

## WATER HYACINTH



Water hyacinth (*Eichhornia Crassipes*) is an aquatic plant which can live and reproduce floating freely on the surface of fresh waters or anchored in mud. The plant is a perennial aquatic herb which is closely related to the Liliaceae (lily) family. The mature plant consists of long, pendant roots, rhizomes, stolons, leaves, flowers, and fruit clusters. The flowers each have 6-10 lily-like flowers. The stem and leaves contain air-filled tissue which give the plants its considerable buoyancy. Plant size ranges from a few inches to a meter in height. Its rate of proliferation under certain circumstances is extremely rapid and cause infestations over large areas of water leading to a variety of problems. Mats can double in size in as little as 6-18 days.

The plant originated in the Amazon Basin and was introduced into many parts of the world as an ornamental garden pond plant due to its beauty. It has proliferated in tropical and subtropical climates particularly in areas of the southern USA, South America, Southeast Asia and Australia. In fact, it can be found on all continents except Europe. Its range is limited by severe cold. Its spread throughout the world has taken place over the last 100 years or so, although the actual course of its spread is poorly documented. In the last 10 years, the rapid spread of the plant in many parts of Africa has led to great concern.

Water hyacinths thrive in environments in which nutrients from fertilizers or other effluent run into the streams. Impeding water flow also encourages rapid growth of this plant. Seeds can remain dormant and become active for up to 15 years. Additionally new plants can grow from the extensive root system.

### ***THE PROBLEM***

Because of its rapid proliferation which results in a mat-like coverage of fresh waterways, water hyacinths cause the following problems:

***Hindrance to water transport:*** Access to harbors and docking areas can be seriously hindered by mats of water hyacinth. Canals and freshwater rivers can become impassable as they clog up with densely intertwined carpets

of the weed. It is also becoming a serious hazard to lake transport such as Lake Victoria in Africa. Many inland waterways in Southeast Asia have been abandoned because water hyacinth mats are so dense.

**Clogging intakes of irrigation, hydropower and water supply systems:** Owen Falls' hydropower scheme at Jinja on Lake Victoria is a victim of the weed's rapid reproductive rates and an increasing amount of time and money has to be invested in clearing this weed to prevent from entering and demining the turbine. Water hyacinth is now a major problem in some of the world's major dams. These blockages cause power outages, flooding, and equipment damage.

**Increased disease in the habitat:** Malaria, water borne parasites such as schistosomiasis, and other water borne diseases increase as the water hyacinths provide havens for mosquitoes and stagnant water.

**Increased evaporation and transpiration of water:** Water hyacinths increase the amount of water that evaporates from a waterway or lake. It has been discovered that water loss can be as much as 1.8 times that of evaporation from waterways free of these plants. This is important for areas where water is already scarce. For example, it is estimated that the flow of water in the Nile could be reduced by up to one tenth due to increased losses of water in Lake Victoria.

**Loss of fishing opportunities:** Access to sites becomes difficult when weed infestation is present. Fishermen also lose equipment when lines or nets become tangled in the weed's root system. Fish populations decrease as water begins to lose oxygen and sunlight while populations of crocodiles and snakes increase. In areas where fishermen are barely able to sustain themselves from this industry, this is an economic disaster.

**Reduced biodiversity:** When water hyacinth thrives, it out competes other aquatic plants. This causes an imbalance in the micro-ecosystem resulting in reduced flora and the fauna that depend on it. Localized water quality also deteriorates which may be harmful to people who rely on the waterway for drinking water.

Although water hyacinth is seen in many countries as a weed and responsible for many problems, some have attempted to turn the problem around and find **useful applications for these plants**. The plant is 95% water but also has fibrous tissue, high protein content, and high energy potential. The following uses for this plant are being explored:

**Paper:** The Mennonite Central Committee of Bangladesh has been experimenting with paper production from water hyacinth for some years. They have established two projects that make paper from the water hyacinth stems. The water hyacinth fiber alone does not make particularly good paper but when the fiber is blended with waste paper or jute, the result is a good quality paper. The equipment to producing the pulp is sophisticated and expensive, however.

