



# The Biological Diversity of Village Ponds and its Crucial Role in Sustainable Development

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## Introduction

Sustainable Development demands the concrete human visualization and realisation that the world is a system that connects space along with being a system that connects time. It focuses intricately upon the needs of the entire human race and humanity and the limitations of nature and time. The biological diversity of village ponds has a vital role to play in the process. They individually and collectively cater to the essential requirements of the entire developmental process to pave the path for the conduction of progress and development without depletion of natural resources.

## The Villages

The villages are the smallest geographical units of global sanctity. The states of villages and their natural assets reflects the respective states and levels of development and progress. The paths, fields, orchards, houses, ponds, trees and shrubs within it and the forests in its vicinity govern their status. The proximity of the village to the forests determines the intensity of the role. The closer the village to the forests the more intense shall be the affect. In the same way the more the wave of urbanization in the village the lesser would be the biological diversity within it. Thus to ensure sustainable development the basic purity of the villages is to be maintained. It is only through the preservation of such purity that the fundamental biological resources can exist and thrive. The most potent mirrors of such commendable purity are the village ponds.

history, mystery and science of rural realities of developing, underdeveloped and partially developed nations. They also grace the gracious realm of the highly developed super powers. They are intricately wedded to biological identities carrying cultural concepts and social strains associated with religious tenets. Birds rendering the melodious morning or evening musical rhythms and flowers and plants sustaining the traditional roots outline and underline their phenomenal calm. The boundless biological treasures within them are matchless gifts for the present and the posterity. In addition to this they are explicit store houses of village water and soil. Their aquatic and edaphic characteristics sustain all adequate modes of development and progress.

## Historicity of Ponds

The origin of the word 'pond' is ascribed to the word 'pound' meaning a confining enclosure. As straying cattle are enclosed in a pound so water is enclosed in a pond. The International Ramsar Wetlands Convention sets the upper limit for pond size as eight hectares but most of the biologists refrain from adopting or accepting this convention. The researchers sponsored by the British Charity Pond Conservation have defined a pond to be a man-made or natural water-body which is between one square metre and twenty thousand square metre in area which holds water for four months of the year or more. Other European biologists set the upper limit at five hectares. Some regions of the United States define a pond as a body of water with a surface area of less than ten acres (forty thousand square metres). The term is also used for temporary accumulation of water from surface run-off. There are several regional names



for naturally occurring ponds viz. 'playas' in American Prairies, 'lochans' in Scotland, 'Tobhaa' in Punjabi and 'Talaab' in northern or eastern India.

## The Biological Diversity of the Ponds

The ponds protect and preserve a wide variety of organisms. The amphibians, the aquatic invertebrates, the aquatic plants and few mammals are the prominently visible ones.

The most common amphibians that live in ponds are the frogs, toads and the newts. Amongst the frogs, the Common Frog and the Indus Bull Frog call for a special mention. The Common Frog (*Rana temporalia*) has the ability to lighten and darken its skin in order to match its surroundings. The males turn greenish-blue in the mating season. The Albino Common Frogs have been found with yellow skin and red eyes. Their females are usually larger than males. The flanks, limbs and backs of the common frogs are covered with irregular blotches. Their eyes are brown with transparent pupils and they have transparent inner eyelids to protect their eyes while under water, as well as 'mask' which covers their eyes and eardrums. They have relatively short hind legs and possess webbed- sized feet. They feed on invertebrates of suitable size namely insects especially flies, snails, slugs, and worms. Their tadpoles are mostly herbivores feeding on algae, detritus and some plants. They hibernate in winter and breed in shallow still fresh water. The Indus Valley Bullfrog (*Hoplobatrachus tigerinus*) carries a green or olive colour with dark spots. They have a mounted head and more or less pointed snout. Their natural habitat falls in Myanmar, Bangladesh, India, Afghanistan and Nepal. Their males are slimmer while their females are stouter. The males have vocal sacs which help them in croaking loudly. The females have no vocal sacs. The Agile Frog (*Rana Dalmatian*) is also one of the most lively frog varieties gracing the calm of the village ponds. Amongst the toads of ponds, the Common Indian Toad (*Duttaphrynos melanostriatus*) is the most common one. It breeds during the monsoons. It has been often seen traced feeding on a large range of

