Journal of Environmental Biology
ISSN : 0254-8704
http : //www.geocities.com/j_environ_biol/

J. Environ. Biol.
26 (2 suppl), 439-447 (2005)
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Minor Review

Economic valuation of wetlands

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(Received: 19 September, 2003 ; Accepted: 06 February, 2004)

Abstract : *This paper with case studies discusses the valuation of ecosystems considering the direct, indirect and existence benefits. The economic valuation of wetlands helps to understand the constituent's functions and benefits and this exercise could act as a catalyst for wetland conservation The services provided by these wetlands are innumerable and these values are often lost through inappropriate development and are used inefficiently due to lack of knowledge about the vital functions performed by them Linkages between use values and ecosystem functions are highlighted to raise awareness among the users The role of the stake-holders especially public and private sectors in managing the ecosystems in a sustainable manner has also been outlined in this paper while evolving the management strategies*

Key words : *Wetlands, Economic valuation, Conservation, Restoration*

Introduction

Wetlands constitute a transitional zone between terrestrial and aquatic habitats They are influenced to varying degrees by both terrestrial and aquatic habitats. They differ widely in character due to regional and local differences in climate, soils, topography, hydrology, water chemistry, vegetation, and other factors Depth and duration of inundation, a key defining force, can differ greatly between types of wetlands and can vary from year to year within a single wetland type. As per the definition adopted at Ramsar Convention (Ramsar, Iran 1971), "Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing; fresh, brackish, or salty, including areas of marine water the depth of which at low tide does not exceed 6-m."

Wetlands are categorised as inland (also known as non-tidal, freshwater wetlands) and coastal (also known as tidal, salt water or estuarine wetlands) (Edward *et al,* 1997) In addition to these, man-made wetlands have also been included under wetland classes Inland wetlands receive water from precipitation, snowmelt, ground water, and runoff. Coastal and estuarine wetlands receive water from precipitation, surface water, tides and ground water discharge

Wetlands due to their biological, ecological, social, cultural, and economic values form an important component of the environment They provide habitats and support diverse range of biodiversity [e.g , in one square meter of coral reef there can be up to 3000 species (Kenya Wildlife Service Training Institute, 2004)]. Wetlands undertake important biological and ecological processes including life support systems i.e. water and carbon cycles. Hence, they are important for hydrological functions, economic development, social, spiritual and cultural development.

Functions are the physical, chemical, and biological processes occurring in and making up an ecosystem. Processes include the movement of water through the wetland into streams or the ocean; the decay of organic matter; the release of nitrogen, sulphur, and carbon into the atmosphere; the removal of nutrients, sediment and organic matter from water moving into the wetland; and the growth and development of all the organisms that require wetlands for life

To aid and improve wise use and management of wetland resources, economic valuation aids as a powerful tool for measuring and comparing the various benefits of wetlands (Edward *et al,* 1997). In terms of economics, the value of the benefit is generally determined by its price, i.e., the amount of money for which it will be exchanged. The value of a benefit is the price of that product in the open market and the worth of that benefit to a potential buyer. This is measured in economic terms as willingness to pay. In other words, the economic value of the wetland services/commodity is measured by people's *willingness to pay* (WTP) for those benefits. Hence, economic valuation is an effort to consign quantitative values to the goods and services provided by environmental resources, whether or not market prices are available to assist In addition, the economic valuation is essentially quantification of the

environmental goods and services, and the values of human beings for the environment.

The economic value of environmental goods and services/commodity is measured by the summation of many individuals' willingness to-pay for it. Therefore, economic valuation in the environment context is about 'measuring the preferences/choices' of people for an environmental benefit or against environmental degradation. Valuation is therefore in relation to preferences held by people. Moreover, the use of economic values permits the comparison that is required between 'environmental' and 'developmental' values. The latter is expressed in fiscal/monetary terms, either in rupees or as economic rate of return (US Army Engineer Research and Development Center, 2004). Using other units to measure environmental values would not permit the comparison with development values. The economic value of wetlands includes both use and non-use values. Typically, use values involve some human 'interaction' with the resource whereas non-use values do not. Wetland use values are associated with a diverse and complex array of direct and indirect uses. Wetland "values" may be derived from outputs that can be consumed directly, such as food, water supply, recreation, or timber; indirect uses which arise from the functions occurring within the ecosystem, such as water quality, and flood control; possible future direct or indirect uses such as biodiversity or conserved habitats; and the knowledge that such habitats or species exist (known as existence value) (Serageldin, 1993).

