CHAPTER ONE

WETLAND ECOSYSTEMS: ISSUES AND OPTIONS

1.1: Introduction

Wetlands are among the most productive livelihood systems having immense socio-economic and ecological importance to humankind. Wetland ecosystems with their rich bio-diversity account for about six per cent of the global land area, and are among the most threatened environmental resources (Barbier et al., 1996). In the recent past, it is increasingly noticed that wetlands are being destroyed or altered, on a global basis. This is a result of the process of blatant commercialisation leading to over exploitation of the benefits provided by the natural resource systems. These losses are occurring as direct result of conversion of parts of these eco-systems to intensive agriculture, aquaculture and industrial uses (including waste disposal). Besides pollution, recreation pressures, increasing grazing and fishing activities have also added to the deterioration. In their natural setting, wetlands provide fishes, forest products, water, flood control, erosion buffering, plant gene pool, wildlife, recreation, tourism etc. Costanza et al (1997) noted that fifteen percent of the value of the world’s ecosystem services and natural capital is generated by wetlands.

Sustainable management of these assets therefore needs high priority on policy front both due to its connectivity to livelihood of large population and the overall deterioration of ecology. Inefficiency in wetland use is connected to multi-functioning of the resource itself and additionally some of the multiple users are in conflict with each other in pursuit of short run profits. On the one hand because of the spatial location of some of the wetlands, i.e. along rivers, on coasts and on level terrain with inherently fertile soils, pressure of multiple users is inevitable. This is enhanced due to the other economic and social forces operating in the regions. On the other hand, conflict in use and inefficiency in wetland management decisions also occurs because of conflicting social objectives (Pearce and Turner, 1990, P. 121). As a result wetlands are operating under significant pressures and their very existence is
threatened. The process is complex, multi-dimensional and involves many stakes. That calls for a systematic mapping of the factors leading to this result.

1.2: Defining Wetlands

A few decades back the connotation of wetlands was not very clear and studies of these ecosystems during time brought significant clarity to the understanding of wetlands. A wetland has been defined as “land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water” (Bergstrom et al 1990, P. 129). The Ramsar Convention\(^1\) adopts a broad approach in defining “wetlands”. According to the convention, wetlands are defined as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters” (Turner et al 1997, P. 2). The convention further elaborates that, wetlands “may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six meters at low tide lying within the wetlands” (Turner et al 1997, P. 2). The convention underscored the economic and ecological importance of wetlands and even though the definition inherently points towards the main components the implicit issues related to these components find place only inherently in the debate.

1.3: Understanding Importance of the Wetland Ecosystem

Wetlands are most productive among the environmental systems that provide a wide array of benefits. These benefits could be grouped into three categories namely, functions, values, and attributes.

\(^1\) Wetlands are the only single group of ecosystems to have their own international convention. The call for wetland protection gained momentum in the 1960s, primarily because of their importance as habitat for migratory species. A series of conferences and technical meetings culminated in the ‘Convention on Wetlands of International Importance especially as Waterfowl Habitat’ (better known as the Ramsar Convention), which came into force in 1975 (see annexure table A1.1 for declared India’s Ramsar site).
- **Functions**: e.g., ground water recharge, groundwater discharge, flood control, shoreline stabilization and erosion control, retention of nutrients, sediments and pollutants, water storage and purification, storm protection.
- **Values**: e.g., water supply, fisheries, agriculture, grazing, timber production, energy resources, wildlife resources, recreation, and tourism opportunities.
- **Attributes**: e.g., biological diversity and cultural heritage

### Table 1.1: Wetland Values

<table>
<thead>
<tr>
<th><strong>Use values</strong> (in production and consumption)</th>
<th><strong>Non-Use values</strong> (relating to safeguarding the existence of resources related to actual use)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Use Value</td>
<td>Indirect Use Value</td>
</tr>
<tr>
<td>Fish</td>
<td>Nutrient retention</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Flood control</td>
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<tr>
<td>Fuel wood</td>
<td>Storm protection</td>
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<tr>
<td>Recreation</td>
<td>Groundwater recharge</td>
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<tr>
<td>Transport</td>
<td>External ecosystem support</td>
</tr>
<tr>
<td>Wildlife harvesting</td>
<td>Micro-climatic stabilisation</td>
</tr>
<tr>
<td>Peat/energy</td>
<td>Shoreline stabilisation, etc.</td>
</tr>
</tbody>
</table>

Source: Based on the information: Barbier (1994), and Pearce and Moran (1994)

The socio-economic values, through water supply, fisheries, fuel-wood, medicinal plants, livestock grazing, agriculture, energy resource, wildlife resource,

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2 Value of production and services
3 Value of ecological functions
4 Value of existence, independent of any use now or in future
transport, recreation and tourism, and so forth, are significant. The functional properties of a wetland ecosystem demonstrate its role in maintaining the ecological balance as shown in Table 1.1.

