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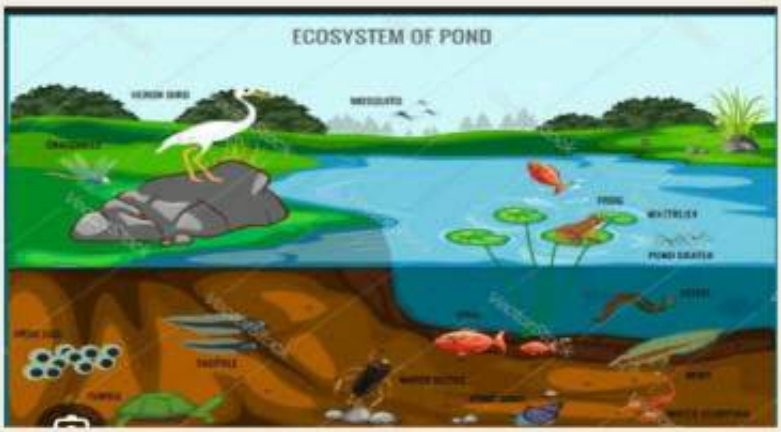
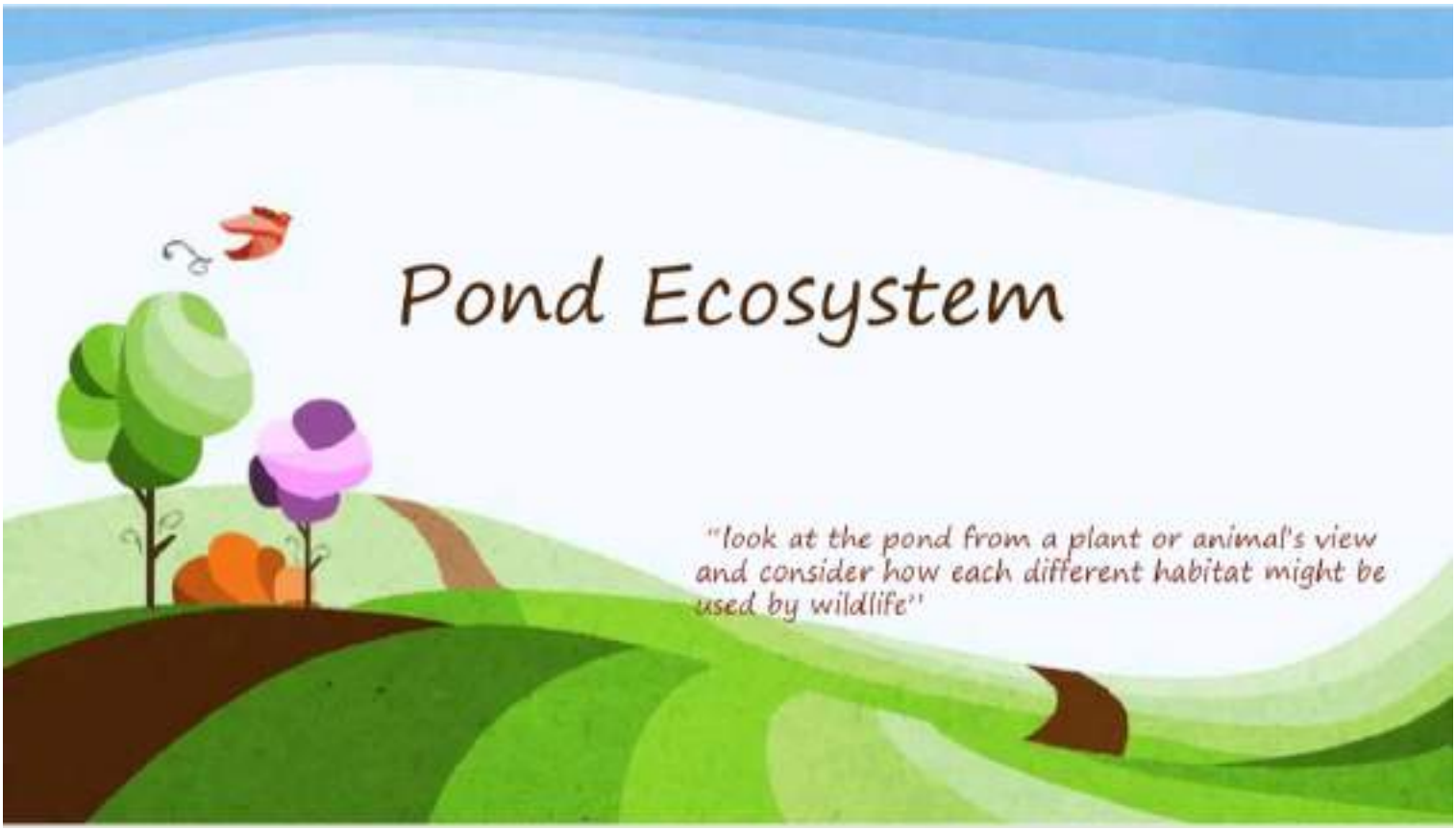
ECOSYSTEM STRUCTURE – POND ECOSYSTEM