Values are "an estimate, usually subjective, of worth, merit, quality, or importance". Direct uses of wetlands could involve both commercial (marketed value) and noncommercial activities whereas indirect use values are unmarketed, go financially unrewarded and are only indirectly connected to economic activities. A special category of value is *option value*, which arises because an individual may be uncertain about his or her future demand for a resource and/or its availability in the wetland in future. If an individual is uncertain about the future value of a wetland, but believes it may be high or that current exploitation and conversion may be irreversible, then there may be *quasi-option value* derived from delaying the development activities. The *quasi-option value* is the value that society would place on wetlands if all knew the complex functions of wetlands. Uncertainty is acceptable in non-economic valuations, but must be accounted somehow in economic valuations. *Quasi-option* value is a concept allowing expert scientists to define wetland value. In contrast, *non-use values,* often referred as intrinsic or existence values are difficult to measure, as they involve subjective valuations by individuals unrelated to either their own or others' use, whether current or future. An important subset of non-use or preservation values is *bequest value*, which results from individuals placing a high value on the conservation of tropical wetlands for future generations to use. Bequest values may be particularly high among the local populations currently using a wetland, in that they would like to see the wetland and their way of life that has evolved in conjunction with it passed on to their heirs and future generations in general. Table 1 lists various use and non-use values of wetlands.

In general, the direct use of marketed products of ecosystems is easier to measure since marketed products exist and their prices may be adjusted for distortions. In contrast, ecological functions, such as groundwater recharge or discharge, may have indirect use values, which are reflected in the economic activities these functions support. Usually, changes in the well-being or *social welfare* are used to define and quantify economic value. Therefore, valuing a good or service requires one to study the change in a person's welfare due to a change in the availability of the resource. The purpose of economic valuation is to reveal the true costs of using scarce environmental resources.

The need for economic valuation of environmental impacts and assets arises for pursuing efficient policies and investing in efficient projects and programmes. At the most general level of intergenerational concern, valuation is still required. If transfers of resources are to be made between generations -- with the current generation sacrificing for the future, or future benefits being lost for the sake of present gain -- then it is essential to know what is being sacrificed and how much it is that is being surrendered (United Nations Environment Programme, 2004). Information on the economic values of policy changes (with regard to the environment) can greatly assist in identifying the policy and sectoral priorities. Economic valuation incorporating environmental aspects helps in evaluating developmental projects, programmes and policies.

Economic decisions of developmental projects, which exclude ecosystem values, lead to ecosystem degradation. Economists trace this problem to market

Table – 1 : Classification of total economic value for wetlands

Use value/benefits			Non-use value/benefits
Direct use benefits	**Indirect use benefits**	**Option and quasi-option benefits**	**Existence benefits**
recreation - boating - fauna (birds, etc) - wildlife - viewing - walking - fishing commercial harvest - fish - fuel wood - transport - nuts - berries - grains - peat/energy – forestry -Wildlife harvesting -agriculture	-nutrient retention -flood control -storm protection -groundwater recharge -external ecosystem support -micro-climatic stabilisation -shoreline stabilisation, etc -water filtration -erosion control	-potential future uses (as per direct and indirect uses) -future value of information, e g , pharmaceuticals, education	-biodiversity -culture -heritage -bequest

failure, which is the failure of markets to reflect the full or true cost of goods or services. In the case of a wetland, the calculation of the economic value for converting the wetland area to housing or commercial layouts does not include costs such as loss of water quality/quantity or flood control. Since these ecosystem services are available as free to all and not purchased, there is a tendency to leave the quantification of the vital function of these ecosystems and indirect benefits derived from them. It is only when these services are lost; the actual financial or commercial costs are incurred. So paradoxically, the zero prices for wetland services are of very high value to human well-being. Since it is difficult for an individual owner to receive direct monetary benefit for those benefits, which a wetland provides to others (e.g , downstream water quality improvement or producing waterfowl which migrate elsewhere), the true value of such benefits is generally not taken into account in land *use decisions* (Michal Bardecki *et al*., 2001)

