

POND CONSTRUCTION FOR SUSTAINABLE DEVELOPMENT OF WATER RESOURCES

CONSTRUCTION DES ETANGS POUR LE DEVELOPPEMENT DURABLE DES RESSOURCES EN EAU

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ABSTRACT

Ponds, have been constructed in various plains since long ago by farmers and are one of the important components of traditional irrigation systems in Mazandaran province of Iran. These ponds store runoff water, which is used for irrigating adjacent fields. They have also become important components of the eco-system, as they encourage natural growth of vegetation, provide suitable places for forming habitats of immigrant bird and promote groundwater recharge. This paper discusses the ponds, including their distribution, water storage capacity, important functions and values and is supplemented by visuals of some of the ponds in the Tajan plains of the Mazandaran province in Iran.

Key words: Ponds, Irrigation, Ecosystem, Groundwater recharge, Mazandaran province, Iran

RESUME

Depuis longtemps, les étangs ont été construits par les agriculteurs dans les diverses plaines, et étaient l'une des importantes composantes des systèmes d'irrigation traditionnels dans la province de Mazandaran en Iran. Ces étangs stockent de l'eau de ruissellement, qui est utilisée pour irriguer les champs adjacents. Ils sont également devenus les éléments importants de l'éco-système, car ils favorisent la croissance naturelle de la végétation, fournissent les lieux appropriés d'habitation aux oiseaux immigrants et favorisent la recharge des eaux souterraines. Ce document traite les étangs, y compris leur distribution, leur capacité de stockage d'eau, leur fonctionnement et leur valeur avec l'aide des visuels de certains étangs de la plaine du Tajan de la province de Mazandaran en Iran.

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Mots clés: *Etangs, irrigation, écosystème, recharge des eaux souterraines, province de Mazandaran, Iran.*

1. INTRODUCTION

Worldwide, ponds have been constructed to store runoff water for various uses. Most important of the uses have been for irrigation, bathing, washing and also for the drinking water source for cattle and in some cases even for humans, depending on the pond water quality and availability of water treatment facility. Traditionally, pond construction proliferated in arid and semi-arid areas where rainfall is low and uncertain. Naturally occurring ponds in both low and better rainfall areas are also found in large numbers the world over. Small community based human habitats, practicing agriculture by most of the population, absence of technologies for the construction of huge dams, reservoirs and river diversions and traditional instinct to live in harmony with nature, all were responsible for the thriving pond culture in the earlier periods.

While providing irrigation water to the crops had been the major function of most of the ponds, they have been performing many other functions. Some of these additional functions are providing a favourable eco zone for sustaining various life forms, especially in the arid and semi-arid regions, groundwater recharge, source of drinking water, community meeting places adjacent to the ponds, tourist spots, fishing, etc. In the context of Iran, ponds have been specifically useful in supplying irrigation water, especially in those plains where defined water rights of the river water did not exist. Ponds have been suitable places for storing significant runoff water volume, which otherwise would have been lost from the area if the ponds were not there. Ponds in upstream of a plain and at places adjacent to rivers are more useful and reliable, as compared to at the downstream of the plains and far from natural water bodies such as rivers and tributaries.

Due to large area under ponds and their good distribution in the Tajan plain, this article presents the result of studies on their providing irrigation water, developing groundwater resources, collecting drainage water and their economical, environmental and tourism values.

Ponds in the Mazandaran Province

About 700 ponds with a total area of 15500 ha are spread from Ramsar to Galooghah in Mazandaran province. Of these about 30% are located in the Tajan plain. Considering 2 meters as their depth, 85 to 90 MCM of water is collected, stored and prevented from waste annually. Although ponds have been constructed primarily for storing and providing irrigation water, by increase of nutrients, variety of vegetation cover and growing hygrophite plants, they have turned into more complex ecosystems and consequently suitable habitation for birds.

Irrigation by pond water. These small ponds distributed over a large area in Mazandaran plains are mostly fed by the small natural streams, precipitation, runoff from upstream lands and hill slopes, agricultural waste water, etc. Compared with storing and utilizing water by a 90 MCM reservoir dam, using similar or even lesser quantity of stored water from the distributed ponds would be more economical. In addition, by constructing the ponds more lands across the province would have the access to stored water. Strategic crops, such as rice and wheat cultivated in study area rely on ponds' storage water. Compared with dry

lands and those with low water availability, soil fertility and productivity of these lands are significantly high. This increases the value of the land.

