

# **Community Activities Contribution to Water Environment Conservation of Inle Lake**

**Mu Mu Than**

Assistant Engineer, Irrigation Department, Myanmar

## **Abstract**

The Inle Lake, through the second largest, is the most important lake in the Myanmar by virtue of its economic, social, cultural and ecological implications. Its also a prominent water resource for largest hydro-power generating in country. In the last decade, the lake has been facing with combined threats due to natural and manmade pressure that become causes of decrease water holding capacity, changes in water quality, disturbs the navigability, decline in livestock and other products. The objective of this paper is to reveal the present situation in face of environmental degradation surrounding Inle region. And also it will present the government agencies have undertaken several activities collaboration with local communities by formulating the long term plan since 1992. From such kinds of integrated activities, especially PH value of water quality is changed from (7.81 ~ 9.03) to (6.84 ~ 8.49) which is acceptable range. Some years after implementing of the cooperative activities, annual rainfall intensity significantly raise and local people have never suffered natural disaster as drought. This condition extremely supports on navigability of lake. Furthermore, there are large numbers of migratory birds and species to lake that shows the environmental condition of the lake is favorable. From this, it is ensure that community participation is the most important component of endeavor which is to be taken for improvement of the Inle Lake.

**Keywords:** environmental degradation, conservation, deforestation, community participation.

## **Introduction**

Inle Lake, one of the biggest inland lakes, is situated in southern Shan State and about 880 m above mean sea level. The weather is warm in summer with the average maximum temperature of 36.6°C in April and the average minimum temperature at 2.8°C in the coldest month of December, January and February. It has an average annual rainfall of 800~900mm. It has long been famous for pleasant climate, attractive landscape and unique lifestyle and handicrafts thus making it a prime tourist resort. And also lake is important natural resources of Myanmar because it is the original water resources of Baluchaung which is the main stream of Moby Dam for Lawpita Hydro-power plant located in Kaya state. In fact that Baluchaung is the only outlet of the lake and connected to Moby Hydro-power reservoir, about 96 m from Inle in far South direction. It is of paramount importance to the nation as it, if fully operated can provide 224 Mega watts which is a major fraction in the electricity use of the country.

## **Inhabitants**

People have been residing in the Inle region since time immemorial owing to its favorable condition for civilization. There are 15 village tracts constituted by over 10,000 households with a population of 55,000 in the lake and 20 village tracts consisting of more than 10,000 household with about 90,000 people in the vicinity of the lake. The races of Pa-O, Danu, Taungyo, Intha, Shan and Bamar reside in the Inle lake region and among them Intha (meaning the people who live in the lake) is the major ethnic group. Despite freedom for

religion, the majority of the people practice Buddhism in harmony with a few in other regions. Intha possess a unique culture of rowing boat by leg and growing vegetables on floating farms. Moreover, hydroponics cultivation or floating agriculture is a major land use in this area. The farmers who practice floating farms, is an eminent organization representing about 85% of the work force.

### **Floating agriculture**

Floating cultivation is successful traditional technologies and practice of the Intha peoples. Floating islands are formed from coarse grasses, reeds, sedges, and other aquatic vegetation, some of which grow submerged while others have floating runners with aerial parts well above the water surface. The dead parts of aquatic and marsh plants become entangled together and are bounded by bog mosses and algae into expanses of fen which float freely. There are swan into blocks 2 m wide and up to 180 m long. The remainder of the decaying aerial portion is burnt out. Black silt from the bottom of the lake is carried by flat boats and spread over it to the extent the bed is not sunk but still floating. Then floating islands are towed into position and anchored with bamboo poles.

The floating islands thus become a growing medium for planting fruits, flowers, vegetables, and other cash crops from which a lot of income is derived by the Intha. The floating islands can be used up to about 15 years or as long as the submerged mattress can hold its buoyancy. The sunken mass of decayed material has to be taken out of the lake bottom and put back on the land. However, the practice of farming on floating cultivation also encroaches into the diminishing area of the lake, since over time, the floating beds become solid ground and it is one of the adverse effects.