To counter the problem of market failure in accounting for wetland values, it is necessary to find ways to calculate the economic value of wetland benefits in a way the market understands – in financial currencies. This helps both the individuals and policy makers to compare alternative uses and policy options. A value for the economic benefits that would be lost through the development of a wetland, for example, could prompt policy makers to put resources into the conservation of the wetland instead. Similarly, such evaluations can lead to a better understanding of tax incentives, rebates or subsidies that could give individuals an economic incentive to retain a wetland. In effect, the community can purchase the wetland services from the individual, through which one can provide panacea for market failure to some extent (Environment Canada, 2000).

Objectives : The objective here is to demonstrate the potential of economic valuation of wetlands and procedure for conducting valuation

Materials and Methods

Valuation of lakes in Bangalore - A case study : Bangalore District is located in the heart of south Deccan of Peninsular India. It is situated in the south-eastern corner of Karnataka state (12°39' – 13°18' N latitude and 77°22' – 77°52' E longitude) with a geographical area of about 2,191 sq km and at an average elevation of 900 m above the mean sea level. The climate of the district has agreeable temperature ranging from the highest mean maximum of 36.2° C in April to lowest mean maximum of 11.4° C in January. It has two rainy seasons from June to

Table – 2 : Results of the socio-economic survey

Area	Domestic	Agriculture	Livestock	
	(per 1000 people per day)	(per ha. per day)	(per 1000 animals every 2 days)	
			Water use	Fodder
Hebbal	Rs 1937 50	Rs 19 00	Rs 2170 80	Rs 33500.00
Guddadahalli	Rs. 1603 30	Rs. 19.00	Rs. 1250 00	Rs 37500.00
Bhoopasandra	Rs 1547 80	Rs 5 00	Rs 1270 80	Rs 16666.70
U.A.S.Layout	Rs. 1547.00			

September and from October to November coming one after the other but with opposite wind regime, corresponding to south-west and north-east monsoons. The mean value of the rainfall of about 900-mm with standard deviation of 18 7 mm was recorded from the year 1875 to 1976

Results and Discussion

Status of a wetland depends on its management, level of anthropogenic activities, management of land, solid waste collection and disposal, disposal of used water and attitude of the people at large. Urbanisation and anthropogenic stress to meet the growing land needs of Bangalore City have resulted in disappearance of wetlands, which has led to the discontinuity of the drainage network. Studies in Bangalore city reveal about 35% decrease in number of water bodies from 1973 to 1996 (Deepa, *et al*, 1998). Earlier investigations have revealed that nearly 30 % of lakes are used for irrigation. Fishing is being carried out in 25 % of lakes surveyed. About 36 % of lakes are used for washing purposes and only 3% are used for drinking purposes Agriculture along drying margins is practiced in 21% of lakes. Approximately 35% of lakes are used for grazing by cattle Mud lifting was recorded in 30 % and brick making in 38 % of the lakes (Krishna, *et al*., 1996).

Economic valuation was undertaken in three lakes namely Hebbal, Amruthalli and Rachenahalli lakes. Hebbal and Amruthalli lakes are situated in Bangalore North taluk (east of Bellary road) while Rachenahalli is situated in Bangalore South and North taluks.

Hebbal lake : To assess the importance of Hebbal lake, a socio-economic survey was carried out in the catchment areas of the lake. A random survey of the houses situated within 1-km radius from the lake was carried out, using a questionnaire designed for the purpose The study was done in four areas around the lake namely Hebbal, Guddadahalli, Bhoopasandra and U.A.S. Layout. The first three areas (Hebbal, Guddadahalli, and Bhoopasandra) were semi-urban and the last one (U.A.S. Layout) was completely urban (Ranjani and Ramachandra, 1999) The economic valuation of wetland resources was done on the basis of Contingent Valuation Technique. Table 2 gives the economic details of lake water benefits in terms of rupees