BOTANY (MINOR) SEMESTER – 3 TOPIC




Pond Ecosystem
"look at the pond from a plant or animal's view and consider how each different habitat might be used by wildlife"

ECOSYSTEM

- Ecosystem is the basic functional unit with which ecology deals since it includes both the organisms and non living environment ,each influencing the properties of the other and both necessary for the maintenance of life on earth.

POND ECOSYSTEM

- A pond ecosystem refers to fresh water ecosystem where there are communities of organisms dependent on each other with the prevailing water environment for their nutrients and survival.Usually ponds are shallow water bodies with a depth of 12-15 feet in which the sun rays can penetrate to the bottom permitting the growth of plants there

The functional components of a Pond ecosystem are-

Biotic Components

- A biotic factor is any living component that affects the population of another organism, or the environment.
- This includes animals that consume the organism, and the living food that the organism consumes. Biotic factors also include human influence, pathogens, and disease outbreaks.
- Each biotic factor needs energy to do work and food for proper growth.
- All species are influenced by biotic factors in one way or another.
- For example, if the number of predators will increase, the whole food web will be affected as the population number of organisms that are lower in the food web will decrease due to predation.

Abiotic Components

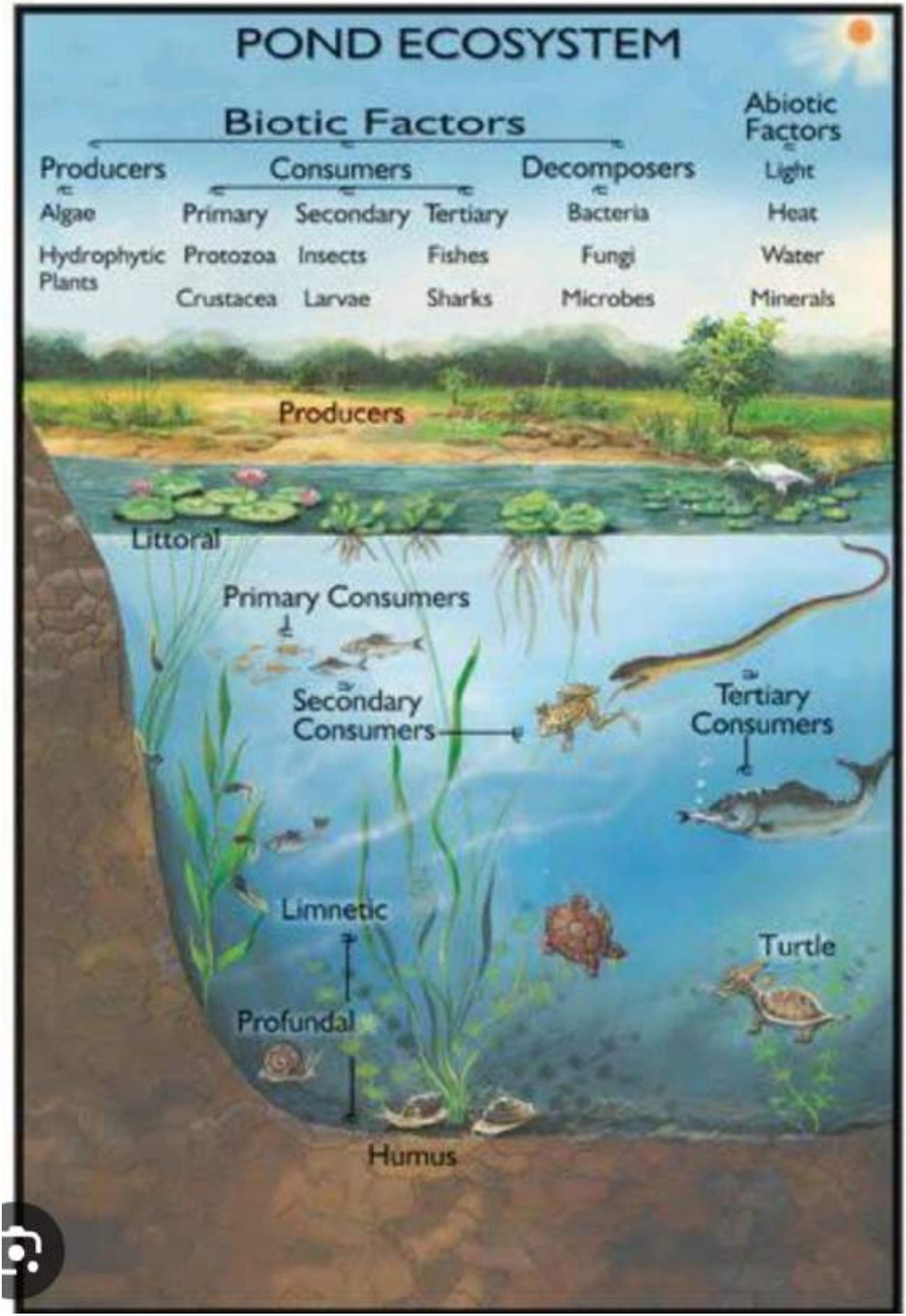
- In biology and ecology, abiotic components or abiotic factors are non-living chemical and physical parts of the environment that affect living organisms and the functioning of ecosystems.
- Abiotic factors and the phenomena associated with them underpin all biology.
- Abiotic components include physical conditions and non-living resources that affect living organisms in terms of growth, maintenance, and reproduction.
- Resources are distinguished as substances or objects in the environment required by one organism and consumed or otherwise made unavailable for use by other organisms.