### **Environmental problems**

Inle Lake is suffering from the environmental effect due to increased population. Moreover, large scale deforestation and shifting cultivation practiced are threatening severely the environmental stability of the entire watershed area of Inle Lake. The surrounding hills have also been stripped bare of trees harvested for their firewood. Deforestation and more intense agriculture on its western and northern watershed areas have brought in increasing amount of silt and nutrients into the shallow lake. As consequence, sedimentation and siltation has been seriously affecting the surface area of the lake and which has shrunk within living memory. Thus technical measures are needed to environmental degradation with respect to deforestation, water pollution, disposal of solid garbage and lake sedimentation.

### ***Deforestation***

The direct causes of deforestation are depending on factors such as the expansion of shifting cultivation, livestock production and fuel wood harvesting, transformation of forest area into permanent croplands and so on. Timber harvesting, grazing and fires can also severely degrade the forest. But the indirect cause of deforestation is population pressure in the lake as well as surrounding area of the lake.

Because of 90 % of the villagers live in the lake and all the needed fuel wood comes from nearby forest. When population pressure was low, the availability of fuel wood was not a problem. However, it has become a new major problem due to increasing population of the village. Furthermore, construction of houses in the lake consumes a great deal required

amount of timber twice as much as in ordinary construction of houses on the land. For that place, wooden boat is essential for transportation and fishery. Even children have to go to school by boat. And also lake is still surrounded by hilly regions whereas the slash burn and shifting cultivation is one of the most important factors which lead to be severe watershed deterioration.

In brief, dependency on forest resource of the villagers is gradually growing bigger and availability of fuel wood and timber are becoming critical in the lake area and its surroundings. By these aspects on deforestation around the watershed area of the Inle Lake which directly effect on increasing rate of annual sedimentation and comparably the bed level is gradually raised.

### ***Water and sanitation status***

For decades inhabitants of the Inle Lake have been using the water from the lake as their sole source of domestic water supply and at the same time disposing all their domestic waste into the lake without encountering extensive health hazards. In some place drinking water is fetched near the vicinity of one's own house and in other special spots is located by the villagers which are reserved for fetching drinking water only.

The use of rain water during the rainy season has neither been the habit nor regarded as a necessity, even up to the present time in some places. Since water is easily available in abundance from the lake and the inhabitants have never experienced adverse health situation by using lake water, it is natural that usage of lake water is acceptable to all living in the lake area. Nowadays, with the construction of rainwater collecting tanks and infiltration wells the inhabitants have begun to use of rain water.

The water pollution is caused by pesticides and fertilizers from the floating tomato gardens scattered across the surface of the lake. At previous time, farmers used to rely on natural fertilizers. With the advance of technology comes the extensive usage of chemical fertilizers for increasing the agricultural products and pesticides for the protection of vegetation from pests. This fact, coupled with the increase in population and the disposal of all human wastes into the lake has began to exert a general strain on the assimilation capacity of the lake water. Eventually pollution of the lake water has been detected by random evaluation of the lake water quality.

In the last decades, most of the latrines are directly discharge into the open body of water. The disposal of human wastes into the lake is considered to be one of the major contributors to the environmental problem of the area. So, the government tried to introduce experimental latrines by the assistance of (WATSAN) of Community Water Supply and Sanitation project with the aim of addressing a specific problem of pollution in the lake.

### ***5.3 Disposal of Solid Garbage***

Inle is not only the famous sightseeing place for the local peoples but also major attractive place for foreigners. Most the tourism groups come from all over the world, so, it should be preserved sound environment. Therefore, disposal of solid waste (e.g, Garbage from kitchen, plastic bags and etc.) is also a noticeable issue in the Lake. And also Phaung Daw U pagoda festival is very famous in the country and which run concurrently in September in every year. At that time, the visitors come from all over the country and local communities of Inle Lake also. In this place, all commutes and several markets are held on water. By these factors,

disposal of solid garbage also should be control to protect the contamination of lake water. In here, the participation of local people and all visitors are very important to disseminate direct disposal of solid garbage and all waste for protection of water contamination.

#### **5.4 Lake Sedimentation**

Studies of sediment transportation and accumulation are of vital importance to environment degradation of lake. In facts, the transport of sediment in lake is important for pollution, channel navigation, reservoir filling, hydro electric equipment longevity, fish habitant and avifauna habitant.