Livestock : The dependency for fodder is about Rs. 33,500 per 1000 cows for every two days in the catchment area of Hebbal Lake The dependency for the livestock on the lake water amounts to about Rs. 2170 8 per 1000 cows every two days. The dependency in the Guddadahalli area for fodder is about Rs.37, 500 per 1000 cows every two days and the remaining Rs.1250 per 1000 cows every two days is the amount for water needed in economic terms to maintain the livestock The total dependency for rearing livestock amounts to Rs. 38,750 per 1000 cows every two days. In Bhoopasandra area, the economic dependency for the livestock rearing is Rs 17,937.5 per 1000 cows every two days. The dependency for water amounts to Rs. 1270.8 per 1000 cows every two days and for fodder, Rs. 16,666.7 per 1000 cows every two days. Here, people rear cows to earn a living and sell the milk in the surrounding areas The fodder available in the local market is very expensive and therefore people use the weeds in the lake as fodder, a cheap source of food.

Agriculture : Agriculture is still practiced in certain parts of Hebbal, Guddadahalli and Bhoopasandra areas. Many of these areas use the lake water for irrigating their fields (for growing a variety of greens). The dependency in the Hebbal lake catchment for irrigation is around Rs. 19 per hectare per day. The dependency in the agriculture sector for Guddadahalli area is Rs. 19 per hectare per day. This area also, like Hebbal is primarily agricultural, and dependent on the lake or ground water for irrigation. In the Bhoopasandra area, the dependency on the lake for agriculture is about Rs. 5 per hectare per day. This is because, a lone farmer in the area owns a coconut grove

and he uses the lake water as well as the treated water to irrigate the land

Domestic sector : The dependency for the domestic sector was calculated by determining the water use per individual In the Hebbal area, the dependency was Rs. 1937.5 per 1000 people per day. While in Guddadahalli area, it was about Rs. 1603 3 per 1000 people per day, and Bhoopasandra area, Rs. 1547.8 per 1000 people per day. In the UAS layout, the dependency is Rs. 1547 per 1000 people per day Residents in Hebbal area depend on ground water for their daily use more than the other areas, as they lack access to treated water supply.

The dependency was the highest for livestock maintenance since, fodder for the livestock is completely obtained from the lakes. The agricultural dependency is low in the areas ranging from Rs.5 to about Rs.19 per hectare. With lake restoration, the agricultural dependency has increased, as the people have relatively clean water of the lake. The dependency of the domestic sector ranged from Rs.1547-1937 5 per 1000 people per day. This dependency was highest in Hebbal area, as the people there depended on the ground water for their daily needs. An interesting thing that came into notice was that the people there used more water for bathing and the water used for bathing alone per individual was much higher than the surrounding areas. Though Guddadahalli is also dependent on ground water for its daily needs, the dependency was less compared to Hebbal. The other areas (Bhoopasandra and U.A.S Layout) have access to treated water, and so the people do not depend much on the ground water to satisfy their daily needs

Rachenahalli and Amruthalli lakes : Socio-economic valuation was undertaken in these lakes, also, to assign quantitative values to the goods and services provided by these wetlands. The economic value was measured in terms of public willingness to pay for the commodity. Total valuation assessment approach was used to assign the value of particular wetland as a whole in terms of rupees This economic valuation concerned ultimately with the allocation of wetland resources to improve human welfare

Socio-economy survey was conducted to:

- quantify the values of wetland resources; and
- determine the economic dependency of the people living in the surrounding areas on these lakes

Approximate valuation of wetland resources based on their use values (human dependency and interactions with the wetland resources) and non-use values (no interactions with the wetland resources) were determined by conducting interviews with the local communities A random survey of the houses around the lake was carried out using a standard questionnaire format exclusively designed for this purpose (Rajinikanth and Ramachandra, 2000). It contains information on various human uses of wetlands for irrigation, domestic, recreation, food, energy and also livestock uses as a

Table – 3 : Socio-economic details.