Flood control by ponds. Tajan ponds are valuable reservoirs for flood control, as they collect storm water before they accumulate and increase in the proportion to cause floods. Accordingly, they prevent agriculture lands and rural roads from flood damage.

Groundwater recharge and salinity control. Water infiltration through pond floor in central and southern areas of Tajan plain increases the groundwater storage where the groundwater table is low and is used for irrigation water for orchards and also for drinking purpose. At the same time, the recharge of fresh water prevents rise of saline groundwater, particularly in coastal lowlands. According to all ecological, economical and social values of Tajan plain, probable negative effects of water penetration through adjacent lands, such as drainage congestion, salinity development, etc., would be negligible. Besides, corrective actions, such as principal drainage around the ponds and lining the water conveyance canals in the flat terrain would save water and further reduce occurrence of undesirable side effects. Some of large ponds in Thailand were de-watered without environmental studies that led to ecological and hydraulic imbalance in groundwater resources and land drainage. Large amount of money had to be spent in order to compensate the ecological damages.

Fish culture. Growing 6 species of fish in these ponds with significant economic benefit is one of their main advantages. According to abundant nutrition resources for aquaculture in the ponds, 300-500 kg/ha annual fish products in dam reservoirs and ponds without any excessive artificial nutrition would be possible. Relevant organizations have added warm water fingerling fish farming, such as *Amor*, *Carp* and *Phytofauge* into the ponds which multiplied the fish products.

Ecological effect. Ecological effect of the ponds is another important aspect, which influence the gene bank improvement, food sources, environmental variety and developing the social values such as tourism. There would be no improvement in wildlife variety in these habitats without these ponds. Current variety and distribution of birds, specially the immigrant and native aquatic birds are due to ponds ecosystems. Aquaculture variety of fish, amphibians, reptiles and aquatic insects in land habitats is very rare. Agricultural drains which contain phosphate and remnant of organic fertilizers penetrating through the ponds lead to growing plants such as straws, bulrush, water lily and willow which are suitable locations for birds' nesting. Sufficient food resources and suitable habitats have attracted native and immigrant birds to these ponds for living and breeding. According to the studies, about 4000 ha of these ponds could be aquatic birds' habitat and would be protected by the long lasting environmental management.

Wetland and wetland products. Wetland growth is another positive feature of the ponds operation. Almost all the macrophyte plants such as straw, bulrush and junk are used in handicrafts like the carpets, mats, baskets, chairs, fences, roof covers and etc. and will increase the pond owner's income. Water use for agriculture and irrigation, hunting the unprotected aquatic immigrant birds, growing native fish by natural or artificial potential water and food resources of ponds, reaping wetland growths and aquatic plants and using them in handicrafts and building materials are the main economical advantages of Tajan plain ponds.

Aesthetic and tourism value. Aquatic immigrant birds living in the vegetation cover and wetland growths provides natural landscapes of native ponds combined with the canebrakes. Various fish species in wetland ecosystems has provided recreational avenues for the residents, hunters and fishermen to spend their free times around the ponds.

Micro-climate improvement. Ponds have also an important role in increase of air humidity and providing sufficient humidity for appropriate microclimates for quantitative and qualitative rice product. They reduce the chemical compounds of agriculture tail water and consequently reduce the side effects on wildlife and balancing the chemical compounds of agriculture lands. They actually act as natural filters for biological refining and assimilating chemical pollutants.

Visuals of several ponds with surrounding locations at various places in the Mazandaran province given at the end of this article highlight some of the benefits of ponds, as discussed above.

2. CONCLUSIONS

Despite several benefits of ponds, it will be prudent to attend to their proper maintenance and operation to avoid occurrence of certain problems. The problems that may arise due to lack of care of the ponds are:

- Incidence of water-borne diseases of both human and livestock.
- Waterlogging of the area adjacent to the pond and its horizontal spread.
- Undesirable rise of groundwater and damage to the agricultural land.
- Groundwater contamination if the pond water itself turns poor.
- Excessive und uncontrollable weed growth around the pond.

However, all the above mentioned ill effects can be avoided through proper planning and action on monitoring the physical condition of the surroundings of the ponds, pond water quality and trend of productivity of the pond water.

REFERENCES

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