invertebrates including scorpions. Next to the distinct amphibians inhabiting the ponds. Adult Newts have lizard like bodies. The Common or Smooth Newt and the Great Crested or Warty Newt are those commonly encountered. In the months of April and May, the village ponds depict the peak period of Smooth Newts obviously engrossed in the breeding displays. In the breeding season, male Smooth Newts also have a small breeding crest along the length of the back and are beautifully marked on the underside with dark spots and some fiery red coloration. Their females are drabber and brown in colour. Smooth Newts have a wonderful courtship dance in water with complex waving and lashing movements of the male's tail, swimming just ahead of the male, until mating takes place. Newt tadpoles have feathery, ruff-like external gills. The Great Crested Newts in breeding with their fascinating colours are a magnificent sight with dark wavy crests running along the back and their orange bellies spotted with black.

## The Invertebrates

Even the smallest pond normally possesses a huge variety of invertebrates. The dragonfly and damselfly species like pygmy damselfly (*Nehalennia speciosa*) and island darter (*Sympetrum nigrifemur*) are the salient ones. They also have the medicinal leech (*Hirudomedicinalis*) and the water beetle (*Graphoderus bilineatus*). The temporary pond specialists like fairy shrimps, clam shrimps and the tadpole shrimps are the other common invertebrates.

## The Birds

The commonly sighted birds are the egrets, the pond herons, the red wattled lapwings, the cormorants, the kingfishers, the ducks, the geese, the swans and the cranes.

The **Little Egret** is one of the most common Indian birds. It has a height almost the same as that of a village hen. Both the male and female Little Egret birds look alike. The female lays four bluish-green eggs in the month of July-August in





Northern India. In Southern India, the bird lays eggs in the months of November and February. The bird is swift and crafty and its food menu ranges from insects, fish and frogs to even small reptiles.

The **Pond Heron** (or the Paddy Bird) is a bird having a brown colour supplemented with maroon hair like plums on the back. It has a long white crest during the breeding season. The bird flashes its shimmering white wings, tall and rump, when it springs into flight. It has a variety of low conversational notes and queer mumbling sounds that a nesting pair utters. The bird is also addressed as the '**Saintly Heron**', as it stands hunched up at the remote corner of a water body, watching and waiting patiently for the fish to come within reach before it picks on it in a flash.

The Red Wattled Lapwing is one of the common Indian birds. It is a partridge like bird commonly found in pairs. The bird can be found all over India up to about eighteen hundred metres in the Himalayas and Peninsular hills. The colour of the bird is bronze-brown on above, white in below and its breast, head and neck are black. There is also a crimson wattle in front of each eye of this beautiful bird.

The **Pheasant tailed Jacana**, conspicuous by its striking white plumage from head to breast and by its long sickle shaped tail during the breeding season is the prime attraction of lotus ponds. This particular bird species is comfortable in walking on aquatic plant. On account of this ability, they are also popularly known as Lily-Walkers. Another intrinsic lover of lotus ponds is the bird named Purple Swamphen. It is a bluish-purple bird with a purple red gaudy beak, commonly found in marshy areas, all over the country, lurking around reed beds and water hyacinth plants.

The **Sarus Crane (*Grus Antigone*)** is the significant occupant of the Indian Sub-continent, Asia and Australia. It is the tallest amongst all the flight bird species of the world having height up to 1.8 metres. It is most common in the Central India and the Gangetic plains. Its healthy presence within or beside a pond is indicative of the healthy

environment and the adequately conserved biodiversity of the pond. The Saras Cranes forage on insects, crustaceans and small vertebrate prey. They form long lasting pair bonds and maintain within which they perform territorial and courtship displays that include loud trumpeting, leaps and dance like movements.

Another bird associated with ponds is the **Common Kingfisher** zoologically addressed as *Alcedo atthis*. Most of them are terrestrial. Having an average length of seventeen centimetres and average weight of thirty grams, they have orange under parts, bluish green wings, bright blue tails, long and pointed bills and short orange coloured legs. Their normal diet comprises aquatic insects, small fish and prawns. They usually hunt during morning or evening hours. They usually mate during the spring season. The males attempt to attract the females with the fish in their beaks. Their young ones are somewhat blue to pale red in colour.

