The Tragedy of Floodplains [1]: Why Floodplains are Underutilized and What Can be Done About it?

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Abstract: Common pool resources (CPRs), widely referred to as common resources or commons, are resources which are hard to exclude from free-riders and one person's consumption reduces the availability of the resource to others. Hardin argued that due to the nature of CPRs, these resources will be overused and hence lead to a 'tragedy'. However, not all CPRs are over-exploited. Some CPRs, such as floodplains, suffer from the problem of underutilization. Floodplains are a special kind of CPR, which are seasonal water-bodies formed due to flooding of privately-owned lands during monsoons. Within the CPR governance literature, floodplains have received little attention. But floodplains are becoming increasingly important due to the formation of an increasing number of seasonal floodplains as a result of climate change and increased flooding, especially in low-lying countries such as Bangladesh. We construct a theoretical model using Ostrom's Social-ecological system (SES) variables to explain the higher likelihood of underutilization of the floodplains. We argue that most of the floodplains remain underutilized and ungoverned due to high transaction costs for coordination, limited information and the capacity gap in the relevant community. We also elaborate on how the unique 'community enterprise' model can help communities sustainably utilize floodplains and helps towards achieving several Sustainable Development Goals (SDGs).

Keywords: Common pool resources, Floodplains, Climate, Social-ecological system

"What is common to the greatest number has the least care bestowed upon it. Every one thinks chiefly of his own, hardly at all of the common interest."

- Aristotle (*Politics*, Book II, chapter 3)

Introduction

Common pool resource (CPR) governance has received considerable attention in the institutional economics and natural resource governance literature, signified by the 2009 Nobel Prize in Economics awarded to the most well-known scholar in this field, Elinor Ostrom. CPR resources, widely referred to as common resources or commons, are resources which are hard to exclude from free-riders and one person's consumption reduces the availability of the resource to others. CPRs are important, especially for the poorest people who live in the communities surrounding the CPRs, who often rely on the utilization of these resources. Hardin argued that due to the nature of CPRs, these resources will be overused and hence lead to a 'tragedy'.[2] However, not all CPRs are over-exploited. Some CPRs, such as floodplains, suffer from the problem of *underutilization*.[3] Floodplains are a special kind of CPR, which are seasonal water-bodies formed due to flooding of privately-owned lands during monsoons. Within the CPR governance literature, floodplains have received little attention. But floodplains are

[1] The title is based on the famous essay titled "The tragedy of the commons" by Hardin (1968)

[2] Garett Hardin, "The tragedy of the commons," in *Science* (1968), 1243-1248.

[3] M.M. Dey, and M. Prein, "Community-based fish culture in seasonal floodplains," in *NAGA, WorldFish Center Quarterly* 29 (2006), 21-27; David McGrath, Oriana Trindade Almeida, Marcelo Crossa, Alcilene Cardoso, and Márcio Cunha, "Working towards community-based ecosystem management of the Lower Amazon floodplain," in *PLEC News and views* 6 (2005), 3-10.

becoming increasingly important due to the formation of an increasing number of seasonal floodplains as a result of climate change and increased flooding, especially in low lying countries such as Bangladesh. Floodplains are generally underutilized as an open access CPR, rarely leading to a self-organized governance system via coordination of the stakeholders. In this essay, we aim to investigate the causes of underutilization of floodplains and why floodplains are less likely to lead to self-organization by the community, compared to other CPRs.

We construct a theoretical model using Ostrom's Social-ecological system (SES) variables to explain the higher likelihood of underutilization of the floodplains.[4] Through this model, we argue that most of the floodplains remain underutilized and ungoverned due to high transaction costs for coordination, limited information and the capacity gap in the relevant community. To illustrate how these challenges predicted by the model can be overcome, we provide a case study of the 'Daudkandi' floodplain, where a community successfully co-managed a floodplain CPR by partnering with a local NGO. We also elaborate how the unique 'community enterprise' model can help communities sustainably utilize floodplains and helps towards achieving several Sustainable Development Goals (SDGs).

The essay is structured as follows: first, we provide conceptual clarifications for key terms, followed by a critical analysis of the literature. Then, we examine floodplains and articulate the floodplain 'puzzle' regarding their underutilization. Next, we construct a theoretical model and use it to explain why floodplains are more likely to be underutilized compared to other CPRs. Afterwards, we analyze the case study of a successful community-based management of a floodplain. Finally, we conclude by considering how this research relates to sustainable development goals (SDGs) and future research direction.

Key Concepts

Broadly, goods and resources can be classified based on two criteria. The first is excludability, which means the ease with which the producer/ property right holder or holders can exclude others from using the good/ resource, especially free riders who do not bear appropriate costs. The other is rivalry in consumption, which means the extent to which one person's use of the good/ resource, subtracts from what is available to others.