BIOTIC COMPONENTS

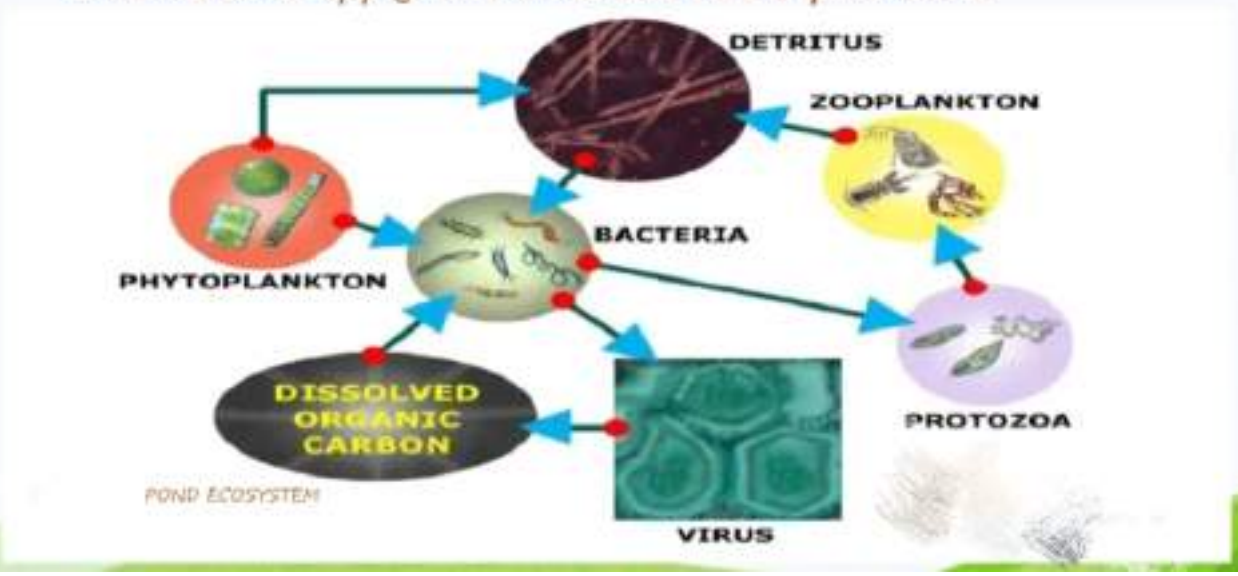
The biotic components of Pond ecosystem consists of