Various regulatory ecological functions of wetlands may have important indirect use values. Their values derived from supporting or protecting economic activities that are directly measurable. The indirect use value of an environmental function is related to the change in the value of production or consumption of the activity or property that is being protected or supported. However, as this contribution is non-market, it goes financially unrewarded and indirectly gets connected to economic activities. Use values are grouped according to their direct or indirect existence. The former refers to those uses, which are most familiar to us: harvesting of fish, collection of fuel wood and use of the wetlands for recreation. Direct uses of wetlands could involve both commercial and non-commercial activities, with some of the latter activities often being important for the subsistence needs of local populations in developing countries or for sport and recreation in developed countries. Commercial uses may be important for both domestic and international markets. In general, the value of marketed products (and services) of wetlands is easier to measure than the value of non-commercial and subsistence direct uses. As noted above, this is one reason why policy makers often fail to consider these non-marketed subsistence and informal uses of wetlands in many development decisions.

People may have contributed almost exclusively to the degradation of the wetlands (lakes). The influx of population into the basin has led to unplanned urbanization that in turn has contributed untreated human wastes and other contaminants to the system. These populations have also created an increased demand for food stocks, including fish, agriculture etc that have been met by overfishing and by cultivating marginal lands. Therefore, the causes of wetland loss and degradation may be due to increased density users leading to over-use, land conversion, degradation, pollution, and introduction of exotic species. These are largely socio-economic interactions but they stem out of the economic over-exploitation. Among the underlying economic causes prominent are, among others,
price distortions, income distribution inequalities, absence of full cost accounting, policy failures, market failures (missing prices), lack of property rights\(^5\) and population/urbanization growth and consequent encroachment (Turner et al, 1997). This is sometimes referred to as interrelated market and intervention failures, which derive from a fundamental failure of information, or lack of understanding of the multitude of values that may be associated with wetlands (Turner and Jones, 1991).

Failure to manage lake/wetland/fisheries is often related to social, economic, institutional and/or political origins. This requires a theoretical perspective to understand how natural resources in general and wetlands in particular are viewed through different economic theories. A review of these theories is attempted here to understand various dimensions of resource economics and role of wetland functioning in that.

### 1.4: A Theoretical Review on Natural Resource, Environment and Economics

Economic, environmental and social values of wetlands have been analysed extensively in empirical studies but at the same time we have a significant theoretical literature exploring the issues pertaining to resource and environment especially wetlands. Keeping the larger theoretical debate in one of the forthcoming chapters here we recapitulate a few issues for the purpose of setting the problem. The Classical Economists did pay attention to natural resources and environment, deliberately or incidentally, when they engaged themselves with the long run consequences of economic growth. One can trace the evolution of environmental economics from the classical concern, which moved in two streams in the subsequent periods a) Natural Resource Economics, and b) Economics of Externality within Welfare Economics.

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\(^5\) Property rights refers to specific rights to utilize, control and exchange assets (Bromley, 1991)
Natural resource economics deals with a number of basic issues associated with environment-economics linkages. Malthus can be considered as the pioneer in suggesting the ecological perspective of economic activities. In 1798 in his Essay on the Principle of Population, he propounded the idea that the scarcity of land and natural resources pose an absolute ecological limit to population growth. He conceived an optimum size of population though he did not use the ecologist’s language of the earth’s carrying capacity. In 1817 in his Principles of Political Economy, Ricardo was concerned with the operation of law of diminishing marginal returns in use of land and the associated rise in the cost of food production. These two classical postulates known as Malthusian scarcity and Ricardian scarcity not only constitute the foundation of economics in general but also of environmental and resource economics in particular.