Common pool resources (CPRs) are resources that are available to more than one person, are difficult to be excluded from free-riders, and have high rivalry in consumption. Hence, CPRs tend to be both under-produced and over-used.[5] If free-riders cannot be excluded or, if it is very costly to exclude them, then the producers and right holders who bear the cost to produce and maintain the good/ resource, have less incentive to produce or maintain of the resource, as they are not properly compensated. At the same time, high rivalry in consumption also leads to the overuse of the resource because people, as rational actors, correctly understand that there is a finite amount of the resource available and each person wants to maximize his own consumption (assuming that maximizes benefits), disregarding the long term sustainability of the resource or the socially optimal level of consumption. Hence, even if someone cares about the sustainability of the resource and wants to abstain from using the resource, the resource depletion will not be stopped as others, especially the free-riders, will consume anyway. Examples of CPRs are fish in the ocean, timber in the forests, national parks, etc. Floodplains are CPRs that share the two critical characteristics of excludability and rivalry in consumption, but are unique because of the seasonal tenure system, which will be explored in detail later.

In this essay, we use Cunningham and Mathie's definition of the 'community', whereby community denotes groups of people who share a 'sense of community'.[6] However, they also caution against the expectation that communities always share strong social bond, have high social capital, and are necessarily co-operative, inclusive or caring, just because they live in the same location or belong to the same ethnic group. In reality, due to the power dynamics involved within the group based on identities of gender, race or class, there can be exclusion, mistrust and uneven co-operation within the group. A consequence of this dynamic is varying coordination costs in different communities, based on their respective contexts.

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[4] Elinor Ostrom, "A general framework for analyzing sustainability of social-ecological systems," in *Science* 325, no. 5939 (2009), 419-422.

[5] Elinor Ostrom, Roy Gardner, James Walker, and Jimmy Walker, *Rules, games, and common-pool resources* (University of Michigan Press, 1994)

[6] Alison Mathie and Gord Cunningham, "From clients to citizens: Asset-based community development as a strategy for community-driven development," in *Development in practice* 13, no. 5 (2003), 474-486.

Literature Review

CPR management has been recognized to be complex due to the nature of the resources, specifically the characteristics of difficulty in exclusion and high rivalry in consumption. Gordon provided one of the first economic analyses of CPR management, particularly in regard to fisheries.[7]He argued that the equilibrium is the overuse of the resource, which is larger than the long-term sustainable level of use. Therefore, fisheries in an open-access setting will be overexploited, underproduced and unsustainable. In the 1968 article titled "The Tragedy of the Commons," Hardin claimed that common pool resources will inevitably face the 'tragedy' of over-exploitation due to the characteristics of the resources.[8] As a result, Hardin also argued that the only solution was mechanisms of “mutually agreed upon coercion”, which meant the CPRs must be brought under state control, or privatization.[9] Hardin's assertion inspired a lot of subsequent research on successful CPR management. Although, initially Hardin's recommendation was taken to be the right approach, numerous case studies since then have illustrated the limitations of these solutions.[10] Runge stressed the fact that in most developing countries, most users of CPRs lived in the same village together, possibly for multiple generations, and intended to live together in the future.[11] Given their reliance on the resource for livelihood earning, it is very difficult to be a free-rider, as a user interacts with other users continuously in a community. Hence, there was strategic interdependence between the CPR users. As a result, the ‘tragedy of the commons’ was not a free-rider problem, rather a coordination problem.[12] Moreover, government ownership of the CPRs, which was a common legislative action in the 1970s and 1980s, often led to several problems.[13] Firstly, the existing indigenous institutions were rejected and actions of local stewards to preserve the resource was outlawed. Secondly, in many developing countries, the government did not have the resources to properly monitor the resource boundaries or the harvesting practices. Hence, the CPRs essentially turned into open access resources, and subsequently, there was a race to exploit these resources. The other suggested solution, privatization, was also challenged on the grounds that often such action was infeasible, given the nature of the resource (i.e. privatization of ocean or atmosphere is implausible). Furthermore, privatization will also not be feasible when the costs of enforcing private property rights are high, and the economic value of the output produced from the resource is low. Even when privatization was feasible, often the CPR was leased to a commercial entity who exploited the resource to maximize their revenues, disregarding the sustainability of the resource.

Due to the failures of government ownership and privatization, there was a broad movement among researchers to collect case studies of successfully managed CPRs from around the world. In her book titled "Governing the commons", Ostrom collected several successful and unsuccessful case studies, and via her empirical and field observations argued that many communities have in fact successfully managed CPRs without government intervention or privatization, contrary to what theoretical models might predict.[14] Ostrom also developed eight design principles (DPs), positing them to characterize the robust institutions that have managed common-pool resources successfully.[15] Besides, Ostrom created the social-ecological system (SES) framework to provide a common framework for all disciplines to analyze common pool resources and build better theories.[16] Almost all CPRs are complex social-ecological systems which have multiple layers and variables impacting each layer. She identified 10 variables that affect the likelihood of self-organized institutions, which are: size of the resource system, productivity of the system, predictability of system dynamics, resource unit mobility, number of users, leadership, social capital, knowledge of the SES, importance of resource to users, and autonomy of the group.