Former dimensions of lake are 60 km in length and 13 km in width, having a water surface area 266 sq-km. Nowadays, the length of the lake is about 18 km, the width is 6 km and the water surface in the raining season is about 150 sq-km and 100 sq-km in the dry season. There are 29 streams flowing into the lake, originate on the North, East and West mountain ranges. The total catchments area of the basin is about 3682.94 sq-km and average annual inflow to the lake is about (1.13 km<sup>3</sup>). The storage capacity of the lake is about (0.34 km<sup>3</sup>) and the remaining (0.79 km<sup>3</sup>) flows to the Moby reservoir.

Main factors affecting situations and reduction of water area are (1) sediments entering the lake by flowing along streams and gullies from surrounding mountainous area, (2) forest fires caused by the uncontrolled burning used in shifting cultivation, (3) increase in surface run off velocity and forms gullies, (4) uncontrolled aquatic plant in lake bed and lake surface, (5) enlargement of village and floating gardens in the lake area and (6) silted up and polluted by village wastes.

#### **Rehabilitation and improvement of Inle lake**

Inle lake is one of the best tourist attraction place for its beauty in having scenic villages, floating island and famous pagoda festivals. The customs and culture of its ethnic people especially the famous Inle lake leg Rower are world renowned. To date the sedimentation in the lake has proceeded alarmingly. The average of the annual sediment in flow is about 476 m<sup>3</sup>/sq km/yr. According to last 10 year records, the lake bed was silted up about 2m within this duration.

The situation is recognized in time, the Government of the Union of Myanmar has being undertaken to develop on effective system for environmental conservation efforts at the national level. Government formed the working committee for long term maintenance of the Inle Lake in 1992. With the guidance of the working committee Irrigation Department, Forest Department and Myanmar Agriculture Service are jointly performed co-operatively in the respective works as follows.

- To protect the sedimentation from the stream flowing into the lake.
- To clear out the weeds and floating island, in the lake.
- To control the enlargement of village and floating gardens.
- To protect and maintain the existing forests and trees planting in the catchments area and watershed.
- To maintain the water resources for Lawpita hydropower station.

Irrigation department has taken steps to check the acceleration of the silting of the lake. This works includes construction of sediment control dams, check dams, silt catching weirs along

the streams and gullies for protection of sediments coming down to the lake. It is also needed to form high level of small island by means of dredging in waterways and the areas of high sediment and disposal of slush on low land area. This watershed management in conjunction with reforestation including watershed management carried out by the Forest department. The eradication of slash and burn cultivation practice and contribution of such knowledge effect to control soil erosion.

### **Community participation in Environmental conservation**

Inle Lake is renowned for its natural beauty and unique culture as national treasure and a major tourist attraction. The lake is also home to about 150,000 people (2005), many from the native Intha group who have lived along its shore for centuries. Since last decades, Intha people, their home land is facing with some problems and which tends to environmental degradation of the lake. In here it is important to control the growing population living on and around the lake. The most recent statistics show that the population concentration is 90 people per square km around the lake and 385 people per square km on the water. Population control will thus be given as main priority in drafting a proper conservation plan of the lake.

Controlling pollution in the lake is another conservation challenge. Hydroponics agriculture is economically and ecologically important for inhabitants. Commercial orientation of this agriculture may, however lead to the use of chemical fertilizer and pesticides, which can cause detrimental effects on aquatic biota. Residual effect of various chemicals is also hazardous for people's health. In here, public awareness and education are important concerning with the proper use and small scale control of fertilizer and pesticide for the cultivation.

Water treatment is still used by natural purification process. Most of the people are still using untreated lake water because they traditionally believe that water hyacinth and floating island are still enough to get purified water. Therefore, it needs to be systematic control and advanced method for improvement of such process of natural purification.

For water supply, the inhabitants of the lake area have tried to accept the use of rainwater and water from infiltration wells. To fulfill their required amount of that water more rainwater collecting tanks and infiltration wells will be constructed. This matter has often been brought up by making discussion about water supply with community.

For sedimentation control, the forest department under the Ministry of Forestry is responsible for the rehabilitation and conservation of forest in the watershed and soil and water conservation efforts were made since 1979-80. There has a plant for to protect and conserve the remaining natural forest in the watersheds and to establish community forests in the watersheds.