**Fiberboard:** Another way people have found to use water hyacinth is to make fiberboards. The House and Building Research Institute in Dhaka has developed a fiberboard that has general purpose uses such as low cost roofing. The process has many steps and is labor intensive. Research is continuing in ways to make the product more efficiently.

**Yarn and rope:** The fiber from the stems of the water hyacinth plant can be used to make rope. The stalk of the plant is shredded lengthways to expose the fibers and then left to dry for several days. The rope making

process is similar to that of jute rope. The finished rope is treated with special chemicals to prevent it from rotting. In Bangladesh, the rope is used by local furniture manufacturers to finish cane furniture.

**Basket work:** In the Philippines and India, water hyacinth is dried and used to make baskets and matting for homes and the local tourist trade. Care must be taken to ensure that the plant is very dry before making these baskets, however, or they will rot quickly.

**Biogas production:** Conversion of other organic material, such as animal or human waste, is well established in small or medium scale technology. This process is one of anaerobic digestion which takes place in a reactor or digester, an air-tight container usually below ground, and results in usable methane gas that can be burned from cooking or generating electricity. This residue from the digestion process provides a rich fertilizer. It has been proposed that water hyacinth can be harvested for this process. The use of water hyacinth for this presents some problems, however. It has a very high water content and harvests yield low actual amounts of organic material for conversion to biogas. The air captured in the plant would have to be taken out through chopping to promote better digestion.

**Water purification:** If the growth can be contained in specified areas and water allowed to pass through the water hyacinth culture, pure water can be obtained. Water hyacinths have been used to pretreat water before it enters the purification plants. The root structures of water hyacinth, and other aquatic plants, provide a suitable environment for aerobic bacteria to function. Aerobic bacteria feed on nutrients and produce inorganic compounds which feed the water hyacinth. Water hyacinths also remove effluent, heavy metals, organic compounds and pathogens.

**Fertilizers:** Water hyacinth can be used directly from harvesting or dried to be used to mix with the soil or as mulch. It breaks down quickly and can be mixed with ash, other soils and some animal manure to increase soil fertility and crop yield. Such compost production is economically suited to areas of few resources but high labor potential. It does not take much capital to produce large quantities of useable fertilizer in areas with poor soil.

**Fish feed:** The Chinese grass carp, tilapia, silver carp and the silver dollar fish all consume aquatic weeds, such as water hyacinth. The manatee or sea cow has also been suggested as another herbivore which could be used for weed control.

Despite all the ways this plant can be used, water hyacinth continues to be a problem around the world and new ways to control it have been extensively explored. Currently the following ways are most often used to **control water hyacinth:**

**Mechanical harvestors** remove water hyacinth from the water and transport it to shore. **Chopping machines** then grind the plant into bits and spray the slurry across the water

Two water hyacinth weevils and some species of **fish** have been used to water hyacinth

Registered aquatic herbicides provide temporary control of water hyacinth

No one method has proven to totally eradicate the water hyacinth, however.