Mill (1848), in Principles of Political Economy, observed a possible imbalance between population growth and economic growth, which must ultimately lead to a state of zero growth. His famous conceptualisation of steady state of economy is considered important for the 21st century. His thesis has been resurrected in the modern concept of sustainable development. Much like the idea of ‘Limit to Growth’ in the contemporary world, Jevon (1865) was concerned with the ‘The Coal Question’. He found that England was running out of coal, which could slow down the pace of industrial revolution.

Notwithstanding the neo-classical optimism, one comes across a few studies, which did look at natural resource scarcity. Luxemburg using Marxist framework argued in “Accumulation of Capital” that natural resources pose the ultimate limit to capitalist expansion (Luxemburg, 1913). Hotelling’s study on “Economics of Exhaustible Resources” worked out the principle of optimum depletion of non-renewable resources (Hotelling, 1931). Exactly a century after Jevon’s “Coal question” it came from Boulding, 1966, in his essay, “The Economics of Coming Spaceship
He said that economics of closed (spaceship) earth of the future should be different from the open earth of the past. He compared the earth to a spaceship partly powered by solar energy. In 1972, the Club of Rome world model on ‘Limit to Growth’ analysed the predicament of human kind. Thus, it brought Malthusian scarcity to the forefront.


1.5: Problems of the Wetland

1.5.1: Economic Perspectives

The economic perspective of wetland is often analysed from non-market viewpoint; therefore, it is generally ignored in development decisions and policies that affect the allocation of the resources and systems. Second, failure to take into account such environmental values may distort development and investment decisions, leading to unnecessary and inefficient depletion, degradation and over-exploitation of wetland resources and environments. The result can be a net loss of economic welfare to the society.

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6 In an essay entitled ‘The economics of the coming Spaceship Earth’, Boulding (1966) incorporated concepts and ideas from economics and science in order to develop a perspective of the economy that emphasized the interdependencies between economy and environment. He suggested that the economy should be viewed as a circular resource flow system, and that the environment imposes a set of constraints according to its stock of resources and its natural ability to assimilate wastes. Boulding argued that it would be imprudent to act as if we had access to unlimited resources, ‘sources’ and ‘sinks’ that exist simply to be exploited (he described this as the ‘cowboy economy’). Instead, we should learn to treat planet earth as a ‘spaceship’ in which we should be concerned about reducing wastes, recycling materials, conserving exhaustible energy sources, and identifying previously untapped energy sources such as solar power.
Quantifying the value of ecosystem services has become an important vehicle for assuring social recognition and acceptance of the public management of ecosystems (Costanza et al., 1997). In any economy, resource allocation hinges on valuation of goods, services and all types of assets. Without proper appreciation of value, resources are bound to be misallocated. While this emphasizes the underlying rationale behind valuation of environment, one can count a few arguments of justification.

In the market economies, prices constitute the base of resource allocation, as these provide signals on scarcity of resources. The scarcity prices provide the true measure of economic value, only if the market is characterized by large number of buyers and sellers with transferable private property and consumers revealing their choice from a number rival goods and services given adequate amount of information on present and future. If these conditions hold good the price system can efficiently direct the process of resource allocation. Unfortunately, in the case of wetland ecology, market fails or these are of limited use. This is one of reasons for the degradation of wetland. The common property nature of wetland makes it impossible to apply the principle of excludability. Those who do not pay for enjoying or using the wetland resource cannot be excluded. As a result, no incentive exists to conserve natural resources and environment because of “free rider” problem. The consequences are misuse, overuse, deterioration or quality or even exhaustion of some natural resources like wetland can occur.

Another argument related to the market failure is the divergence between prices and social value of resources. In case of scarce ecological resources individual preferences and social benefits invariably conflict. As a result, the individual and societal viewpoints differ. This difference requires that environmental policy should bring the private and social cost of environmental resources into as a tool to decide policy. Economists trace this problem to market failure; the failure of markets to reflect the full or true cost of goods or services provided by wetlands. To counteract the problem of market failure, it can be useful to find ways to understand the economic value of wetland benefits. This helps both wetland users and policy makers
more easily compare alternative uses and policy options. A value for the economic benefits that would be lost through the development of a wetland could prompt policy makers to put resources into the conservation of it.