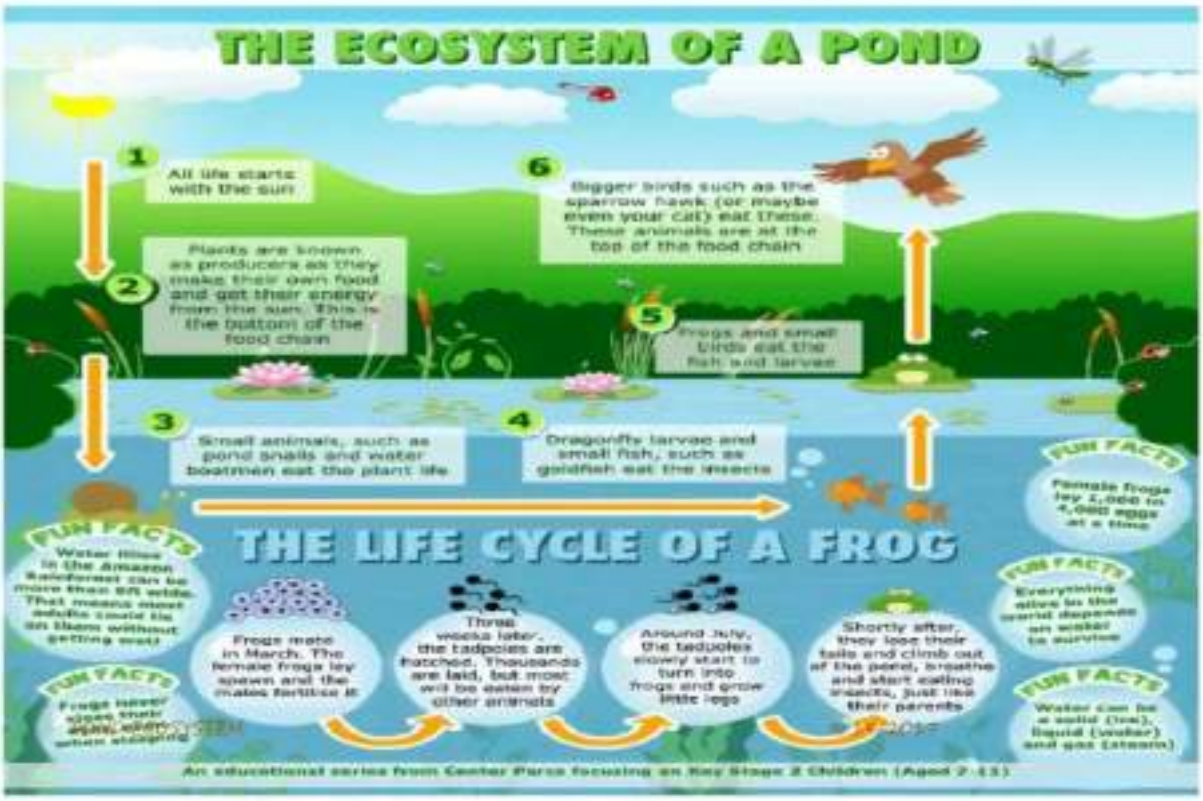
- **Producers:-** the plants of the ecosystem which are able to synthesize food from the inorganic components to make food.
- **Phytoplankton, literally "wandering plants," are microscopic** algae that float in the open water and give it a green appearance.
- **Submerged plants grow completely under** water
- **Floating plants include plants that float on** the surface and plants that are rooted on the bottom of the pond but have leaves and/or stems that float.