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[7] H.S. Gordon, “The economic theory of a common-property resource: The fishery,” in *Journal of Political Economy* (1954),124-142.

[8] Hardin, “The tragedy of the commons” (1968)

[9] Hardin, “The tragedy of the commons” (1968)

[10] Elinor Ostrom, *Governing the commons* (Cambridge, MA: Cambridge university press, 2015)

[11] C. F. Runge, “Institutions and the free rider: The assurance problem in collective action,” in *Journal of Politics* (1984), 154-181.

[12] C. F. Runge, “Strategic interdependence in models of property rights,” in *American Journal of Agricultural Economics* (1984), 807-813.

[13] Elinor Ostrom et. al., *The drama of the commons* (National Academy Press, 2002)

[14] Ostrom, *Governing the commons* (2015)

[15] Ostrom, *Governing the commons* (2015)

[16] Ostrom, "A general framework for analyzing sustainability of social-ecological systems” (2009)

As one of the social-ecological systems, floodplains have received little attention in the CPR management literature so far, although floodplains are examples of social-ecological systems. This might be because of the complexity and relative lack of successful management cases of floodplains.[17] However, there have been some case studies illustrating different management institutions, but no formal model has been created.

The Floodplain Puzzle

Floodplains are seasonal water-bodies created due to the flooding of land areas during monsoons. Floodplains share the two main characteristics of a CPR. Firstly, everyone has access to them, when they are under open access regime, or no clear property rights. Floodplains, in the open access regime, are also sources of capture fish (the fish that is available naturally, without aquaculture) and anyone who harvests them subtracts its availability for others. However, floodplains are distinct from most other CPRs because of the unique tenure system and associated complexity with property rights regime. During the dry season, boundaries separating the privately owned lands, where agricultural production takes place, are clear and hence, private property rights are enforced. During the monsoon season, the lands are flooded, making it almost impossible to distinguish between privately owned lands. Hence, no landowner can legally exercise property rights over the entire floodplain. Thus, seasonal flooding creates a unique tenure system, whereby the floodplain is neither strictly private or public property. When the flood water recedes after 4-5 months, the land plots become distinguishable and private property rights return. Hence, floodplains as CPR are available for a limited period of time in a year but are also recurring.

Seasonal floodplains should be considered as a 'resource' to be utilized because of its enormous potential for aquaculture, as the water-bodies are suitable to grow fish. Several studies were conducted which tested the technical feasibility of aquaculture in seasonal floodplains and concluded that floodplains have the productive potential to increase fish production by more than 1 trillion per hectare, per year.[18] Recent studies have reported that if only 25% of the floodplain areas can be brought under community management, then about 6.7 million people would benefit, including 2.7 million landless people.[19] For the landowners, there are also additional benefits of floodplain aquaculture as it increases the subsequent rice yields due to the fertilizing effect of the fish.[20] Thus it can lead to lower pesticide use, higher earnings from rice yield.

Given the productive potential of floodplain aquaculture and the additional benefits it brings, it is puzzling to find that most floodplains remain under-utilized as the active management of floodplains has been very rare.[21] By utilization, we mean using the floodplain for aquaculture, which has been proven to have high productive potential, compared to the default open access regime. It is important to emphasize that the puzzle of underutilization is not due to a 'technical' problem. There are technologies available by which seasonal floodplains can be turned into water-bodies suitable for aquaculture and although it requires capital investment, the cost is not prohibitively high, especially compared to the potential earnings from fish sales. So, what prevents coordination between the landowners to practice floodplain aquaculture?

Theoretical Model

Floodplains have enormous productive potential, yet they are mostly underutilized because landowners, whose lands are submerged, creating the seasonal floodplain, do not coordinate or cannot reach an agreement. This is a puzzle because each landowner can receive greater benefits by coordinating and reaching an agreement to practice seasonal floodplain aquaculture. The critical issue then, is how an individual landowner decides whether to coordinate and enter a contract or not.

In the model, we make two realistic behavioral assumptions about each economic agent, which distinguishes my approach from neoclassical economics.[22] They are: (1) The agents have bounded rationality, which means they are neither ‘hyper-rational’ like the neoclassical ‘economic man’, nor are they irrational. Rather, bounded rationality implies that they have limited capacity for processing all available information and solving complex problems. (2)

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[17] F. Berkes, C. Folke and J. Colding, *Linking Social and Ecological Systems: Management practices and social mechanisms for building resilience* (Cambridge UK: Cambridge University Press, 2000), 459.

[18] See for each country: Bangladesh (Ali et al. 1998), Cambodia (Gregory and Guttman 1996; Guttman 1999, 2000), and Vietnam (Rothuis et al. 1998a, Rothuis et al. 1998b)

[19] Dey and Prein, "Community-based fish culture in seasonal floodplains,” (2006)

[20] M. Halwart, “Trends in rice fish farming,” in *FAO Aquaculture Newsletter* (1998), 3-11.