ITEMS	Quantity of Amruthalli lake resources	Amruthalli lake value in Rs.	Quantity of Rachenahalli lake resources	Rachenahalli lake value in Rs
Domestic consumption	277 9 l/ house/day	1 667/house/day	214.97 l /house /day	1 289/house/day
Livestock consumption	59.28 l/Cow/day	35 5 /100 cows/ day	60.39 l/cow/ day	36.18 /100 cows/day
Agricultural consumption	7201 02 l/ Hectare/day	43 19/hectare/day	12087 8 l/hectare/day	72 /hectare/ day
Agricultural products:				
Paddy:	15 1Q/ha/0 5year	21140/ha/0.5year	32.00Q/ha/year	44814/ha/year
Ragi :	7.6Q/ha/0 5year	4560/ha/0.5year	12 5Q/ha/0.5year	7500/ha/0.5year
Flowers:	3.95Q/ha/year	11847.9/ha/year	6.64/ha/year	19920/ha/year
Guava:	74.23Q/ha/year	37115/ha/year	60 1Q/ha/year	30050/ha/year
Vegetables:	--	-,-	7.69Q/ha/year	10381 5/ha/year
Coconut:	3000Nos /ha/yr	11253/ha/year	5100 2Nos /ha/yr	19125/ha/year
Energy resource	0 47 Kg /person/day	117.5/1000 persons/day	1.298 Kg/ person/day	324.5/1000 persons/day
Fishing products	-----	-------	75 Kg./day	900/day

Table – 4 : Valuation of Rachenahalli and Amruthalli lakes

Lake	Direct use		Indirect value	Existence value
	Use	Value in Rs		
Rachenahalli	* Agricultural * Fuel * Fish * Livestock consumption Total	9173.0 324.5 900 37.5 **10435.00**	*Ground water table varies from ↑ 50 ft (vicinity of lake) ↓ 250 ft (at 2-3 km away from lake) *It has greater capacity to retain flood waters from heavy rainfall and disposal of treated water from JNCASR	* birds and migratory birds * culture and heritage value * pooja during festivals
Result	Total value is Rs 10435 per day ,during cropping and fishing season		Ground water recharge and flood protection is increased due to pervious lakebed	Functional aspects, biodiversity and cultural, recreational aspects indicate importance of the wetland eco system
Amruthalli	Use	Value in Rs	* Ground water table varies from ↑ 180ft (vicinity of lake) ↓ 400ft (3 km away from the lake)	*Existing lake has no culture, heritage and biodiversity value
	* Fuel	12.5		
	*Livestock consumption	7.5	* It has lower flood protection value.	
Result	Total value is Rs 20.0 per day. Lower value is due to eutrophic condition of the lake which has made the wetland resources unusable		It has no ground water recharge and fewer flood control values mainly due to impervious lake bed resulting from the accumulation of silt.	This is due to pollution because of anthropogenic activities in and around the lake.

direct use value The economic dependency of the people residing closer to wetlands is shown in Table 3 and the values are expressed in rupees. Ground water table is provided as an indirect use value, and biodiversity, culture and heritage as non-use values in Table 4.

Five villages were selected in this regard, namely Amruthalli (around Amruthalli Lake) and Rachenahalli, Mestripalya, Srirampura, and Dasarahalli (around Rachenahalli Lake) The valuation of wetland products was done using market prices method and Contingent Valuation method with respect to publicwillingness to pay. By conducting this study, the requirements of the local communities and their economic dependency on the wetlands can be assessed In the case of Rachenahalli lake (by surrounding villages) the estimation is about Rs. 10,435/day (during cropping and fishing season) and Amruthalli lake is about Rs 20 0/day. This shows that, the economic dependency in the case of Rachenahalli lake is more than that of people living around the Amruthalli lake due to betterwater quality and ecosystem, which is explained in detail below.

