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TURNING WATER HYACINTH INTO BEAUTIFUL HANDICRAFTS TO MAINTAIN BIODIVERSITY

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Abstract: Water Hyacinth or Echornia is a water weed those spreads rapidly in rivers, lakes, and other water bodies. The weed spreads like a blanket over the water bodies. It depletes the oxygen content of the water and thus causes a problem for aquatic life. It also disrupts livelihood by causing problems in fishing and boating. The municipal corporations invest huge amounts in cleaning the weed but it does not get destroyed and regrows quickly. The weeds after removal are either sent to the landfills or are burnt. But both these methods are again harming the environment. We have devised a method to convert the water weeds into beautiful handicrafts. This project has helped to save the environment as we are converting the weeds into useful products, i.e., reducing waste and recycling and reusing the products. Additionally, our project has helped several women become self-reliant and provide financial support to their families. Our project is thus ensuring financial stability for rural and tribal women and also saving the environment. This paper will discuss our process of training the women to use water weeds and convert them into useful products and the social and environmental impact of our project through our unique and innovative method of using wastewater weeds.

***Keywords*— Water Hyacinth, Biodiversity, Waste Management, Women Empowerment.**

1. Introduction:

Water hyacinth *(Eichhornia crassipes)* is an aquatic weed found widely in rivers, lakes, and other water bodies in most parts of the world. It grows very fast. Its high rates of survival and regeneration have raised difficulties for the municipal organizations engaged in clearing the water bodies ingested with water hyacinth [1]. It is a free-floating and flowering aquatic plant that originated in South America in the Amazon basin and then spread to the rest of the world. The plant doubles itself in 5-15 days and grows well in nutrient-rich water within temperature range of 28°C to 30°C, pH value between 6.5 and 8.5, salinity < 2%, 20 mg/L N, 3 mg/L P, and 53 mg/L K [2].

Water hyacinth is an invasive weed and is a threat to aquatic life. A study conducted in the Pokhara Valley in Nepal examined the effects of water hyacinths on diversity and the plentitude of fishes. The study reveals the negative impact of the aquatic weed on the fishes. It says that the water quality has deteriorated due to the invasion of water hyacinth which negatively affects the fish

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species [3]. The water temperature and free carbon dioxide are closely related to the water hyacinth cover. The spreading of water hyacinths on the water bodies reduces dissolved oxygen in water by blocking sunlight and thus restricting the photosynthesis process for other aquatic plants. The reduction in oxygen levels in water causes an increase in the release of phosphorus thereby increasing the temperature and carbon dioxide contents. The PH value of the water decreases and leads to eutrophication and thus reduces water quality [4]. The occurrence of the fish species is influenced by the physical and chemical parameters of water. But both these parameters get negatively impacted by the water hyacinth thus affecting the availability and growth of fishes [5]. Along with deteriorating the water quality the weed causes fishing and transportation problems [6]. Water hyacinth plants grow extremely dense and block the water bodies [7]. This affects biodiversity and has a detrimental effect on tourism especially in the areas where people visit dams and reservoirs for recreational purposes. The notable oxygen supplies from the environment to the aquatic plants and animals are reduced due to the absorption of sunlight by the water hyacinth leaves [8]. The water bodies with water hyacinths serve as a suitable breeding ground for mosquitoes thus causing malaria and other diseases [9].

Taking into account the effect of water hyacinths on the water bodies and the lives of people around, the removal of weeds seems to be one of the solutions. The invasive weed is one of the fastest-growing plants. Each plant produces thousands of seeds every year that can be used for more than twenty-eight years [10]. Though the average size of the plant is 40 cm it can reach to a height of 1m. It spreads like a mat with a thickness of nearly 2m. The plant has a high rate of multiplication. Its population doubles in two weeks due to the asexual vegetative reproduction. Each mother plant produces four daughter plants that are capable of reproduction after two weeks [11]. These plants directly or indirectly affect public health and comfort. One of the solutions is to either remove the plants from the water or destroy it. Some of the widely used methods to control the growth and the effects of water hyacinths include manual extraction and chemical and biological methods. Manual extraction is considered to be effective as it is environmentally friendly. But this method is suitable for smaller areas. It is not feasible for the larger areas due to the increase in labor costs and expenses for water-based vehicles and transportation facilities. In the chemical method, herbicides like bispyribac, diquat, glyphosate, etc. are sprayed on the hyacinth plants. These herbicides act on the green part of the plant and inhibit its growth. However, the chemicals used in this method can be harmful to aquatic plants and animals. The biological control method uses weeds like Neochetinabruchi, N. eichhorniae, that feed on the water hyacinth. These weevils limit the vegetative propagation of water hyacinths and their seed production. This method is cost-effective and environment-friendly and does not harm any aquatic plants or animals.