[21] Dey and Prein (2006); McGrath et. al. (2005)

[22] Williamson (1981) articulated these assumptions for the transaction cost economics approach.

Some agents are opportunistic. Here, opportunism does not just mean self-interested, but also the possibility of not fulfilling a promise or commitment. Hence, realistically, one can never fully trust the other in a transaction. This is not to say that everyone is opportunistic, but it is very costly to distinguish opportunistic from non-opportunistic types ex ante.

Given these assumptions, the users of a resource will coordinate to avert a *tragedy of the floodplain*, when their expected benefit from coordination is greater than their expected costs.

Expected Benefits (EB) > Expected Costs (EC)

For each agent in the model, in this case each landowner, the expected benefits and expected costs are expressed mainly via variables identified by Ostrom in the Social-ecological system (SES) framework to analyze CPRs.[23]

Expected benefits (EB) is a function of 'productivity of the system' (P), which determines the revenue from aquaculture in the future; such that:

$\Delta EB = f(P)$

Here, productivity refers to the amount of resource units (in case of floodplains, it is fish) available for harvesting. The higher the productivity, the higher the incentive for coordination as users can earn higher revenue from being part of the contract. The productivity depends on various factors, including the infrastructure, capacity of the users to effectively manage and harvest the resource units, and the climate.

Expected costs (EC) can be expressed as the sum of setup cost/ initial investment (I) and the transaction cost (TC) such that:

$EC = I + TC.$

The setup cost (I) is the fixed cost of initial investment required to set up the required infrastructure to utilize the resource (in case of floodplains, there are fixed costs of building an embankment, for example). On the other hand, transaction costs (TC) are costs associated with negotiation, coordination, monitoring, maintenance and enforcement of rules.[24] In this model, TC specifically focuses on the costs of bargaining with other agents to reach an agreement. This cost does not have to be monetary necessarily.

Transaction cost (TC) is a function of social capital (SC), resource unit mobility (UM) and investment specification (IS). As, *I*is taken to be fixed cost, we get:

$\Delta EC = \Delta TC = f(SC, UM, IS)$

Here, social capital (SC) refers to the level of trust between the agents. If there is sufficient trust between the agents involved in the contract negotiations, they will face lower transaction costs in reaching agreements.[25] Resource unit mobility (UM) refers to the mobility of the resource units and it is important because the more mobile the resource unit, the costs of observing and managing a system is higher.[26] Investment specification (IS) refers to the *nature* of the initial investment (not the amount), and it can be two kinds- specialized or general physical capital. The specialized physical capital is not useful to the agent and hence, do not have a value outside the specific setting it is essential in. The more specialized the physical capital, the higher the transaction costs of negotiation because the agents do not have alternative uses of the physical capital that they would have to invest in, if an agreement is reached.[27]

Application of the Model in case of Floodplains

Based on the successful case studies of managed floodplain aquacultures, the realized benefits or revenues are far greater than the total costs.[28] Hence, in a perfect world with hyper-rational actors who have perfect information,

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23 Ostrom, "A general framework for analyzing sustainability of social-ecological systems" (2009)

24 Ronald Harry Coase, "The nature of the firm" in *economica* (1937) first emphasized the role of transaction costs in contracts.

25 Ostrom, "A general framework for analyzing sustainability of social-ecological systems" (2009), 421.

26 Ostrom (2009)

27 Oliver E. Williamson, "Transaction-cost economics: the governance of contractual relations," in *The journal of Law and Economics* 22, no. 2 (1979), 233-261.

28 Dey and Prein, "Community-based fish culture in seasonal floodplains," (2006)

agents will always choose to coordinate and utilize floodplains via aquaculture, given that the benefits outweigh the costs. However, based on our assumptions of bounded rationality and agents being opportunistic, the expected costs (EC) can outweigh the expected benefits (EB) in three possible ways:

(1) If EB is underestimated
(2) If EC is overestimated
(3) If both EB is underestimated and EC is overestimated.

For the agents participating in the primary negotiation, who in case of floodplains are the landowners, if EC is greater than the EB, they will *not* coordinate. But why might floodplains uniquely suffer from these distortions in expected values of EB and EC?

In the following, we provide six reasons explaining the higher likelihood that the EC outweighs the EB in case of floodplains.

1. *Greater uncertainty*: Both EB can be underestimated and EC can be overestimated due to greater uncertainty associated with the system dynamics of the floodplains. Based on numerous case studies, Ostrom found that the more predictable the system dynamics, the higher is the likelihood of coordination.[29] Aquatic systems tend to be less predictable than other CPRs such as forests.[30] In case of floodplains, as it is a complex system, highly dependent on the climate, there is even greater uncertainty associated with its productivity and costs.

