations have resulted in an alliance of practitioners and a people’s framework for action projects.

6. ACKNOWLEDGEMENTS

This article is based on work supported by the Asia-Pacific Network for Global Change Research (APN) under Grant No. CBA2018–10SY–Kumar. We thank Prof. Achuthan Nair (Environmental Resources Research Centre, Thiruvananthapuram),

who conceived the project concept and Mr V. Nama-sivayam for all the support. We specifically thank our resource person team led by Dr R. Ajayakumar Varma. We also thank Joseph John, Parvathy Radhakrishnan Jamshina P. M., Binesh M. K., Jibin Thomas, Manoj Kumar T. and Prejeesh K. P. of MSSRF. The first author acknowledges Dr Vivek U. Padvetnaya for his guidance. We thank Aranmula Gramapanchayath, Community members and leaders of Attathode, Vadasserikkara, Veeyapuram and Adv. N. Rajeev for the regional support. Finally, we are grateful to all the participants of the two-tier training conducted as part of the project.

NOTES

¹ The three influential models were adopted from the Governing of Commons (1990) by Ostrom. For more information, see (Ostrom, 1990, Ch-1, p. 18–22).

² Kuttanad region is a Globally Important Agricultural Heritage System accredited by the Food and Agricultural Organization where paddy farming is practiced below sea level. More details are available at: <https://www.fao.org/giahs/giahsaroundtheworld/designated-sites/asia-and-the-pacific/kuttanad-below-sea-level-farming-system/en/>.

³ Vembanad Lake is part of the Vembanad-Kol Wetland Ecosystem, an accredited Ramsar site. More details are available at: <https://rsis.ramsar.org/ris/1214>.

⁴ Consequent to the 73rd and 74th amendments to the Indian Constitution, a three-tier governance system is in place: (1) District Panchayats, (2) Block Panchayats and (3) Grama Panchayats/Municipalities/Corporations. The 3rd tier is the most powerful institution at the grassroots level. THE KERALA PANCHAYAT RAJ ACT (1994) defines these Local Self-Governments (LSGs) or Panchayat Raj Institutes – PRIs. Kerala State has 941 Grama Panchayats, 152 Block Panchayats, 14 District Panchayats, 87 Municipalities and 6 Corporations. These Local Self-Government Institutions have been meaningfully empowered through massive transfer of resources and administrative powers. More details are available at: <https://lsgkerala.gov.in/en/lsgd>.

⁵ The presentations are available at: <https://www.youtube.com/playlist?list=PLVUhfEQnRD9yvszFzj6vODioyo6LyG0d>.

⁶ For more details, check the project website. https://mssrfcab.res.in/?page_id=13904 and https://www.apn-gcr.org/wp-content/uploads/2022/07/Photo-Report-CBA2018-10SY-Kumar_MR_15May2022.pdf.

⁷ The Stakeholders analysis was carried out based on three steps: (For more details, see Nishat et al. (2016).)

- Identification of Stakeholders: The stakeholders were identified as primary and secondary, based on the literature review, interviews with individuals & experts, and a snowball sampling. The number of stakeholders in the study is limited to the participants and training faculties of the ToT.
- Classification of the stakeholders: The classification was based on the influence and interest grid (Figure 3).

(i) Interest/Importance: The stakeholders' primary interest is protecting the environment or the river.

(ii) Influence/Power: The stakeholders who have the power to make decisions that can influence the implementation of actions related to the river's health.

c. Analysis of stakeholder engagement: Based on the influence and interest grid, the analysis of the engagement of stakeholders for River Health Management is categorised into power, knowledge, influence and interest. These categorisations were ranked in terms of high, medium and low.

⁸ Pampa Parirakshana Samithy (PPS) is a non-governmental organisation established in 1994 that focuses on environmental development in urban and rural areas. More details are available at: <http://www.doaram.com/organization/pampa-parirakshana-samithy>.

⁹ Details available at: <https://riverhealth.in/river-health-training-project/>.

¹⁰ Details available at: <https://riverhealth.in/>.

REFERENCES

- Agrawal, A., & Ostrom, E. (2001). Collective action, property rights, and decentralisation in resource use in India and Nepal. *Politics & Society*, 29(4), 485–514. <https://doi.org/10.1177/0032329201029004002>
- Bardhan, P., & Mookherjee, D. (2006). The rise of local governments. In P. Bardhan & D. Mookherjee (Eds.), *Decentralisation and local governance in developing countries: A comparative perspective* (pp. 1–52). The MIT Press. <https://doi.org/10.7551/mitpress/2297.003.0002>
- Carr, G. (2015). *Stakeholder and public participation in river basin management — An introduction: Stakeholder and public participation in river basin management*. Wiley Interdisciplinary Reviews: Water.
- Elster, J. (1998). *Deliberative democracy (Cambridge studies in the theory of democracy)*. Cambridge University Press. <https://doi.org/10.1017/CBO9781139175005>
- Fung, A. (2006). Varieties of participation in complex governance. *Public Administration Review*, 66, 66–75. Retrieved from <http://www.jstor.org/stable/4096571>
- Hardin, G. (1968). The tragedy of the commons. *Science*, 162, 1243–1248.
- Harris, J. H., & Silveira, R. (1999). Large-scale assessments of river health using an index of biotic integrity with low-diversity fish communities. *Freshwater Biology*, 41, 235–252.
- Heikkila, T., Schlager, E., & Davis, M. W. (2011). The role of cross-scale institutional linkages in common pool resource management: Assessing interstate river compacts. *Policy Studies Journal*, 39, 121–145. <https://doi.org/10.1111/j.1541-0072.2010.00399.x>