1.5.2: Property Rights and Institutional Arrangements

Neo-classical analysis includes environmental problems as examples of Pigovian externalities (Pigou, 1920). Environmental services are under-provided because of uncorrected Pigovian external diseconomies and we thus have market failure. These externalities are not internalised by Coasian bargaining theory (Coase, 1960) for two basic reasons: property rights are not properly defined and transaction costs are prohibitive. Non-rivalry and non-excludability lead to free riding and "freedom in the commons brings ruins to all" (Hardin, 1968, Pp. 1244). To avoid the tragedy, Hardin (1968- cited in Feeny et al, 1990, Pp. 2) suggested that the commons could be privatized or kept as public property to which rights to entry and use could be allocated. Hardin has been widely cited as having said that resource degradation was inevitable unless common property was converted to private property, or government regulation of uses and users was instituted\(^7\) (cited in Feeny et al, 1990, P.2). Prior to Hardin, "commons dilemmas" were understood either in terms of Malthusian explanations of overpopulation and resource degradation (McCay and Jentoft, 1998). Although Hardin (1968) did little to dispel Malthusian biases, it invoked a new body of scholarship which called into question the notion that the commons will always be open access, thereby dismantling the deterministic idea that individuals will always degrade the commons.

Now we can see the nature of property rights in wetland as ecological system. Each wetland tends to have different property rights regimes associated with it. Property right refers to specific rights to utilize, control and exchange assets (Bromley, 1991). These rights are attenuated by various legal and customary

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\(^7\) The resource economist, Gordon (1954), is credited with the first statement of the conventional theory of the commons, although Hardin (1968) does not mention it.
restrictions defining limitations on the use or consumption of the goods or resources. There are various types of property rights decided by the inherent nature of the resource, and by cultural and social determinants. These are from open access to common property, state property and private property. Common managed systems have been documented for fisheries in all regions of the world (Ostrom, 1990).

Table 1.2: Different Property Rights Regimes

<table>
<thead>
<tr>
<th>Situation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Open Access</td>
<td>Open access is the absence of well-defined property rights and unregulated and is free and open to everyone</td>
</tr>
<tr>
<td>Common Property</td>
<td>Sometimes called communal property, the resource is held by an identifiable community of interdependent users. These users exclude outsiders while regulating use by members of the local community</td>
</tr>
<tr>
<td>State property</td>
<td>Rights to the resource are vested exclusively in Government which in turn makes decisions concerning access to the resource and the level and nature of exploitation</td>
</tr>
<tr>
<td>Private Property</td>
<td>Private property, rights to exclude others from using the resource and to regulate the use of the resource is vested in an individual (or group of individuals). Rights are exclusive and transferable</td>
</tr>
</tbody>
</table>

Source: Adapted from Ostrom (1990)

Resources that do not have ownership or control are referred to as open access. Common property denotes resources that are owned by a community and rules of access to the resource are defined by the community that owns the resource (Helberg, 2001). Common property could either be regulated; where the rules governing the resource utilization are clearly specified; or unregulated where the rules do not exist or not enforced to limit the use of the resource (Baland and Platteau, 1996; Helberg, 2001).

The unregulated common property is also known as the common-pool (Helberg, 2001). These resources have two main characteristics; difficulty or high cost of excluding potential users, and every user subtracts from the benefit of other users (Ostrom, 1990). Fishery stock is good example of these resources. The two characteristics are recipes for over-exploitation of fishery resources, a phenomenon known as the “tragedy of the commons”. The five property rights that are very
relevant for the use of common pool resources are access, withdrawal, management, exclusion, and alienation (Schlager and Ostrom, 1992).

State Property, on the other hand, are resources owned by the state, and rules of access and conservation are enforced by the state (Heltberg, 2001). It is not uncommon that due to high cost of enforcement, state property degenerates to open access or common property like in big lake or lagoon. In many developing countries, marine fishery stock is state property, however due to high cost of monitoring the resource becomes a common pool to fishers.

Finally, private property exists when an individual has a property right over a resource. This right, typically, includes the right to possess, use, transfer, destroy, manage and exclude other potential users of the resource (Ostrom, 1990; Heltberg, 2001). This type of right is not related to big wetland or common property like village tank and village pasture land.

Property rights focus on the implications for income of present property right holder, mechanism of changing property rights to meet specific management goals, and the institutions that govern the allocation of rights (Hanna et al., 1996). The social benefits of the common property management of wetlands tend to be undermined by conversion to private or state property, may leading to negative consequences in terms of the distribution of wealth and security of livelihood. Common property management regimes are a set of institutional arrangements that define the conditions of access to a range of benefits arising from collectively used natural resources.