In this paper, we will discuss one such use in which the harvested weeds have been converted into beautiful handicrafts. This project is trying to reduce the ill effects of the weed on the environment

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and at the same time has evolved as an income-generating source for several women in the tribal and remote areas of Chandrapur district. The motivation behind this research is to find how an environmental challenge can be turned into an opportunity for the generation of livelihood.

2.Background Study : The water hyacinth is found abundantly in Chandrapur district as the climatic conditions are tropical. The problem caused by the weeds was observed prominently when one of the historical landmarks of Chandrapur, Ramala Lake was fully covered with water hyacinth in 2009. The weed was found gradually in nearby areas in the district too. After that, some local organizations came forward to study the effect of weeds on the water bodies and aquatic life. The municipal corporation in Chandrapur uses a manual extraction method for the removal of weeds. The weeds are then either sent to the landfill or are sometimes burnt.

However, both of these methods are not safe for the environment. The disposal of weeds increases waste in the landfill. It is well known that the accumulation of biodegradable materials in landfills may increase global warming. The components of the garbage decompose to emit gases like methane, hydrogen sulfide, and carbon dioxide. Sometimes the reactions of the waste may leak toxic contents into the atmosphere thereby contaminating the nearby ecosystems [12]. Sometimes the municipal corporation tried to destroy the harvested weeds by burning them after drying. The burning of wastes emits harmful pollutants and degrades the quality of air [13]. The stems and the leaves release thermal energy after burning. The amount of thermal energy depends on the moisture content [4]. Burning of waste releases carbon dioxide in the air. Our team realized that both the methods of dealing with the water hyacinth and its removal cannot be considered to be efficient methods for waste management. The water hyacinths however grow fast and again the water bodies are covered with weeds in two weeks. Additionally, the removal process levied a financial burden. The process required skilled workers who could enter the water bodies, cut the weeds, and remove them. Along with that, the workers had to be very careful with the snakes, crocodiles, and other aquatic species. The vehicles required for disposal in landfills or taken to a place to be burnt also increased the cost of the weed removal process. Removal of weeds is not a solution for dealing with the problems caused by the weeds, especially by relying on manual extraction methods. A better solution to the problem is to search for new methods or techniques to use the extracted weed. Some of the uses/applications of the water hyacinth include wastewater treatment, biomass, animal feed, manure, paper production, and medicines [15].

Besides some of the widely used application of water hyacinth some researchers have come up an innovative way by turning the weeds into handicrafts [16,17]. Ajay Bahuudeshiya Sanstha in Chandrapur district of Maharashtra, India, conducted an extensive study on the availability of water hyacinth in the region and methods to convert it into handicrafts. It was found that the dried stems could be used for making products like bags, baskets, mats, etc. The group found the initiation of the project will be beneficial to the Chandrapur region as it will facilitate regular

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uprooting of the weeds, protect the water bodies and aquatic life and at the same time emerge as an employment-generating source for the rural people, especially women.

3. Implementation Phase:

The project was started in December 2021 with the support of the local Government authorities. Initially, it was a difficult task to explain the viability of the project and convince people to join the project. It is one of the unique projects going on in Chandrapur for three reasons: (i) It is one of the first of its kind, in which a waste weed is converted into beautiful handicrafts. (ii) It helps to maintain biodiversity. (iii) The products are eco-friendly and some of them are eventually being used as a replacement for plastics. It is therefore helping to save the environment. (iv) The team of master trainers, skilled and semiskilled workers, and artisans are women. This project has become a source of employment generation for the households of many families in remote and tribal areas.

The implementation of the project started with Rajura village of Chandrapur district. The pilot project was started at this place due to the abundance of weeds in the region. The project in the vicinity of the source weed helped to cut down on the transportation cost and time required to carry the weeds. The women involved in the project are generally working in three groups: (i) Removal and drying of stems of water hyacinth (ii) Making products like bags, baskets, yoga mats, etc. (iii) trainers to train more women and involve them in the manufacturing process. In the first phase of the pilot project at Rajura, training was provided to 45 women.