Uncertainty (↑) → *ΔEB* (↓) *and ΔEC* (↑)

2. *Capacity gap*: Both EB can be underestimated and EC can be overestimated due to the lack of specialized human capital required to attain the maximum productivity from the resource system. Aquaculture requires people with specialized skill and capacity to effectively manage and harvest from the waterbody. In case of floodplains, the landowners are primarily engaged in agricultural activity and do not have the specialized skill. Due to the seasonal nature of floodplains, hiring fishermen with the required skills from other communities can be costly. So, if there is a capacity gap, the expected benefits decrease and as more capital will be required to employ skilled people, the expected costs will increase.

Capacity gap (↑) → *ΔEB* (↓) *and ΔEC* (↑)

3. *Knowledge gap:* EB can be underestimated due to the limited knowledge of the landowners about floodplain aquaculture productivity (P), given they have no prior experience of seasonal floodplain aquaculture. It is important to note that limited knowledge of the landowners do not directly impact the productivity of the system, rather it impacts the *perception* of the productivity, which in turn impacts the *expected* benefits.

Knowledge of the system (↓) → *perception of P* (↓) → *ΔEB* (↓)

4. *Low social capital*: EC can be overestimated due to low social capital or trust between the landowners. As floodplains are hard to monitor, exclude from and there is rivalry in consumption of fish, social capital among landowners and all people in the community is critical. In communities where landowners have traditionally worked independently and did not have to coordinate, the level of trust is more likely to be low. Hence, lower social capital creates higher transaction costs.

Social capital (↓) → *ΔEC* (↑)

5. *High bargaining power*: EC can be overestimated because each landowner in the negotiation has high bargaining power. Due to highly mobile fish (the resource unit) in floodplains, it is very costly to build temporal boundaries within a floodplain to prevent fish from going to the land area of a landowner, who did not coordinate. Hence, all landowners must agree to reach a joint contract. Even if one landowner refuses, the contract cannot be reached. Hence, each holds a high bargaining power, increasing the transaction costs.

Resource unit mobility (↑) → *Individual bargaining power* (↑) → *ΔEC* (↑)

6. *Specialized physical capital investment*: EC can be overestimated due to the high initial investment required for specialized physical capital, such as an embankment. Building an embankment surrounding the floodplain is a necessary investment for aquaculture and all landowners who agree to a joint contract, most likely have to contribute and hence, own part of this physical capital. However, this embankment is not useful for any other purpose for the

[29] Ostrom, "A general framework for analyzing sustainability of social-ecological systems" (2009), 421
[30] Ostrom (2009), 421

individual landowner, outside the context of floodplain aquaculture. Hence, this is a 'specialized' physical capital. Floodplains require many such specialized physical capital, which increases the transaction costs for the landowners.

Specialized physical capital investment (↑) → ΔEC (↑)

What can be done: Community Enterprise Approach

Although floodplains are ungoverned and underutilized in most cases, there are successful floodplain aquaculture case studies which portray the diversity of governance structures used to successfully overcome the challenges and achieve the productive potential of floodplains. we focus on one such case study, the 'Daudkandi' floodplain in Bangladesh. Bangladesh is a delta and more than 55% of the land becomes floodplains during the monsoon, making floodplains one of the major CPRs of Bangladesh.[31] The first floodplain aquaculture management system in Bangladesh was developed by a local NGO named SHISUK, by collaborating with a community in the Daudkandi sub-district in Comilla district.[32] We chose this case study because of the unique approach called 'community enterprise approach', popularly called the 'Daudkandi model'. This model was awarded one of the"Best Practice in livelihoods" in 2007 and has raised annual income of the community by around 100%.[33] Before SHISUK's pioneering approach, the community did not utilize the floodplain for generating income.

The 'community enterprise approach' (CEA) mobilizes the community and creates 'enterprises' or cooperative business entities to manage and utilize the community assets and resources. Community enterprises (CEs) are different from traditional co-operative enterprises because although they are driven by corporate incentives to make as much money as possible for their share-holders, they are also managed with democratic mandate from the community. Hence, the CEs also invest part of the profit in community development projects which typical enterprises do not.

This approach combines the power of corporate incentives for efficient management of the resource, with the democratic mandate from the community to involve all community members in the economic development process. After mobilizing the community and the landowners, the community enterprise offers 'shares' to the community, by which community members become shareholders (owners) and are empowered to democratically elect their representatives, who make management decisions. So, the enterprise works like a publicly traded company, although the shares cannot be traded. One potential concern of this enterprise model could be that only the rich in the community will be able to buy shares in the enterprise. To address this concern and benefit the community members, including the most marginalized and poor members, SHISUK mandated maximum cap for one shareholder (so that one person cannot have high influence) and allocated 5% of its shares for the landless farmers. Ultimately, 60% of the shares was owned by the community, 20% by the landowners and 20% by SHISUK (of which 5% were given to the poor).[34] SHISUK was the minority shareholder, who provided technical knowledge, capacity training and part of the financial capital for the infrastructure building. Most importantly, SHISUK acted as a neutral and trusted arbiter for conflict resolution, and also as an oversight body to ensure transparency and accountability. At the end of each year, after deducting all costs from the earned revenue from floodplain aquaculture, 70% of net profit is distributed to shareholders as dividends, 27% is paid to the landowners as lease payment (the enterprise does not own the land area of the floodplain), and 3% is spent on community development projects.[35] In the following figure, the development and operational cycle of floodplain aquaculture (FPA) in Daudkandi is shown.[36]