Agriculture : Wetlands are an obvious source of water for agricultural use. The economic dependency in Rachenahalli lake catchment for irrigation and its products is about Rs. 9173.0 per day, during cropping season While Amruthalli lake, has no agriculture value. This is mainly due todecline in the water quality and quantity mainly due to eutrophication and drying of water during summer seasons

Fuel : Rachenahalli and Amruthalli lakes also yield fuel wood for cooking and heating . The economic dependency of communities in Rachenahalli lake is around Rs. 325 per day, while in Amruthalli lake it is about Rs.13 per day

Fish : Wetlands also provide food for local communities in the form of fish and has socio-economic value attached to it. The dependency of the community on Rachenahalli lake is about Rs. 900 per day, during fishing season. But

Amruthalli lake has no value due to lack of oxygen concentration or oxygen deficiency, light (transparency) and temperature

Livestock : The economic dependency for livestock in the Rachenahalli lake water is about Rs 37 per day and in Amruthalli lake, it is about Rs. 7 per day. This mainly depends on the quality and availability of water in the wetlands Amruthalli lake has lower value due to eutrophic condition of the lake which has made the wetland resource water) unusable

The ground water table of Rachenahalli lake ranges from 50 ft in the immediate vicinity and 250 ft at farther places (2-3 kms), while in the surrounding region of Amruthalli lake ground water table ranges from 180 – 400 ft. This is mainly due to sediments accumulated in lake-bed becoming impervious, which hinders recharging Sediment accumulation is due to siltation, which is a result of removal of vegetative cover in the catchment area Apart from this, waste disposal in lake has resulted in eutrophic condition of the lake as a consequence of urbanisation and industrialisation.

Amruthalli lake is degraded mainly due to siltation, excessive input of domestic sewage, street and industrial effluents and dumping of organic waste materials from the surrounding areas. These have turned the lake eutrophic Due to this, the economic dependency of people living in the surrounding area has become less To avoid eutrophic conditions and to improve the economic dependency of people residing closer to the lake, appropriate conservation and restoration strategies are needed

Action plan for conservation of wetlands : Investigating the economic benefits of wetlands is a step in the direction of formulating Wetlands Conservation Action Plan (WCAP). The WCAP should be a cooperative programme involving government and non-governmental organisations in efforts to establish a comprehensive wetlands conservation programme for restoration, conservation and management of wetlands The goal is to create, reclaim, rehabilitate and protect wetland habitat in the watershed basin or a catchment based on ecosystem management approach The strategies towards this goal are (Ramsar, 1971):

1. *increase public awareness and commitment to protect wetlands from becoming extinct through a variety of outreach materials and activities;*
2. *develop a wetland database and increase understanding of wetland dynamics;*
3. *promote the wetland conservation in State protected areas;*
4. *enhance co-operation among State, District, Regional and Non Government partners;*
5. *strengthen legislation, policies, agreements and compliance;*
6. *strengthen local planning and commitment to protect wetlands;*
7. *improve coordination and planning between government and nongovernmental organizations, and*
8. *evaluate the outcomes of the programme and ensure a sound scientific basis for policy.*

Wetland policy guidelines : The objective of policy with respect to wetland conservation is to promote the conservation of wetlands to sustain their ecological and socio-economical functions, now and in the future (Lake 2000, 2000) Towards this end, the goals are,

- **maintenance** of the functions and values derived from wetlands;
- **no net loss** of wetland functions in regional lands and water;
- **enhancement and rehabilitation** of wetlands where the continued loss or degradation of wetlands or their functions have reached critical levels;
- **recognition** of wetland functions in resource planning, management and economic decision making with regard to all national/state programmes, policies and activities;
- **securement** of wetlands of significance;
- **recognition of sound,sustainable management practices** in sectors such as forestry and agriculture that make positive contribution to wetland conservation while also achieving wise use of wetland resources; and
- **utilisation** of wetlands in a manner that enhances prospects

The wetland policy at State level provides :

- A signal of commitment to wetland conservation and acts as a catalyst for mutually supporting action across the region;
- A heightened profile for the issue to call attention to wetland, socioeconomic and environmental benefits, to ensure that wetlands receive adequate consideration by the State government;
- Direction and support for individual decision makers to ensure that opportunity for the sustained wise use of wetlands is realized, to avoid or reserve wetland related conflicts;

- Clarification of specific State responsibility for wetlands, as well as a synthesis of existing legislation, policies and programmes which already contribute to wetland conservation:
- A consistent, co-ordinated approach among the many State agencies, which influence wetlands, aimed at adjusting activities, which conflict with wetland conservation and ensuring progress towards specific objectives and goals