- **Consumers:**-Consumers of Pond ecosystem are heterotrophs which depend for their nutrition on other organisms.eg:insects,beetles,fishes.
- **Primary Consumers :** The primary consumers in a pond's food web consist of tiny herbivorous animals that feed on algae and other aquatic plants to sustain themselves. These animals include insects, tadpoles, very small fish and snails. They also include a variety of nearly microscopic animals collectively known as zooplankton.
- **Secondary Consumers :** The next strand in the aquatic food web is the secondary consumers. They eat the primary consumers. This second level of animal consumers includes many species of fish, frogs, other amphibians, crayfish and reptiles such as turtles and water snakes.
- **Tertiary Consumers :** The aquatic food web also includes the tertiary consumers, which eat the animals of the primary and secondary levels. This third level of animal consumer includes fish- and frog-eating water birds, fish-eating hawks, numerous small mammals and human beings. Sometimes human beings and predator birds are classified as top consumers rather than tertiary consumers.


POND ECOSYSTEM
Biotic Factors
Abiotic Factors
Producers
Consumers
Decomposers
Light
Algae
Primary
Secondary
Tertiary
Bacteria
Heat
Hydrophytic Plants
Protozoa
Insects
Fishes
Fungi
Water
Crustacea
Larvae
Sharks
Microbes
Minerals
Producers
Littoral
Primary Consumers
Secondary Consumers
Tertiary Consumers
Limnetic
Turtle
Profundal
Humus

- **Decomposers:-** Most of the decomposers of Pond ecosystem are saprophytes but some parasites are also found .Bacteria,fungi like Aspergillus Cladosporium are decomposers.Generally the decomposers either live in the soil layer beneath water or in the mud.They act on dead and decayed organic matter of plants and animals and supply raw materials to the producers.




THE ECOSYSTEM OF A POND
1
All life starts with the sun
2
Plants are known as producers as they make their own food and get their energy from the sun. This is the bottom of the food chain
3
Small animals, such as pond snails and water boatmen eat the plant life
4
Dragonfly larvae and small fish, such as goldfish eat the insects
5
Frogs and small birds eat the fish and larvae
6
Bigger birds such as the sparrow hawk (or maybe even your cat) eat these. These animals are at the top of the food chain
THE LIFE CYCLE OF A FROG
Frogs mate in March. The female frogs lay spawn and the males fertilise it
Three weeks later, the tadpoles are hatched. Thousands are laid, but most will be eaten by other animals
Around July, the tadpoles slowly start to turn into frogs and grow little legs
Shortly after, they lose their tails and climb out of the pond, breathe and start eating insects, just like their parents
FUN FACTS
Water lilies in the Amazon Rainforest can be more than 6ft wide. That means most adults could lie on them without getting wet!
FUN FACTS
Female frogs lay 2,000 to 4,000 eggs at a time
FUN FACTS
Everything alive in the world depends on water to survive
FUN FACTS
Water can be a solid (ice), liquid (water) and gas (steam)
An educational series from Center Parcs focusing on Key Stage 2 Children (Aged 7-11)

Lentic & Lotic Ecosystems

- **LENTIC FEATURES** :

A lentic ecosystem entails a body of standing water, ranging from ditches, seeps, ponds, seasonal pools, basin marshes and lakes. Ponds, due to their having more light penetration, are able to support a diverse range of water plants.

- **LOTIC FEATURES** :

A lotic ecosystem can be any kind of moving water, such as a run, creek, brook, river, spring, channel or stream. The water in a lotic ecosystem, from source to mouth, must have atmospheric gases, turbidity, longitudinal temperature gradation and material dissolved in it.

Importance of pond ecosystems

1. **Biodiversity** : Pond ecosystems are very important habitats for so many different types of fish, birds, plants and crustaceans as well as insects such as dragonflies, damsel flies and pond skaters.
2. **Ubiquity** : Pond ecosystems can be found on every continent on the planet. That makes them very important for the life of organisms all over the world.
3. **Abundance** : Pond ecosystems are very abundant. Not only can they be found almost everywhere, they can be found plentifully. That, again, makes them a key habitat for many different species.

4. **Source of hydration** : Even if they do not actually live in the pond ecosystem, many species of animals will come to pond ecosystems whenever they need a drink. A key example is a watering hole in a prairie or desert. Humans can also use these ecosystems as a source of water.

5. **Beauty** : Pond ecosystems are very beautiful as well. As we watch the sunlight reflecting off the surface of a pond we can feel inspired, calm and in touch with nature.

Characteristics of pond ecosystems.

1. **Still waters:** pond ecosystems are lentic ecosystems – i.e. they involve stagnant or standing water.

