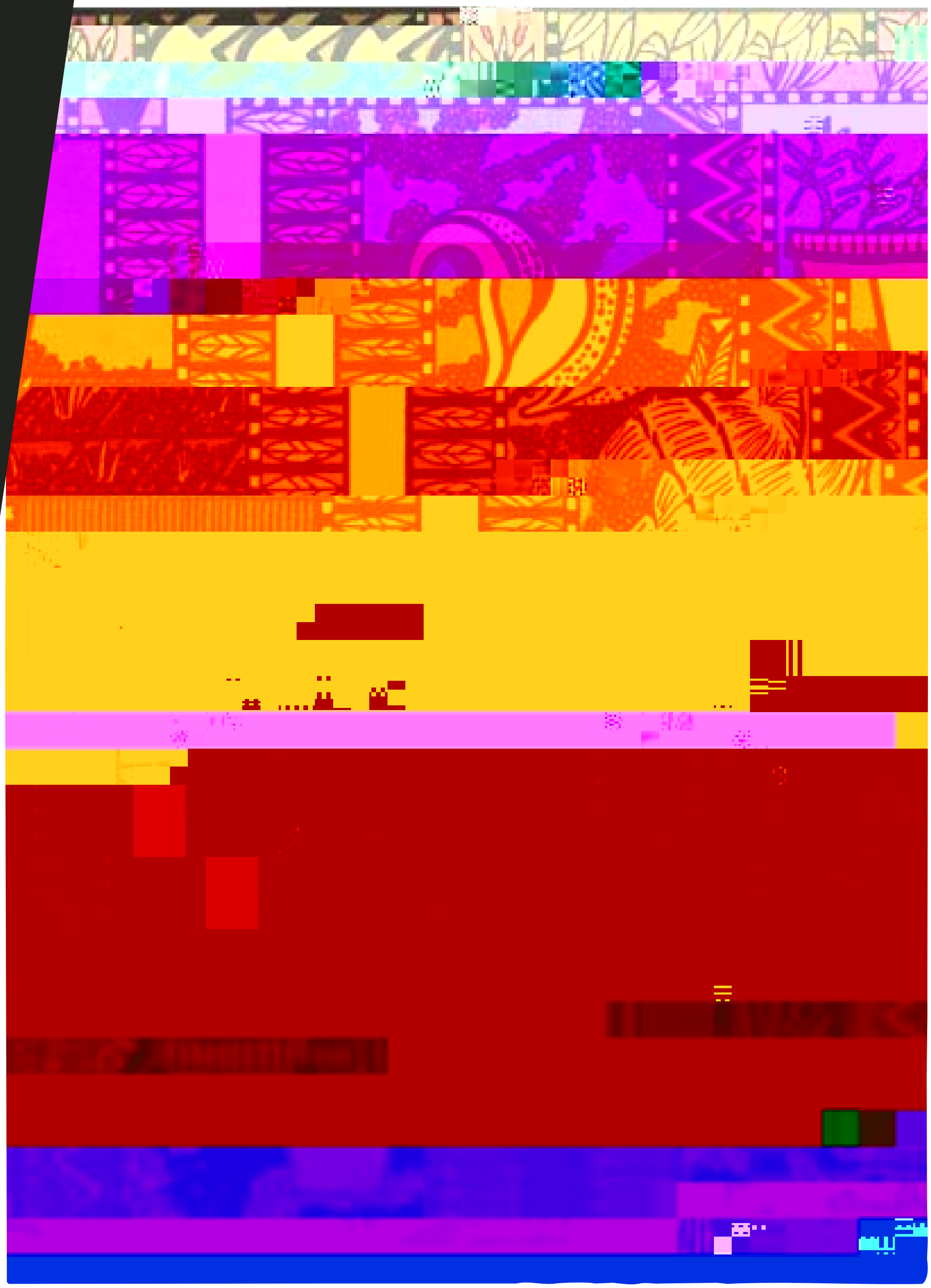
Environnement Can

PLANTING THE SEED



Author:

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Acknowledgements

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Planning a Restoration Project