A comprehensive policy on wetlands needs to be formulated to enhance the quality and increase the spatial coverage specific to the region, to offer some of the most environmentally productive and cost effective opportunities for wetland conservation The objectives should focus on addressing the following aspects,

- To reverse the current decline in the wetland base, ensuring no net loss and long-term net gain in the quality, quantity and permanence of wetlands
- To encourage partnerships in restoration, management, usage, through co-operative planning efforts with the primary focus on wetland conservation
- Draft procedures for administration of wetland usage and its conservation

The emphasis is placed on the formation of Regional Wetlands Forum, involving local educational, public and private organisations (involved in wetland issues) For effective functioning, the forum should consist of, researchers, school and college-students and teachers, economists, policy makers, representatives from the agricultural community, developmental concerns, conservation organizations, state and local agencies under the collaboration efforts from the Ministry of Forest and Environment, Department of Science and Technology, Indian Council of Agricultural Research and planning departments with the following responsibilities The policy should address the following

1 Define wetlands, classification (based on degree of saturation, type of vegetation, usage, soil etc), inventory, planning, wetland regulation, and conservation approaches (i e , acquisition, restoration, management and education).

2 Establish regional and state-wide goals to achieve long-term increase in wetland acreage, functions and values in emphasizing the economic uses (fishing, agriculture, drinking water supply, etc)

3 Draft programmes for preservation, conservation, restoration, and enhancing wetlands acreage and provide technical and adequate funding for wetlands mitigation and management programmes

4 Develop consistent standards concerning wetland water quality, and guidelines for mitigation, monitoring and restoration efforts

5 Encourage actions that promote efficiency of wetland-related permitting processes for the varied usage of wetlands for economic purposes (as fisheries, irrigation etc) by suitable policies and creation of concurrent permit review procedures.

6 Enhance co-ordination of governmental (state, central) and non-governmental organizations responsible for wetland conservation Action oriented restoration and conservation programmes could be initiated and monitored through discussion meetings of academicians, and planning and implementing agencies for providing a platform for exchange of ideas.

7 Help in the development of internal policies within state agencies like irrigation department, public works department, forest department, urban development and others that will encourage wetland conservation activities, which are compatible with programmatic goals of flood control, ground water recharge, water management, water pollution control, recreation, and others.

8 Establish inter-agency task force responsible for co-ordinating and information exchange among the agencies, boards, and departments as necessary to ensure co-ordinated development and implementation of wetland conservation program.

9 Integrate wetland policy and planning with other environmental and land use processes

10 Undertake cost-benefit analysis of the wetland resources derived by the society and economic evaluation caused due to the loss of wetlands.

11 Advise government to provide funds for wetland research and conservation programs

12 Formulate Wetland Protection Act as a legislative vehicle to restrict any disturbance of wetlands leading to loss in biodiversity dependent on them

Recommendations for effective wetland management are :

- Integration of different Government Agencies for effective implementation of activities related to restoration of wetlands, their sustainable utilization and conservation.
- A National Committee for Lakes and Wetlands reclamation, restoration and development is formed to

formulate a National Policy to evolve strategies for their sustainable utilization and conservation.

- A Comprehensive Plan is to be prepared to study selective, representative wetlands in a phased manner to create database with regard to their present status, sustainable use, management and conservation and to formulate strategies for their long-term management.
- Regular monitoring of wetland ecosystems through the involvement of Schools, Colleges and Universities Student's involvement including curriculum development concerning the protection of the wetland ecosystem.
- Mass awareness programme be chalked out and implemented through Governmental and Non Governmental Organisations (NGO) for popularization of the importance of the lakes, wetlands and rivers, and their role in the aquatic biodiversity and sustenance of human civilization.
- Lakes and Ponds in each Zilla Panchayath area be identified and their streams recharged through people's participation People should be made aware of wetlands' significance so that reclamation and conservation of these water bodies be taken up effectively.
- Fishermen's socio - economic aspects be taken into consideration while formulating wetland policies.

Education and training : Public needs to be better informed about the rationale, goals and methods of aquatic ecosystem restorations. In addition, scientists and researchers with broad training are needed for aquatic ecosystem restoration, management and conservation

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