<p style="text-align: center;"><b>MECHANICAL CONTROL</b> (removing the water hyacinth using machines)</p> <ul style="list-style-type: none"> <li>*this is the best short term solution</li> <li>*most suitable for relatively small areas</li> <li>*since water hyacinth floats, it is possible to scoop the plant out of the water without disturbing the sediment of reducing water clarity.</li> </ul> <p><i>Drawbacks to <b>biological</b> control:</i></p> <ul style="list-style-type: none"> <li>*it takes a long time for the predator species to reach population density sufficient to tackle the problem</li> <li>*in some cases, the predator species was only able to reduce plant height or number of seeds produced; it did not eradicate the plant</li> <li>*not all predator species are able to survive in the new habitat</li> <li>*there is a danger that the predator species will negatively impact native species</li> </ul>	<p style="text-align: center;"><b>CHEMICAL CONTROL</b> (using herbicides to kill the water hyacinth)</p> <ul style="list-style-type: none"> <li>*the common herbicides used have been found to be very safe with used as directed and applied by certified personnel</li> <li>*herbicides can be applied from the ground or the air and are less expensive than some other controls</li> <li>*this type of control is closely monitored by many government agencies to insure safe conditions exist after application.</li> </ul> <p><i>Drawbacks to <b>mechanical</b> control:</i></p> <ul style="list-style-type: none"> <li>*very costly because it requires a large fleet of water and/or land-based machinery that can transport large quantities of very heavy plant material (because it's mostly water, water hyacinths are very heavy)</li> <li>*this type of control cannot keep pace with the rapid plant growth in large water systems</li> </ul>
<p style="text-align: center;"><b>NO CONTROL</b></p> <ul style="list-style-type: none"> <li>*it is better to control the situations that allow the water hyacinth to reproduce or flourish; reduce the number of nutrients that enter the water</li> <li>*attempting to control this plant is expensive; it is estimated that even the most simple solutions could cost over 7 million dollars; do we have that kind of money?</li> <li>*the plant is only present because the ecosystem is already compromised</li> <li>*water hyacinths have many uses; we should explore those options instead</li> </ul> <p><i>Drawback to <b>biological</b> control</i></p> <ul style="list-style-type: none"> <li>*it takes a long time for the predator species to reach population density sufficient to tackle the problem and could cause more problems for the ecosystem</li> </ul> <p><i>Drawback to <b>mechanical</b> control</i></p> <ul style="list-style-type: none"> <li>*very costly because it requires a large fleet of special equipment and not all waterways are accessible</li> </ul> <p><i>Drawback to <b>chemical</b> control</i></p> <ul style="list-style-type: none"> <li>*after the herbicide is used, the decaying plants will deplete the water of oxygen making it unusable for aquatic wildlife; any chemical remediation must also include mechanical removal</li> </ul>	<p style="text-align: center;"><b>BIOLOGICAL CONTROL</b> (using predatory plants and animals to control the water hyacinth)</p> <p>There are a variety of weevils, moths, and fungi that have been identified as possible biological controls:</p> <ul style="list-style-type: none"> <li>*recent research has found that geese will eat water hyacinth at a rate that makes control possible</li> <li>*this is the most favored form of long term control because it is economical and sustainable</li> <li>*these tend to be self-regulating because when the host dies out, so does the natural enemy</li> <li>*this is the most economical method of controlling water hyacinth</li> </ul> <p><i>Drawbacks to <b>chemical</b> control</i></p> <ul style="list-style-type: none"> <li>*the main concern is when the herbicides are used where people collect water for drinking and washing; direct contact is worrisome</li> <li>*the long term effects of using these herbicides is still unknown</li> <li>*after the herbicide is used, the decaying plants will deplete the water of oxygen making it unusable for aquatic wildlife; any chemical remediation must also include mechanical removal</li> </ul>

# POWER OF PERSUASION

Here are a few tips to help persuade others to see your point of view.

➤ **Organize your thoughts and concepts logically.**

You may want to jot on a note card your major points in order of priority so you don't forget them.

➤ **Start with an attention grabber.**

Open with a powerful statement to grab the attention of your audience.

➤ **Clearly explain your point of view.**

Give specific examples, if you can, to illustrate your point.

➤ **Be concise.**

Keep it short and simple! Short speeches are usually more powerful and memorable than longer ones.

➤ **Make eye contact.**

Eye contact shows that you are sincere about your topic and that you acknowledge your audience.

➤ **Speak slowly.**

Most people tend to rush when they talk before a group. Speak slowly and loudly enough so everyone can easily hear you.

➤ **Use visuals.**

You may want to highlight major points by writing them on a chalkboard, easel pad, or handout; showing slides, a poster, or other pictures will help people remember important points.

➤ **Reinforce your position and argument.**

After you introduce your position and argument, you should articulate your position, then conclude by reiterating the major points of your argument.