In economic theory, pure public goods means non-rival in resource use or consumption. But most Common Property Resource (CPR) is not pure public goods, rather they exhibit the property of subtractability, e.g., each resource user reduces the availability to others. In this context, it is called as Common pool resources\(^8\). But

\(^8\) The distinction between common pool resources and common property regimes (Ostrom et al., 1994), the former referred to resource systems whose size, mobility and complexity make it difficult – although not impossible – to prevent individuals from using them and whose use can deplete the
Hardin (1968) did not consider the possibility of exclusion under communal-property regimes. Hardin’s conclusion of unavoidable tragedy may follow from his assumptions of open access, lack of constraints on individual behaviour, conditions in which demands exceed supply and resource users who are incapable of altering the rules. Actual common property situations often do not conform to all four of these assumptions (Feeny et al, 1990).

Property and property relations have strong bearing on the ways in which people use, manage and abuse natural resource systems, and that institutional arrangements – grounded in the creation and management of common property – may have positive impacts on resource use and conservation. In the context of natural resource management, property rights are thought to explain the conditions under which individuals will co-operate to manage and conserve natural resources and obtain access to resources of value (Ostrom, 1990, Bromley et al., 1992).

North (1990), suggests that institutions are the humanly devised constraints that shape human interaction. Such constraints may be informal ones (e.g., social norms, conventions, moral codes), or formal ones that are consciously designed or articulated. Formal rules include political rules (constitutions, regulations), economic rules, and contracts. Economic rules define property rights, that is, the bundle of rights to use and dispose of an economic resource and to derive utility (income) from it. Contracts are (enforceable) agreements, embedded in property rights rules, regarding the use or exchange of goods.

Community level institutions work as mechanisms to ensure norms to govern or regulate the access of local community or outsiders to resources and specify among them. Often the norms-formal or informal- are well understood, respected and observed by the communities. From a resource use perspective, community

number and quality of benefits the resource can provide. The latter were the systems of rules, rights and duties that govern the ways in which group members relate to the commons and to one another.

Exclusion means the power to exclude people other than members of a defined community. But some cases, like fish and wildlife for which exclusion is particularly difficult because of the migratory nature of the resource.
institutions are crucial vehicle through which development initiatives are endorsed, empowered and implemented (Geevan and Bedamatta, 2007; P. 1). Recently, it has been argued that a community-based cooperative fisheries management, which is one of the property rights approaches in fisheries management, seems to be a viable option in many of the artisan fisheries. Community-based cooperative fisheries management is a system where authority and responsibility over local resources is shared between government and local resource users and/or their communities. The community-based cooperative fisheries management is often used interchangeably with other terms, such as joint management, collaborative management and community-based management. These strategies have similarities in terms of approach, but may differ in relative participation of government and resource users (Pomeroy, 1998). The community-based cooperative fisheries management shares responsibilities between government and communities. Under this system the government serves a number of important functions including providing support polices and legislation. According to Sajise (1995), community based management (in contrast to community-based cooperative fisheries management) is a process by which people themselves have opportunity and/or responsibility to manage their own resources, define their own needs, goals and aspirations, and make decisions affecting their socio-economic welfare. Under this system the government most often plays a minor role. Community management, where communities or otherwise defined groups are given certain exclusive rights, seems particularly attractive where other rights based approaches (such as individual transferable quota system) cannot be applied for socio-political or enforcement reasons (Arnason, 2001). He argues that the great advantage of communal fishing rights is that they are often socially acceptable and facilitate effective law enforcement on the basis of social and physical proximity and social pressures.

Pomeroy (1995) argued that the underlying causes of the failure to manage fisheries are often of social, economic, institutional and/or political origins. Pomeroy pointed out, that fishing communities under certain conditions can regulate access and enforce rules through traditional or community institutions\(^{10}\). Fisheries

\(^{10}\) e.g., social norms, rules, customs, traditions, moral codes etc.
management authorities in many countries have recognized that a fishery often cannot be managed effectively without the cooperation of fishing communities (Bulayi, 2001).