## The Reptiles

The most prominent reptiles found in ponds are the snakes. They are excellent swimmers and consume newts and frogs. The **Grass Snake** has time and again been described in records. It is easily identified by its bright yellow collar contrasting with its dark greyish olive-green, black-patterned body. A Grass Snake can sustain itself on one frog every two or three days, or even fast for periods of a week, without obvious ill effect. They are also known to climb trees occasionally in search of bird chicks or eggs. Usually Grass Snakes are only seen slipping rapidly into the undergrowth or water when disturbed by humans but when faced with other would-be animal predators they can feign death rolling on their side or back, jaws agape and with tongue hanging out.

## The Fish

The carps are the most common fish associated with ponds. Various species of carp have been domesticated and reared as food fish



across Europe and Asia for thousands of years. They have been observed to be good and subtle. The Indian Carp (*Cyprinus catla*), the Grass Carp (*Ctenopharyngodon*), the Mud Carp (*Cirrhinus molitorella*), the Silver Carp (*Hypophthalmichthys molitrix*) and the Rohu (*Labeo rohita*) are the leading ones. In Europe, the most common carp is the Crucian Carp (*Carassius carassius*). The smaller ponds have small size fishes like the Stickleback fish.

## The Pond Plants

A well conserved pond must have native plants growing in it. They provide food, oxygen and shelter to the animals. Ponds in the open are healthier than ponds in the shade due to the sole reason that green plants need sunlight to make their food. The smallest plants in a pond are the microscopic phytoplankton which provide most of the food in a pond. The phytoplankton and larger algae form the first part of the pond's food chains. Pond vegetation grows in areas called zones. Plants such as great willow herb and meadow sweet grow in the bankside zone. They like damp places but are not true water plants. The emergent plants like yellow iris and mud-sedge grow nearest to the pond edge in the marsh zone these plants provide good hiding places for some young pond animals such as young frogs and the tall stems are used by dragonfly nymphs when they climb out of the water before emerging as an adult.

In the aquatic zone live the truly aquatic plants. Some of them float on the surface with tiny roots dangling in the water e.g. **Duckweed** and Frogbit. Others have their roots buried in the mud at the bottom of the pond and their leaves float on the surface e.g. Water-lilies and crowfoot.

There are also fully submerged plants such as **Starwort** and **Spiked milfoil**. These produce most of the oxygen so it is important that they receive plenty of sunlight (oxygen is produced during photosynthesis). If the plants on the surface are completely covering the pond then some of them should be pulled out or else the submerged plants will suffer.

## The Microbes in a Pond

The ponds are potent shelters of several categories of microbes for the intrinsic observation and study of the inquisitive microbiologist. They have the bacteria, the protozoa, the algae and the rotifers.

**Bacteria** is a large group of single celled organisms that are found in every corner of the earth. There are approximately five thousand one hundred and fifty bacteria on the earth that form a major part of the biomass. Cyanobacteria are very commonly found microorganisms in water. The bluish-green colour of water in ponds or ditches is attributed to these organisms. Nostoc and anabaena are common cyanobacteria that are found in pond water. Spirochaete is another group of bacteria commonly found in pond water that unlike cyanobacteria have numerous hair like structures that make them fast movers.

Among the **protozoans**, the ponds have the microorganism Euglena that moves with the help of flagella and Amoeba that moves with the help of pseudopodia (false feet). In addition to these, they have Ciliates like paramecium, vorticella and ophrydium that move in water with the help of their numerous small hair like structures called the cilia.

Some of the common algae found in pond water are **chlamydomonas**, **euglena** and **spongomonas**. While chlamydomonas is a free swimming flagellate, spongomonas use their flagella to collect food instead of moving around and live in a gelatinous matrix. **Volvox** is an alga that lives in colonies. **Diatoms**, **spirogyra**, **oedogonium**, **cladophora**, **zygnema** and some filamentous types of alga that are common microorganisms found in water.