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[31]YaminBayazid, "The Daudkandi model of community floodplain aquaculture in Bangladesh: a case for Ostrom's design principles," in *International Journal of the Commons* (2016), 855.

[32]Bayazid (2016), 855.

[33] P. Sultana, "Implications of Floodplain Aquaculture Enclosure," in *Journal of Environmental Planning and Management* (2012), 1159–1174.

[34]Bayazid (2016), 861.

[35]Bayazid (2016), 863.

[36] Adopted from Bayazid (2016), 862.

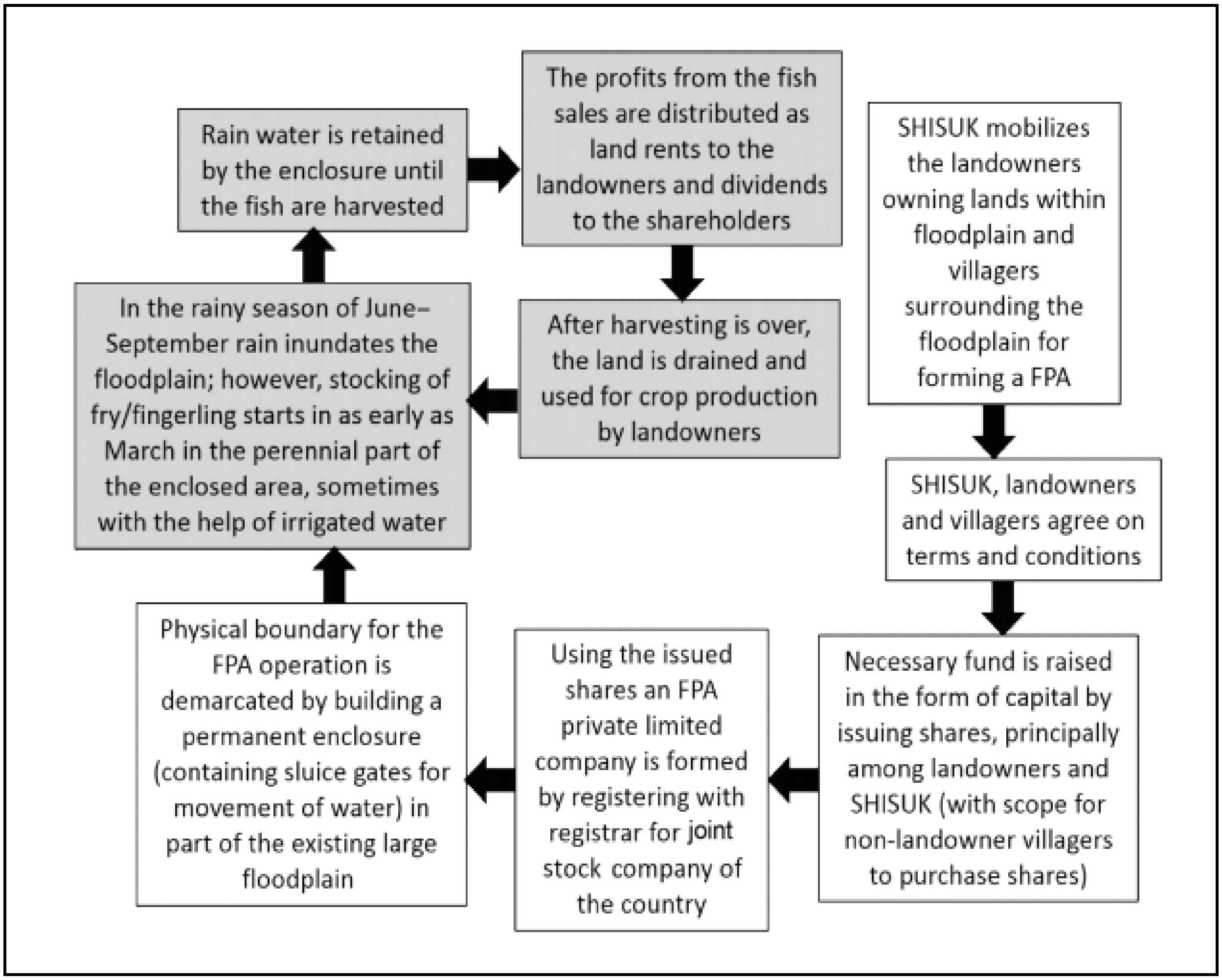

Figure 1. the development and operational cycle of floodplain aquaculture (FPA) in Daudkandi

Hence, given the unique nature of CEs, they not only prioritize employing local members generating jobs and income for the community, but the participation of community members in decision-making, management and implementation stages also train community members to become future entrepreneurs. The enterprise structure also ensures that the CEs become self-sustainable within a short period of time.