**1.6: Fishery Management Regimes: Theoretical Issues**

When fishery is being developed, resource stock can generate good catches and the fishermen earn high return on their investment and effort (Arnason, 1993). Under common property management regime, this encourages more investment and fishing effort. It also attracts new fishermen to the fishery. This may reduce the fish stock and consequently the net profits gained by fishermen. However, while profits are positive fishermen will continue to invest in fisheries. As fishing efforts rise stocks are depleted, catch per unit of efforts decline and the economic benefits from the fishery are reduced (Arnason, 1993). The expansion of fishing capacity may continue as long as the fishermen can hope to get a positive rate of return from the fishery. Long before equilibrium is reached, the fish stock may have reduced far below the level corresponding to a maximum sustainable yield, and total catch may be reduced in spite of greatly increased fishing effort. As long as harvesting revenues exceed cost, there will be an incentive to increase fishing effort to the level where total fishing costs are equal to total revenue. At this stage, there are no incentives for expanding investment in fisheries. This basic model is described and illustrated in figure 1.1.

Where $FE^*$ is optimal fishing effort, $MSFE$ is maximum sustainable fishing effort whereas $FE^C$ is fishing effort at competitive equilibrium where total revenues equal to total harvesting costs.
In the above figure fishing effort, denoted by E, is measured along the horizontal axis while costs and revenues are measured along the vertical axis. The curve “Total Revenues” represents total gains from a fishery at different fishing effort levels while the curve “Total costs” represents total costs of fishing effort.

The maximum sustainable yield (MSY) can be identified at the fishing effort level MSFE. Stocks that have been reduced below MSY are usually considered over-exploited (Bulayi, 2001). As described above, under a common property competitive fisheries regime, fishermen tend to increase fishing effort up to FE^C level, where total revenue is equal to total costs of harvesting (equilibrium point). At this point there are no more incentives for fishermen to expand the investment and fishing effort. Maximum net benefits from the fishery can be generated by controlling fishing effort at level FE^* where the difference between total revenues and total costs is the greatest. The problem, however, is that a reduction of fishing effort to the E^* level may not be supported by free access, competitive fisheries. This situation has been
described as the tragedy of the commons (Hardin, 1968). Hence, property right may have a positive impact on resource use.

In traditional fishery, fisherfolk could not withdraw their fishing efforts at $FE_c$ (competitive equilibrium where total revenues equal to total harvesting costs). The factors responsible for continuation of fishing efforts beyond $FE_c$ are, first, fisherfolk established themselves in tightly knit communities and are most reluctant to move to other jobs. For many of these communities fishing is not only a job but it is a way of life a cherished tradition. Second, skill which fisherfolk inherited and acquired may not be readily used elsewhere in the economy. In the event of withdrawal fisherfolk may have to go through extensive job training schemes before they fit into a new work. Friendships and kinships established in fishing could not be maintained outside the fishing occupation and therefore a resistance develops among fisherfolk against withdrawal of fishing effort. Third, fishing equipments like boats and nets committed to fishing represents sunk capital which could not be recovered by withdrawal. For instant, fishing gear is of no use in any other occupation but fishing. Fourth, it has been argued that fisherfolk are natural optimists and gamblers: they always dream about a big catch or good fishing season which may moderate their financial problems. In effect, this happens very seldom in the fishing occupation and fisherfolk hope that the next season will the best. This encouraged them to work even beyond the competitive equilibrium point ($FE_c$) with negative income. Fifth, fisherfolk association with the middlemen-agents-Mahajans, who provides money (sometimes fishing equipments also) for their livelihood and fishing operation. This type of practice for the fisherfolk has been continuing for generations. The above factors suggest that many fisherfolk always operate their fishing activities beyond ($FE_c$). For all these reasons labour and capital get trapped in over-expanded fisheries, to a certain extent, this explains why many fishing communities are poor in most parts of the world.

There are many types of property rights systems in fishery sector. Various types of property rights have been employed to alleviate the fisheries problem. The
most common of these are territorial user rights, individual catch quotas, community fishing rights and licenses. Apart from these rights, there is one more right called social right, which is nothing but right to have equal access, fishing right depending on castes, history and cultural milieu.