For this situation, regular mass meeting is held among community for the purpose of collecting the firewood from gentle slopes and plains and rotationally using coppice as standard method. The community have new adopted this method and established community forest plantations. Moreover, these are tall and rough grasses in some area and thus it is highly prone to forest fires in summers. Local community and outsiders are strictly prohibited from setting and using fire around these areas. During the summer, local community groups keep themselves alert to prevent forest fire and put it out if it happens.

However, most farmers and local peoples have poor knowledge. Thus, watershed degradation can often be closely related to the educational study of the residents. In recent years, the several conservation projects undertaken for the reduction of environmental degradation in Inle lake. Even though, the government agencies conducted for the assessing of environmental conservation on lake, the community participation and their awareness is most important. Local people must know the consequences of deforestation, land conservation, unsustainable upland agriculture, uncontrolled burning and poor soil management practice. They should learn to make sure that Inle lake must be in good hands for the sake of future generations. And also government agencies should share knowledge about environmental performance assessment techniques with local people and they should know that the people who live on the lake suffer the effect of damages.

### **Environmental conservation in current situation**

The development of the Inle Lake conservation activities can be justified in accordance with environmental scheme as a performance indicator of the implementation process. According to water quality test results, heavy metal contamination is negligible in lake water and it can be said that chemically portable. However, in Biological test data, Coliform organism is some amount dissolved. Especially, PH value of water quality is changed from (7.81~9.03) to (6.84~8.49) which is acceptable range. Anyway, more extensive studies are needed because the lake is thought to be the most changing site in country as a result of both the tourism boom and increasing agricultural activities.

During 1993~1998, Inle-region faced with environmental degradation as drought problem in which annual rainfall intensity is very low. In 1997 and 1998, annual rainfall intensity is less than 600mm. Some years after implementing of the cooperative activities, annual rainfall intensity significantly raise 1150mm in average. For this situation, the water body of lake can judge by navigability of lake. During the pagoda festival, Phaung Daw U Buddha statue move all round area by big boat. Nowadays, although some part of the area shrunk due to sedimentation but navigation is still good which mean that holding water body of lake is efficiently.

From the environmental survey results, there are large numbers of migratory birds and species to lake that shows the environmental condition of the lake is favorable. Due to these condition, the environmental degradation in and out of Inle region being partially recovered by all round aspect of activities. These should be extended in a holistic approach, professionally, equally distributed as long term plan.

### **Conclusion**

Inle is a huge and beautiful lake which has not only contained a marvelous microcosm of aquatic life but also surrounded by a harmonious blend of national races. Among of these groups, Intha people are major race who are non-indigenous and living in 17 stilled villages around the lake. They have migrated from Dawei, in southern part of Myanmar, in the late 13<sup>th</sup> century. So, the protection and conservation of sustainable development of Inle lake is extremely important for one and unique ethic in the country. The lake is home to the Intha people, who have developed a unique way of living style country. Transportation on the lake is traditionally by small boats, or by larger boats fitted with outboard motors. Hence, without water or it change into plenty of marsh soil, the transportation would be vanished in this area.

In Inle region, reforestation, rehabilitation development of food security, income generation and environmental conservation activities stretch to some part of the area. But the tremendous amount of volume of work activities and fund requirement cannot be met only by a government agency or single organization. The crisis has led to an unprecedented effort by multiple governments' agencies to save the lake. Moreover, the establishment of culturally and naturally sound environment in Inle lake, the collaboration and cooperation of local people activities, contribution of their knowledge and their intensive supporting are very important. The government agencies as well as NGOs & other expertise should persuade the practice of local people to understand for the protection and prevention of their home land from the environmental damage.

Small water resources should be developed in compliance with the watershed management concepts and protected by the religious acts for sustainable conservation of all-round aspects in lake. Finally, to maintain the long term existence of lake together with Lawpita hydro-power station full capacity production, it is responsible for all local living in and out of the lake region and also all Myanmar nationality and all who had set foot to Inle region, to all who love Inle and its traditions. There are so many ways and means such as raising fund, giving new idea, technical know-how support, equipment and lastly their heart supporting whatever they can to get the successful environmental conservation of Inle Lake.

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