It is noteworthy that many of the existing farmers and fishermen in the community work as individual producers. But as CEs facilitate bulk collective production by the fishermen, and the regular availability of the product in a more systematic way, can attract more market players (input suppliers and buyers of different level) and consumers at the farm gate and creates its own market space. Hence, instead of middleman domination, the aggregators compete themselves to satisfy the producer (community enterprise) to ensure the supply chain. It also helps other neighboring farmers connected to the mainstream market to get a fair price for their products.

Challenges for Individual producers	Opportunities for CEs
Costly intervention to outreach and capacity building of individual members. Resistance to innovation or new technology.	Easy to outreach. Once leaders are convinced, ready to adopt innovation and new technology.
High input cost, Lack of availability of quality input, High labor cost for production and post-harvest management,	Low input cost for bulk purchase, Quality input supply, Low cost for production and harvesting
No or low access to institutional finance	Better access to institutional finance
Difficult to maintain value chain factors (Production, quality control, transportation, preservation, shelf life)	Ability to produce value added product with updated technical knowhow
High risk in any disaster, difficulty to bear loss by individual farmer	Shared risk in any disaster (accident, market fall / climate change effect, etc.)

Figure 2: Challenges accessing mainstream market to get a fair price for their products

How the 'Community Enterprise' (CE) Approach overcame the Unique Challenges

For initiating a successful management system for a floodplain, the first issue to resolve is the seasonality and the unique tenure system of floodplains. The CE approach leased the land inundated by the flood water, and the landowners agreed to this contract in exchange of payments. An embankment was built, covering only part of the floodplain which were the land areas of the landowners who agreed to the contract. This enclosed area came under the community enterprise during monsoon, and in the dry season the landowners regained their right over individually held lands. Through the leasing system and having a cap on individual shareholding, the CE approach decreased the bargaining power of the landowners and reduced the transaction costs. Share issuances also raised sufficient capital that could be invested for building specialized physical capital, such as the embankment. The risk for each shareholder was lower, as most people in the community were part of the shareholder group. Moreover, the CE approach promised greater profits for people who took more risks. Hence, it managed the risk preference of the community members effectively, including of the landowners.

SHISUK mobilized the entire community using the 'asset-based community development' framework.[37] They identified the community assets and networks, built relationships with the community leaders, collected stories of community success from community members and involved key community stakeholders in the planning process. Most importantly, they treated community networks as assets and not only did they just built a relationship of trust with the community, but also built social capital among the community members. Hence, the increased social capital, significantly lowered the transaction cost.

SHISUK also conducted capacity building exercises for the community users, given that there was no specialized fisher group in the community prior to their initiative.[38] The training was provided for free and most of the beneficiaries were the landless and marginalized people, who gained a specialized skill and was employed by the enterprise for floodplain aquaculture. SHISUK also provided management support in various ways such as arranging external credit when required, performing audits, staffing, establishing networks with government bodies. These are crucial activities, especially given that a formal enterprise was established, and the community had no prior experience with dealing with these issues. In addition, SHISUK arranged several workshops on the system dynamics of floodplain aquaculture, given the local leaders and landowners lacked experience in commercial aquaculture. Through these initiatives, the capacity and knowledge gap were addressed.

This case study of a co-management model of the community and a local NGO is just one of the many ways that the unique challenges of floodplains can be resolved. It is important to note that even though in this case, the role of the NGO was crucial, it is not a necessary condition for successful management of floodplain aquaculture, as there are case studies of successful community driven management without an NGO.

How the Community Enterprise (CE) Model Supports achievingSDGs

<u>Goal 1: No poverty and Goal 8: Decent work and economic growth</u>

The CE model directly contributes towards Goal 1: No poverty and Goal 8: Decent work and economic growth. The approach prioritizes employing community members which generates income. Furthermore, many job opportunities are created through backward and forward linkages. Some of that are listed below:

Backward linkages (Input services)

1. Using small household ponds for Fingerling nursery
2. Fingerling traders
3. Fish feed sellers
4. Lime and Fertilizer traders
5. Transport worker (Carrying inward): Rickshaw/ trolley
6. Transport owner (Carrying inward): Rickshaw / trolley
7. Cow dung /poultry litter-based compost supplier
8. Fingerlings rearing workers
9. Project staff (admin, security)

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[37]Mathie and Cunningham, "From clients to citizens: Asset-based community development as a strategy for community-driven development" (2003)
[38]Bayazid (2016), 863.