**Figure 1.2: Conceptual Framework of Various types of Property rights regimes in Fishery management**

![Property Rights Diagram](image)

Source: Prepared by the author

In the above self-explanatory figure Territorial User Rights in Fisheries (TURFs) is the exclusive right to engage in fishing within a certain specified geographical location (Charles, 2000). The system may give incentives to the TURF holders to control and conserve the environment. Individual Quota system (IQs) offers the most promising general approach to the management of fisheries resources. From an economic point of view, IQ systems may appear to be far better than other systems, provided they can be adequately monitored and enforced. What is needed is the means of allocating the quota among the fishing firms or units which create a sense of establishing a private property right to a particular level of harvesting (Total Allowable Catch). A quota allows a firm to manage its fishing in an efficient way, but not in competition with other firms. According to Sajise (1995), community based fisheries system is a process by which, people themselves have the opportunity and/or responsibility to manage their own resources, define their own needs, goals and aspirations, and make decisions affecting their socio-economic welfare.
Wetlands are considered as a resource-livelihood system and comprising a broader socio-cultural-ecological system. They are most dynamic system having enormous socio-economic-cultural-ecological importance to the communities depending for their livelihood sustenance. But it is argued that these vital systems are degrading. Hence the study intended to understand wetland ecosystem in some aspects comprising community dependency, changes in organizational set up and techno-institutional arrangements with respect to fishery management and ecological degradation.

1.7: Study Area

Community based fisheries could regulate access and enforce rules through its own institutional framework and social-cultural practices to use fisheries resources in a sustainable manner. This management system is also referred to as traditional fisheries resources management. Pomeroy (1995) described that governments transfer property rights over fish stocks to the fishing communities through legal mechanisms. This may lead to better management because it involves the communities themselves, reduce the conflicts as issues are easily resolved and also prevents competition over resources.

The fishery resources in Chilika are been managed by fishermen cooperative societies. But after the commercialization of fisheries, there is some evidence about social segregation, conflicts and with the impact of techno-institutional changes leading to breakdown of traditional fishing practices. The breakdown of traditional fishing practices, slowly but surely, converted Chilika from a common property resource to open access. Pomeroy (1995) noted, that majority of these traditional fisheries management systems have been weakened or disappeared, due to government restructuring during the colonial era, technological development and modernization, the rise of national-state owned economy, socio-economic changes and unequal distribution of benefits within fishing communities. As Pomeroy and William (1994) explain, the types of common property regimes in fisheries which
evolved through traditional management practices can rarely now provide the answer to contemporary management problems.

To examine a few of these issues we have selected Chilika lagoon, Orissa, India for our study. 132 fisher folk villages and 900 other villages in the catchments with a population of more than 1 million (CDA, 2003; chilika.com), that depends on the lagoon and its catchments. Fishing is the dominant livelihood practices for the villagers in and around Chilika. The specific methods of fishing are a reflection of the particular caste characteristics of the community. There are various sub-castes among the fishing community like Keuta, Kandara, Nali, Tiara, Khatia, Kartia, Nolia. Besides, fisherfolk from Bangladesh also depend on this system for their livelihood. People in and around Chilika depend on it in various ways and in various parts of the lagoon. Therefore, the fishing activities in Chilika are complex. There are various types of traditional fishing practices like Jano, Khati, Bahani, Dian, Uthapani and trap fishery like Dhaudi and Baza which exist in different parts of the Chilika. Since mid 1980s, culture fishery gradually substituted the traditional capture fishery in the lake. Culture fishery refers to prawn culturing in the lake. Besides the issue related to fishery, the study intends to explore the factors affecting ecology of the lagoon and its interface with the communities in and around Chilika.

1.8: Objectives of the Study

1. To understand the sharing system of fisheries resources in historical and contemporary perspectives and factors causing conflicts and disputes in and around Chilika Lagoon

2. To understand the ecological changes and factors causing ecological changes in Chilika lagoon

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11 See chapter 3 and 4 for the extensive discussion on castes, communities and fishing practices
3. To study the factors causing changes in the fishery practices in Chilika lagoon and its effects on the livelihood system of the communities

4. To estimate the technical efficiency in the economics of resource use specifically for fisheries production in Chilika lagoon