2. **Surrounded by banks:** by definition, pond ecosystems are surrounded by either artificial or natural banks.

3. **Wet:** these ecosystems are wet and humid ones.

4. **Different levels:** distinct communities of creatures will live at different levels of a pond. Crustaceans and deep water fish may live at the lower level, for example, whilst birds and blooming plants may live towards the surface.

5. **Variable in size:** some pond ecosystems can be very small whilst others can be almost as large as a lake.

Types of pond ecosystem.

- Salt ponds
- Garden ponds
- Freshwater pools
- Vernal pools
- Underground ponds
- Mountain Ponds
- Farm Ponds

1. Salt ponds.

- Salt ponds contain brackish (i.e. salty) water and can occur close to the sea side where waterlogged ground creates natural pools.
- Salt ponds can also occur in rocky areas on the beach, though here they are called rock pools.
- It is also possible to find salt ponds inland, thanks to the presence of brackish streams created through streams flowing through salty rocks.

2. Garden ponds

- Garden ponds can be excellent wildlife habitats, and can make a contribution to the protection of freshwater wildlife Invertebrate animals such as dragonflies and water beetles, and amphibians can colonise new ponds quickly.

- Garden pond owners have the potential to make many original and valuable observations about the ecology of small waterbodies , which garden ponds replicate.

3. Freshwater pools

- Freshwater pools can form anywhere inland, either from rainfall or from the presence of water saturating the soil.
- They can also be created by rivers flowing in to a depression in the ground.
- They can be home to fish, birds, amphibians, crustaceans and many other kinds of wildlife.

4. Vernal pools

- Vernal pools are seasonal ponds.
- They form in depressions in the ground, but only during certain types of the year when the rainfall is heaviest. As a result, they will attract certain types of animals and birds that are in need of a drink whenever they appear and at other times of the year will be relatively deserted – one example for instance is a seasonal oasis in the desert.
- These types of pond ecosystems are sometimes referred to as ephemeral pools as well, to reflect the fact that they only exist at certain times of year.

5. Underground ponds

- Ponds can also form underground, in the rocky environment of caves. Here, a surprising amount of life can be found, including fish, different bacteria, lichens and so on.

6. Mountain Ponds

- Formed by glaciers
- Bottoms range from being rocky, graveled or muddy.
- Most of the time Mountain Ponds have ice in them and they usually dry up at some point during the summer.
- Sedges grow along its margins. In spite of the pond's short summer season, a variety of animals and plants live in these icy waters.

7. Farm Ponds

- Man-made ponds built to help keep the farmlands fertile.
- It should also have a spillway to control the water level.
- Farm ponds usually become abundant in fish, and are usually good waters for swimming and boating.
- They should also fill from seepage, not from another stream which would fill the basin of the pond with silt and eventually kill the pond.

What makes a good wildlife pond?

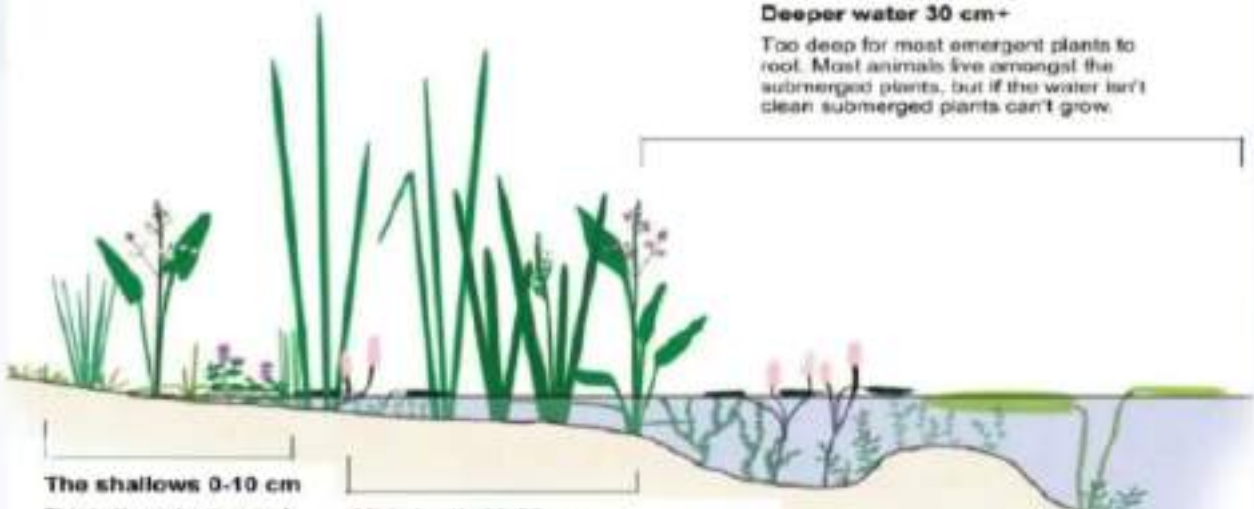
1. Clean water : The most important factor influencing the wildlife value of a pond is whether or not it is fed by clean, unpolluted, water. This generally means water with low levels of nutrients (like nitrates and phosphates) and heavy metals, and no pesticides or other manmade chemicals.
2. Ponds free from heavy disturbance : In areas of public access, unpolluted and high quality clean water ponds are impacted because of activities such as fishing, duck feeding and regular disturbance by dogs. The water becomes cloudy and turbid, and the pond becomes unable to support submerged plants.