Forward linkages (Output services)

1. Local Entrepreneur (wholesale buyers)
2. Fish traders / wholesalers
3. Retail buyers for local market
4. Transport worker (Carrying Outward): Rickshaw / trolley
5. Fisherman Harvesting,
6. Project staff marketing

The CE model prioritizes job creation and employment (Goal 8) as an important tool for poverty eradication (Goal 1). When people have a regular and decent income, it is much more likely that their families would no longer suffer due to poverty.

Goal 2: Zero hunger

Adaptation of Community Enterprise Approach has improved crop intensity and productivity by using the floodplain for fish culture during monsoon and grow rice in the dry season with maximum irrigation from surface water. During three (3) years project period 67.68MT additional fish produced in monsoon in 62 ha fallow floodplain area @ 1.05 MT/ha, only on the third year 36.08MT additional fish was produced, it is expected that the production will increase from 0.15ton/ha (national average) to 1.5 ton/ha in the next two years. Here, SHISUK is trying to contribute in achieving zero hunger by increasing productivity which can be directly linked to food security. Besides, SHISUK also focuses on the availability, accessibility, adequacy and sustainability of getting food.

Goal 3: Good health and well-being for people

The increase in productivity of fish in the floodplain improves the availability of fish at an affordable price, including Small Indigenous Species (SIS) with high protein and nutrition value. Community members, especially the women can buy fresh fish of their choice at the farm gate. On the other hand, the vegetables grow on the dyke and mulch sounding the aquaculture project increase the availability and intake of vegetables.

Goal 9: Industry, Innovation and Infrastructure

The bulk production of Community enterprise and collective production by the small farmers and regular availability of the product can attract more market players (input suppliers and buyers of different level) and consumers at the farm gate and creates its own market space. Instead of middleman domination, the aggregators compete themselves to satisfy the producer (community enterprise) to ensure their supply chain. It also helps other neighboring farmers connected to the mainstream market to get fair price of their products. Many infrastructural developments are taking place due to the new markets established by the community enterprise approach.

Goal 12: Responsible consumption and production

CE approach-based floodplain management brings positive results not only in fish production but also supports environment to maintain the Food Safety Code of practice for sustainable agriculture and safe food production.

- No Weedicide, the floodplain remains clean because of aquaculture
- Zero tillage, synchronization of draining the water and planting the seedlings need no tillage
- Less use of chemical fertilizer, the supplementary feed for fish and fish droppings contributes to soil fertility
- Less/no pest manifestation and pesticide use
- Less drawing of groundwater, as the seedlings are planted using the soil moisture
- more recharge of ground water table

Goal 10: Reducing inequalities

The key principle of the community enterprise approach is to engage the local community with equitable partnership, where community members regardless of their financial situation, have equal/ equitable opportunity for investment and the landless/ underprivileged members get privileged share. Besides, the land owners also get equitable benefit for land ownership. This how through CE approach, SHISUK has addressed the goal 10 and its targets.

Goal 13: Climate action

In Bangladesh, more and more landmass would be flooded due to climate change, which will disrupt the existing agriculture practices and livelihoods. Collective initiatives have better ability to cope with situations resulting from climate change such as floods, droughts, etc. CE intervention can be an adaptation model to make use of the changing condition. Moreover, the approach has inbuilt togetherness and collective governance to build a resilient community.

Conclusion

Unutilized floodplains can be transformed into resourceful aquaculture that generates income for the community and integrates fisheries with agriculture to optimize use of the resources in an ecologically sound manner. Moreover, the process of community mobilization to manage the resource can create more social capital in the community and drive the economic development process form the bottom-up. The aquaculture can also provide poor community members access to nutritious fish for low cost and facilitate social development by mandating part of the profit to be invested back in the community. Hence, utilization of floodplain can help us achieve different UN sustainable development goals (SDGs). With the growing challenges of climate change, increasing number of floodplains will be formed and people in low lying areas have to find coping mechanism with the changing environment. Community based floodplain aquaculture can become a critical part of sustainable community development.

In this essay, we identified a critical gap in the literature that no formal model to examine floodplain management systems has been formulated. Given the productive potential of floodplain aquaculture and the additional benefits it brings, it is puzzling to find that most floodplains remain under-utilized. To investigate, we used Ostrom's Social-ecological system (SES) variables such as social capital, productivity of the system, resource unit mobility, knowledge of the system and predictability of the system and constructed a theoretical model to explain why floodplains remain underutilized in most cases. Through this model, we argued that most of the floodplains remain underutilized and ungoverned due to high transaction costs for coordination, limited information and the capacity gap in the relevant community. To illustrate how these challenges predicted by the model can be overcome, we provided a case study of the 'Daudkandi' floodplain, where a community successfully co-managed a floodplain CPR by partnering with a local NGO, taking the community enterprise approach. In the future, more case studies of successful and unsuccessful floodplain management attempts need to be collected and analyzed to improve on the model provided in this essay.

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