1.9: Methods of Data Collection

In Chilika, different regions have different socio-economic-ecological characteristics. Therefore, to facilitate the survey, Chilika was divided into three geo-ecological zones namely, zone I (North-western region), zone II (South-eastern region) and zone III (Eastern and North-eastern region). The study follows an unique kind of method of data collection to understand multifaceted socio-economic-ecological system of Chilika lagoon. We have chosen three levels of fieldwork for the purpose of our analysis i.e. village level, senior citizens and household level. The three level survey facilitates to understand better the lagoon ecology and the stakeholders’ dependency on it. Besides the survey method helped to enhance our understanding of Chilika lagoon from village level dynamics to household level dependency in a temporal and spatial way. Besides, village level surveys (Focus Group Discussions) were conducted to collect information on various socio-economic-institutional aspects. Apart from these; the village level discussion helped us to understand the ecological changes across above mentioned three zones. Further, senior citizens were consulted in order to collect information on a temporal scale. Senior citizens consultation could help us to gather information on ecological degradation and community adaptability to the ecological changes. They were asked questions about the conditions around the villages, lake and the ecology in a historical context as well as to highlight changes that have taken place.

Therefore, the study is based on an intensive primary survey, group discussions from thirty six villages and interview with two hundred households from

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12 See Chapter Three for the selection of the villages and method of data collection
four villages in and around Chilika lagoon. Eighty senior citizens were interviewed in order to collect information on various socio-economic, ecological and techno-institutional changes in and around Chilika on a temporal scale (how the situation was and how the situation is). The secondary source of information is also used to substantiate the study. These include information from Chilika Development Authority (CDA), Department of Revenue, Department of Fishery and Primary Fisherman Cooperative Society. The study also utilises historical literature and local poems to enhance our understanding of socio-cultural-economic and ecological perspectives of Chilika in a historical sequence.

1.10: Limitations

The study puts the emphasis on fisheries and aqua resource management issues with respect to coastal wetland and lagoon ecosystem. The time series data on ecological parameters are not available for Chilika lagoon. Hence, the study has used ecological information based on secondary studies and reports. Again during the field survey special attention was given to collect stakeholders’ perception on ecological changes in and around Chilika lagoon.

Another limitation of the study is that the data used in the analysis were collected from thirty-six villages only which forms around twenty percent of total villages in and around the Chilika lagoon. Therefore, the limitation of primary survey method applies to this study.

1.11: Chapter Scheme

In the second chapter we are discussing the profile of Chilika lagoon. This will give a broader idea of the lagoon, its topography, location, ecological history, people and their dependency on the lagoon system.

Third chapter provides an extensive discussion on the selection of the study area and methodology. This chapter provides discussion on village selection criteria,
socio-economic-ecological characteristics of the study villages, occupational patterns, dependency on Chilika lagoon and other natural resources, profile of fishing communities, caste structure, social status and linkages with fishing practices and mode of production.

In the fourth chapter we are discussing “sharing” of Chilika in a historical and contemporary perspective and provide a review on fishery management policies. In this chapter we are also discussing the conflict situation that prevails in and around Chilika. Nature and extent of conflicts, factors causing conflicts are also discussed in this chapter. Apart from these issues, peoples’ movement and collective action has been analysed.

Fifth chapter discusses the ecological changes of Chilika lagoon. Ecological parameters like siltation, salinity, and weed infestation have been analysed on the basis of available secondary data. Besides, we have analysed the stakeholders’ perceptions on ecological changes that includes perception of villagers and senior citizens. The introduction of prawn culture and consequent socio-economic and ecological problems too have been analysed.

In the sixth chapter we are discussing the changes in fishing practices and their implications on the livelihood of the communities. This chapter embodies discussion on institutional changes with respect to the fishing practices like changes in the functioning of the Primary Fisherman Co-operative Societies, factors diluting the village level traditional indigenous institutions, changes in technology and adaptation of new fishing practices. Income, expenditure and borrowing pattern also has been analysed. The chapter also analyses the informal credit institutions (Mahajanasa). The factors causing changes in the fishing practices and consequent conflict and changes in social relations and status have also been discussed in the chapter.

Seventh chapter discusses the technical efficiency of fishers and non fishers in and around Chilika. In other words, in this chapter we attempt to understand the
factor influencing fish production on the basis of our sample observations. From our field observations as well as analysis of primary data we identify that apart from technological changes, ecological attributes of the fishing zones, institutions play significant role in quantity and quality dimensions of fish production. These institutions include Mahajan credit institution, market institution, rules and norms (informal) of the village level fishing activities. Therefore, these issues form a substantive part of this chapter.

Chapter eight provides overviews, conclusion and references used.