3. Broad shallow margins : Most pond animal species live in very shallow water at the edge of the pond in water which is between 0 and 10 cm deep. Often ponds which are well vegetated can appear to have dried out – but if we consider it from the point of view of the invertebrates and plants which only need a few centimetres of water, we find that many ponds still have plenty of water.

4. Moderate grazing can help to increase biodiversity : Grazing can prevent single plant species from dominating a site. Animal grazing and hoof poaching creates patches of bare ground where a wider range of non-competitive plant species can germinate.

5. Trees and shade : There is a perception that shade is bad for pond biodiversity and that trees should be removed to allow light to the water and open up views across a pond. This is often not the case. In fact, in semi-natural habitats such as the New Forest, tree shade and leaf litter, combined with clean unpolluted water, are important habitats for a number of species found only in ponds which have areas of significant shade and tree cover.

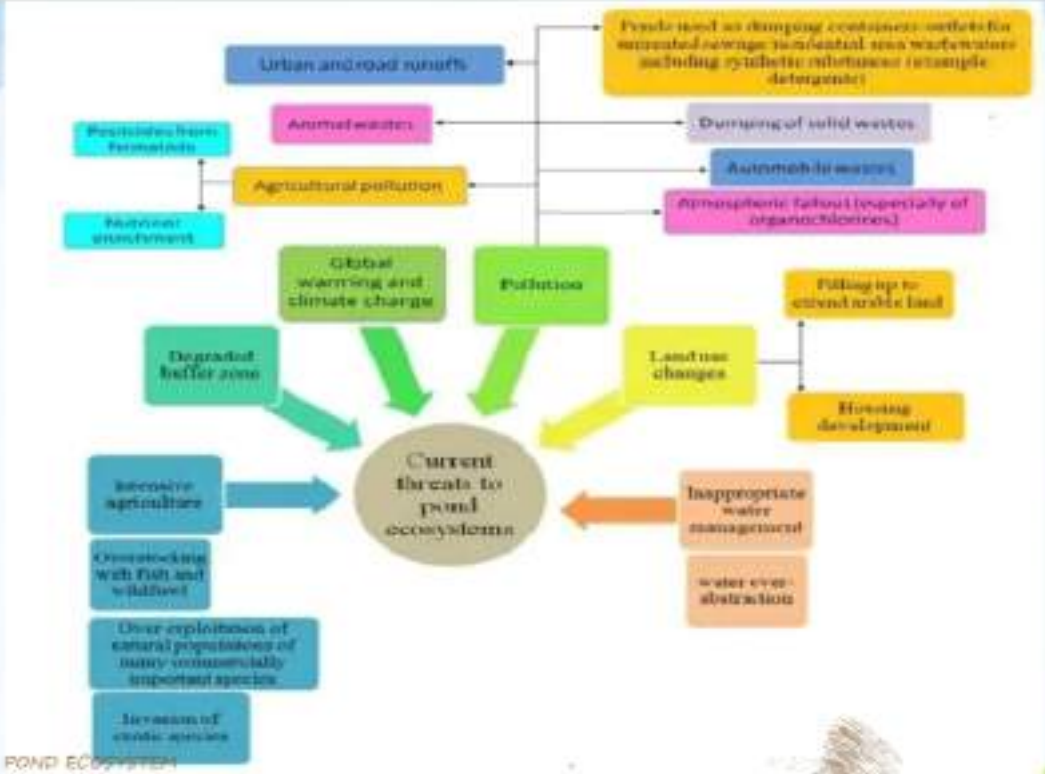
Figure 1.1 Identifying the most important habitats for pond wildlife