**Hydra** is another fresh water animal that is most commonly found in pond water. This animal belongs to the class hydrozoa. It is a predatory animal that hunts its prey with the help of specialized stinging cells called cnidocytes. These stinging cells are present in the tentacles that





surround the mouth. **Rotifers** are a type of multicellular micro-animals that are commonly found in fresh water. They get their name from the tuft cilia that is present at the front of the body around their mouth. They use their cilia to propel themselves and also direct food into their mouth. Rotifer's diet includes algae, dead bacteria and waste of fishes.

## The Mammals

The water voles and the water shrews are the two mammals usually associated with ponds. They are also convenient shelters for the large semi-aquatic rodent known as the **American Beaver** that has been recorded to possess the potential of holding its breath for fifteen minutes. It is an herbivore having habitats in Europe and Asia. It builds underwater entrances. It also carries a creature known as '**Raccoons**' with fluffy furs and desiring to eat blackberries. They love to go on night prowls. Their tails have rings about them (usually 4-10 rings). The smallest mammal of ponds are the Opossums. They are omnivorous who like Garbage and dead animals. They use their keen sense of food to locate food. Their tails are mainly hairless and black. They have fifty teeth more teeth more than any mammal. The Muskrats having big heads, short ears and webbed feet are also observed in ponds. They eat roots, crayfish, frogs, snails, cattails and bulrush. Their babies are called kits. They make den in water with an underwater entrance by burrowing. Their dens are made out of packed mud and twigs.

## The Peculiarities of Pond Life

The most noteworthy feature of ponds is the fact that the community in one pond may be quite different from that in another, even if the ponds are close together. This is because most of the pond animals cannot travel from one pond to another. As a matter of fact, the water temperature, oxygen content, water cleanliness and the material of the pond bottom have an influence on the kind of life present in it. In any pond it is essential that there is a balance of different kinds of organisms so that

there is enough food for them to live and reproduce. Many different foods are to be found in a pond because each animal eats different things. A pond, therefore, may have combinations of three different food webs, one based on larger plants, another based upon decayed plants and the other based upon algae. Hence, ponds often have a large number of different animal species using the wide array of food sources. They therefore provide an important source of biological diversity in landscapes. They also provide a natural habitat to some species that have become or are becoming rare like the water violet, the great crested newt, the natter jack toad and several species of dragon flies.

## The Role and Importance of Ponds

Ponds are central to the life and prosperity of the whole eco-system in rural India. In fact villages originate around ponds. Rain water gets harvested naturally by the pond, gets stored up, recharging the ground water and serving as an indicator of the water table in the village. Ponds have evolved their own unique biodiversity, wherein each species discharges its specific ecosystem functions. The classic lotus and water lilies blooming, clumps of the submerged 'keystone weed Hydrilla, harbouring myriads of microbes and attracting varieties of shrimps, water bugs and snails, marginal reeds (Typha) with colourful but vanishing dragon flies and the duck weeds (**Spirodela** and **Lemna**) helping to heal the waters by phytogmediation, extracting the excessive nutrients and pollutants from the pond and also serving as food for fishes, tadpoles, ducks and cattle are the wide variety of greenery producers in and around the ponds.

The ponds have a profound cultural and historical significance because their sediment records can tell us about the way of life of our ancestors. They also play a crucial role in maintaining and encouraging the link between people and wildlife. There are numerous instances of village ponds that are worshipped and adored by the villagers since times immemorial. The weekly,



monthly and annual fares on the banks of ponds, remains a salient reality even till the present times. Thus the Biodiversity Value of ponds is based upon the three fundamental truths namely their status as a critical habitat for uncommon and rare species, their role as stepping stone habitats and their value as biodiversity hot spots. They can be used as outdoor laboratories for education and research. Properly managed ponds are the most potent and enlightening centres for recreation and nature tours and above all for sustainable development . They epitomise the universal evolutionary theory of the great philosopher and thinker Henryk Skolimowski which considers the universe as a dynamic product of four categories of evolution namely Geological, Biological, Epistemological and Theological. The concept recently reappeared in an article of Dr. Veer Singh titled 'Let our Gods be in constant evolution' published in The Times of India of fourteenth April, 2015.