- Jodha, N. S. (1994). Management of common property resources in selected dry areas of India. In J. Kerr et al. (Ed.), *Natural resource economics, theory and application in India* (pp. 339–361). Oxford & IBH Pub Co.
- Karr, J. R. (1991). Biological integrity: A long-neglected aspect of water resource management. *Ecological Applications*, 1, 66–84.
- Kiser, L., & Ostrom, E. (1982). The three worlds of action: A meta-theoretical synthesis of institutional approaches. In E. Ostrom (Ed.), *Strategies of political enquiry* (pp. 179–222). Sage Publications.
- Krishna, M. V., & Kumar, M. G. (2014). Pollution studies in the Chengannur segment of River Pampa based on physical parameters. *International Journal of Scientific and Research Publications*, 4(8), 1–7. Retrieved from <https://ijsrp.org/research-paper-0814.php?rp=P323036>
- KSBB, K. S. (2020). *Biodiversity conservation of River Pampa*. Kerala State Biodiversity Board (KSSB). Retrieved June 25, 2022, from https://www.keralabiodiversity.org/images/2020/Reports/PAMPA_PROJECT.pdf
- Kumar, N. A., Shakeela, V., Parameswaran, P., & John, J. (2023). *The health and restoration of economically and culturally important rivers using biological indicators found in Kerala streams, within the context of climate change impacts and sustainable development: Final Report of the project supported by the Asia Pac. MSSRF*.
- Mahajan, G. (2023). *Report: Aware the local stakeholders of the health of the Saptalingi River in Sangameshwar block, Ratnagiri district, Maharashtra*. Applied Environmental Research Foundation. https://www.apn-gcr.org/wp-content/uploads/2023/04/ANNEXURE-13_FOLLOW-UP-ACTION-REPORT1.pdf
- Mayaja, N., & Srinivasa, C. (2016). Land use and land cover changes and their impacts on floods in Pampa River basin in Kerala: A remote sensing based analysis. In N. Raju (Ed.), *Geostatistical and geospatial approaches for the characterization of natural resources in the environment* (pp. 779–783). Springer. https://doi.org/10.1007/978-3-319-18663-4_120
- Magrath, W. (1989). *The Challenge of the Commons: Non-Exclusive Resources and Economic Development – Theoretical issues*. Working Paper World Resource Institute, Washington, D.C. <https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/5232/Magrath-The%20challenge%20of%20the%20commons.pdf?sequence=1&isAllowed=y>
- McGinnis, M. D. (2011). An introduction to IAD and the language of the Ostrom workshop: A simple guide to a complex framework. *Policy Studies Journal*, 39(1), 169–183. <https://doi.org/10.1111/j.1541-0072.2010.00401.x>
- Narayan, S. (2021). Seasonal water pollution and its health impact observed in Pampa River. *EPRA International Journal of Economic Growth and Environmental Issues (EGEI)*, 9(2), 8–12.
- Nishat, B., Rahman, A. Z., Mandal, S., & Mahmud, S. (2016). *Stakeholder analysis and engagement plan for Sundarban joint management platform*. International Water Association.
- North, D. C. (1991). Institutions. *The Journal of Economic Perspectives*, 5(1), 97–112. Retrieved from <http://www.jstor.org/stable/1942704>
- Olson, M. (1965). *The logic of collective action: Public goods and theory of groups*. Harvard University Press.
- Ostrom, E. (1990). Reflections on the commons. In E. Ostrom (Ed.), *Governing the commons: The evolution of institutions for collective action* (pp. 1–28). Cambridge University Press. <https://doi.org/10.1017/CBO9780511807763.003>
- Ostrom, E. (2005). *Understanding institutional diversity*. Princeton University Press. <https://doi.org/10.2307/j.ctt7s7wm>
- Ostrom, E., Gardner, R., & Walker, J. (1994). Institutional analysis and common-pool resources. In E. Ostrom, R. Gardner, & J. Walker (Eds.), *Rules, games, and common-pool resources* (pp. 23–51). The University of Michigan Press. <https://doi.org/10.3998/mpub.9739>
- Padvetnaya, V. U. (2017). Deliberative participation: Theory, empirics and propositions. In V. U. Padvetnaya (Ed.), *Does deliberative participation matter? Political economy of provision of local public health goods in rural India* (pp. 60–71). The University of Oxford.
- Rawls, J. (1999). *A theory of justice*. Oxford University Press.
- Speed, R., Li, Y., Tickner, D., Huang, H., Naiman, R., Cao, J., Lei, G., Yu, L., Sayers, P., Zhao, Z., & Yu, W. (2016). *River Restoration: A Strategic Approach to Planning and Management* (p. 9). UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000245644>
- The Commonwealth Scientific and Industrial Research Organisation of the Australian Government (CSIRO). (1992). *Towards healthy rivers*. CSIRO Division of Water Resources Consultancy (Report No. 92/44).
- Wester, P., Merrey, D. J., & de Lange, M. (2003). Boundaries of consent: Stakeholder representation in river basin management in Mexico and South Africa. *World Development*, 31(5), 797–812. [https://doi.org/10.1016/S0305-750X\(03\)00017-2](https://doi.org/10.1016/S0305-750X(03)00017-2)