Human Impacts on Pond Ecosystems

- OVERUSE : Humans can have a major impact on freshwater systems is through water overuse. The same waterways that support wildlife and plants also provide municipal water for cities and towns, and when consumption outstrips the natural regeneration of these waterways, it can negatively affect the ecosystem.
- POLLUTION RUNOFF : Freshwater ecosystems near towns and cities also face threats from runoff and pollution. Industrial dumping, particulate pollution from combustion engines, and agricultural fertilizers and pesticides can all end up in rivers and streams, either falling there directly or carried to the waterways by rain.

- WASTEWATER : While municipal sewage plants and livestock operations release only treated water into the environment under normal circumstances, system failures and floods can trigger a release of untreated sewage into the water cycle. Depending on the particular toxicity of the spill, it may kill large numbers of wildlife, or it may only alter the nutrient balance in the water.
- Runoff containing fertilizer and other wastes, and industrial dumpings enter into rivers, ponds, and lakes tend to promote abnormally rapid algae growth- ARTIFICAIL EUTROPHICATION
- When algae die, dead organic matter ends up in the water. This makes the water unusable, and it kills many of the organisms living in the habitat.



A summary of factors which are threats to the functioning of the pond ecosystem

Possible Solution:

Pond Aeration :

- Aeration circulates top surface water with cooler low flowing water.
- Aeration includes an air compressor on the outside of the pond and an air diffuser located near the bottom of the pond.
- Either air stones or air membrane diffusers allow the diffussed air to enter into the water column of the pond increasing the amount of dissolved oxygen in the pond.
- Dissolved oxygen levels increase with aeration which means your fish will stay active and healthy despite spikes in sun and temperatures.

- To restore a pond or lake to a healthy condition, we must restore the natural processes that allow them to assimilate the nutrient load that it receives. Eg Blanket weed
- Ideally, nutrient inputs should be reduced or eliminated wherever possible. Only use phosphorus-free fertilizers on lawns.
- Preventing nutrients from flowing down storm sewers is a good way to prevent pollution.
- Condition your water with a pond de-chlorinator during water changes. Insuring the pond water is free of Chlorine will keep the fish's slime coat thick and healthy.

Real hero: Why this man dug a pond for 27 years all by himself in Chhattisgarh

- Saja Pahad village in Chhattisgarh's Koriya district faced water shortage. Villagers found it difficult to quench the thirst of their cattle, but they did not know what to do. And the government, too, did nothing.

- Because of continuous negligence from the officers and other government authorities this man took a decision.

- Then one day 15-year-old Shyam Lal decided to take his spade and dig a pond. Fellow villagers laughed at him. But the tribal teenager was determined.

- Lal identified a spot in the forest in and kept digging — for 27 years, according to villagers.

- Lal's work comes as a relief at a time Chhattisgarh is suffering from drought-like situation this year. The rainfall has been 10% short of the average over 10 years. District collectors have been directed to ensure proper utilisation of irrigation facilities.

The 5 Keys to establishing an ecological balance

- Choose plants from each of the 5 Pond Zones (see Zone Map) to create a well balanced selection.
- Don't add more fish than your pond and filter will support and don't over feed your fish.
- Choose the right pump to circulate the pond water.
- Choose the right skimmer and biological filtration system.
- Lots of rocks and pebbles to create a habitat for beneficial bacteria.

Conclusion

- A pond is a living ecosystem – a balance of fish, plants, and beneficial bacteria that compliment and support each other.
- When the ecosystem is balanced, a properly designed and built pond will require very little maintenance.
- A variety of natural, and fish friendly materials are available for those times when an adjustment is needed to keep the ecosystem in balance.