In the second phase, training was provided to 35 women from Nimbala and Dudhala villages situated in the Tadoba Andheri Tiger Reserve region. These villages are greatly affected by man-animal conflict. Though agriculture is the main occupation here, people hesitate to be on the farms due to increasing cases of man-animal conflicts. However, the number of women going out for work was very low. Some of them were worried about the man-animal conflict while others preferred taking care of the house and children, especially girls. There are very few organizations that reach out to remote villages to support rural and tribal women. The women who receive training work according to their interests. Some of them engage themselves in cutting and drying of stems. Some of them become master trainers while others make products using dried stems. The third phase of the project was started at the village Gojoli of the Gondpipri block with the support of the Central Chanda Forest Department. In this village, 40 women were provided training at the initial stage. The fourth village was Daheli of Ballarpu block in which 40 women received the training. The fifth village was Chorgaon, again a village located in the buffer zone. The village has the least employment opportunities due to less agriculture, no tourism, and no local industries. The

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project is thus trying to support women to become self-sufficient. At the same time, nearly 40 women are working in their villages and most of them are working from their homes.

The women are provided with the raw material. The finished products are collected by our organization and they are paid according to the number of products made by them. We are also helping the women to reach out to the local markets to sell their products. Besides that, we have helped women to participate in the exhibitions to popularize the products. Each village adopted in the project has been assigned different products to avoid repetition of the work. The women in Rajura are involved in making bags and gift boxes. The women from Nimbala and Dudhala make side purses and hats, while the women in Dudholi make yoga mats.

The women involved in the weaving and production of goods earn around a minimum of Rs. 5000 per month initially which then increases as they become proficient in the process. Similarly, the master trainers earn nearly Rs. 12000 per month for each training. All the women involved in the project have formed self-help groups and they are carrying out their work in groups. A few years ago, the women who never stepped out of the house, are supporting their families. They are self-sufficient and more confident. The women living in the areas with the fear of man-animal conflict are more relaxed as they are working from their homes. Earlier they were reluctant to go out for work not only due to the social stereotypes but also due to the dangers of wild life.

Phase	**Village**	**Number of women**	**Products**
I	Rajura	45	Bags and Gift Boxes
II	Nimbala and Dudhala	35	Side purses and Hats
III	Gojoli	40	Bags
IV	Daheli	40	Yoga Mats
V	Chorgaon	40	Official file and caps

Table 1: Villages, no. of women and products

4. Manufacturing Process:

The manufacturing process consists of the following steps:

(i) Extraction of weeds: The first step is the removal of weeds from the water bodies. A group of 10 men can remove approximately 1000 kg of weeds per day. The group of semi-skilled women workers remove the stem from the weeds. The weight of the stem is nearly 600 kg after separating the leaves and roots.

(ii) Drying of Stem: The other group of women is involved in the drying of stems. The drying of stems is done in natural sunlight as Chandrapur has a hot climate in most of the months of the year. We have to be very careful in this process as the stems may get rotten or damaged when they are left for drying.

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(iii) Rolling of dried Stem: Once the stems are dried completely, they are passed through a rolling machine and converted into strips. The strips are collected and given to the skilled workers for weaving.

(iv) Final Products: The strips are used by the women to make different products. The products have been assigned to different villages where the manufacturing takes place. The group of women is provided training for specific products. The finished products are collected and they are paid as per the number of products made by them.

We hope that products like bags and gift boxes can act as a replacement for plastic bags and thus contribute to saving the environment. The yoga mat is one of the most popular products. Its price is higher as compared to the synthetic or PVC yoga mats available in the market. However, the higher price cannot be considered as a drawback after considering the eco-friendly benefits of the products.

5. Solutions and Impact:

The project has helped maintain the biodiversity. The regular removal of weeds from the water has reduced the harm caused by the water hyacinth to the water bodies. Besides that, the involvement of women in the project has helped many families in the rural area. The standard of living of the families has improved as these families were deprived of employment opportunities due to their remote locations and the unavailability of industries in the vicinity.

One of the challenges that we are facing is to create a special place in the market. There is less awareness about handicrafts in our district. We are trying to reach the outside market by participating in exhibitions and popularizing our products. We hope to use technology to have better types of equipment and machines for manufacturing. We need to have a mechanized workshop to increase the production to meet the demands of our customers. At the same time, it will help in lowering the costs of our products.

We hope to involve 300+ women in our project in the future. As the world talks about sustainable development goals and its achievement by 2030, we are keenly involved in working on SDG 05 and 08. We are trying to make women self-reliant by providing them opportunities to work and achieve gender equality. At the same time, we are working to ensure decent economic growth for all those involved with us.

At the moment we are involved in making handicrafts. We are trying to study other uses of water hyacinth. We are using only stems but, in the future, we will come up with some techniques to utilize water hyacinth in which we can contribute more to reducing waste by using the roots, flowers, and leaves.

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