### **Threats to Ponds and their Biodiversity**

Ponds are threatened by many human activities such as development and intensive agriculture and by climate change. Pollution from run-off from agricultural land. Drainage of ponds is a frequent problem in agricultural areas. Overgrazing and wading is turning ponds to muddy holes. Nutrient sources such as pastures, human sewage and even lawn fertilizer is causing explosive growth of algae and the consequent loss of rooted plants and many other aquatic species.

The most noticeable kind of pollution of ponds is the thoughtless dumping of rubbish in them which tends to destroy pond life. Another serious threat to ponds is chemical pollution as a result of modern farming methods and the use of artificial fertilisers. Powdery chemical fertilisers containing nitrates are put on the crops to augment their growth but they can also be washed off by rain into nearby ponds. They do not poison the plants but the rich supply of nitrogen causes the water plants, especially the algae to grow very quickly. The plants use up so much oxygen during the night and during decaying processes that there is none left

for the other pond-life. The growth also prevents sunlight from reaching the organisms below. Eventually all the algae die leaving an obnoxious decaying mass. Roads near ponds can kill large numbers amphibians and turtles that may migrate to and from the pond as part of their annual breeding cycle. Many well-intentioned people introduce fish to ponds, being unaware that some species of fish eat aquatic plants, stir up sediment and eat the young of amphibians. The construction of retaining walls, can severely degrade the life in a pond. However the gravest threat to the biodiversity and beauty of ponds is the human act of conversion of ponds to other land usage. Detailed surveys conducted by several Non-Government Organisations indicate that in the last one hundred years, about forty percent of the old village ponds have been choked or filled up for residential or office purposes. The intensity and gravity of the situation in the villages of India is greater. The condition in many villages has become immensely pathetic as their present is totally devoid of any water body.

### **Management and Eco-Restoration of Village- Ponds**

The management of village-ponds comprises a systematic mixture of certain actions that are to be dispensed with and certain specific tasks that we have to perform. The most important note of caution is that we have to totally dispense with the act of dumping any non-biodegradable wastes (especially plastics) in the pond. We also have to stop the habit of washing linen and vessels in the pond. For the proper maintenance of ponds their management can be handed over to Women Self Help Groups. In addition to this, the force of NSS volunteers should be used periodically for its scientific cleansing. The organisation of summer camps of students to ponds shall also turn out to be fruitful for the cause of sustenance of water and biodiversity of the ponds. They would also augment the level of human awareness pertaining to conservation of water and ponds.





Most of the village ponds require a pragmatic eco-restoration. The most important task in this direction is the de-silting of the ponds by its annual deepening and widening, leaving sloping margins all around. An open shallow well dug at the lowest point in the pond helps in the year round conservation of water and its biodiversity. The construction of flat mounds (islets) with vegetation and rocks, in the midst of water will enhance the habitat diversity to attract birds and other biodiversity. The channelization of the free flow of rain water from the village catchments is essential for the eco-restoration of ponds. Another significant task required for the purpose is the stocking of the various niches of the pond with native vegetation and animals.

### **The Concluding Note**

Let us collectively conceive of village ponds, nursing a high ecological interest and associated

with water that is free from pollutants and having low levels of soil nutrients. The particular conception can become a reality only if we become reasonably aware of their profound and unrestrained biodiversity and their socio-economic sanctity. We have to provide each village with an aquatic hot spot breathing alive in the ponds. The adequately transparent water regime, the captivating amphibians, the coiling and crawling reptiles, the vibrating fish, the chirping birds and the inquisitive mammals moving within or without the ponds, have to be watched and observed. The role of the microbes has to be appreciated and assessed. The essential task of the systematic eco-restoration and sustained management of ponds has to be performed by individuals, groups and organisations acting in unison for the noble cause. It is an essential requisite for ensuring the sustainability of development and progress.

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**Humankind has not woven the web of life.**

**We are but one thread within it.**

**Whatever we do to the web, we do to ourselves.**

**All things are bound together. All things connect.**

**– Chief Seattle, 1854**