"Ecological restoration is the process of renewing and maintaining ecosystem health."[2] This process is not a simple task. Successful projects require adequate background data, understanding of the project area, clear goals and objectives, long-term commitment (a minimum of five years) and some amount of luck. Projects must be carefully planned and well thought out. In some cases, the planning process will identify aquatic planting as inappropriate or that other mitigative measures must first be in place. Establishing aquatic plants is only one aspect of the wetland restoration process. For this reason, it is necessary to use this guide within a planning framework similar to that outlined in *Habitat Rehabilitation in the Great Lakes, Techniques for Enhancing Biodiversity*. The document outlines a number of important landscape planning issues to consider before embarking on a project:

I. *Past history and present condition of the restoration site.*

II. *Making sure rehabilitated or newly created habitat is connected.*

III. *Environmental contaminants and potential effects on the success and failure.*

IV. *Pre and post-project monitoring: learning from successes and failure.*

V. *Planting habitat restoration sites.*

VI. *The degree of management required to initiate the project and to maintain the site in the long run.*

Establishing Wetland Vegetation

There are two approaches for establishing wetland vegetation: natural colonization and planting. The most appropriate or a combination of methods will be identified during the planning phase of the project. Natural colonization refers to the establishment of plants through the germination of existing seeds or those brought to the site naturally by wind, water or wildlife from nearby sources. Planting involves placing desirable species at a site.

Natural colonization is a viable method and in some cases it will occur relatively quickly. Annual species such as nut grass (*Cyperus* sp.) or pioneers like soft rush (

PLANTING THE SEED

Ability to reach suitable size in a reasonable time period
Many plants require a substantial amount of time to grow. Developing a sufficient root system can take several months, and is important for maintaining plant stability in areas with high wind and wave action, strong currents or ice movement. Slower growing plants should be planted earlier in the season to facilitate their establishment.

Resistance to herbivores
Some plants are more susceptible to herbivory than others. This is largely dependant on the site conditions and the type of herbivores present in the area. See the Protection of Plants section for further discussion.

Ability to propagate
Plants like giant bur-reed (*Sparganium eurycarpum*) and sweet flag (*Acorus calamus*) can be difficult to propagate. They have low germination rates, special growth requirements, special stratification procedures and require more time and expertise to grow successfully. This affects the cost of the plant. Other factors that can increase costs include slow growth rates, rarity of the plant in nature, lack of seed producing plants, difficulty of collection (e.g., submerged seed heads), and processing difficulty. Plants that are easy to propagate have high germination rates and fast rates of growth (e.g., cattail, rush (*Juncus* spp.), bulrush).

Competition with other plantings and naturally occurring species
It may be inappropriate to plant a dominating species like cattail with other less aggressive species such as rushes or sedges. Cattails tend to takeover when competing with other plants for space and resources. However, cattails are an ideal species to plant in many situations because they are easy to propagate, spread quickly and are tolerant of poor water conditions.

8. Availability

With increasing interest in wetland restoration, several nurseries now have a wide selection of native aquatic plants grown from local sources. It is impossible however, for a nursery to carry every species, so it is better to collect seeds and have them grown by a local nursery under contract. This will ensure the availability of appropriate species and is more economical. The following section provides a further explanation of other sources for plant material.

Obtaining Plant Material

After deciding which species to plant, the next thing to consider is where to obtain them. There are two main sources of plant material. Collecting from a donor site or buying directly from a commercial supplier or nursery. A combination of both options works best.

Donor Site (within study site or similar local habitats):

Obtaining plant material from within the study site and from similar local habitats is most desirable. This includes transplanting fully grown plants or collecting seeds, tubers, rhizomes or cuttings. These plants are adapted to local environmental conditions and are more likely to establish successfully. For some species, pollen and seeds may travel so far that there is little genetic difference between plants of the same species that are thousands of kilometres apart. However, it is also true that even nearby populations can become somewhat distinct in ways that allow them to survive in slightly different conditions including water depth, soil type, micro climate or disease tolerance. It is difficult to place an exact measurement on the distance from the restoration site for obtaining material, but as a guide, acquire material from areas that are as close as possible. Try to remain within a 10 to 100 kilometre radius. Overall, native plant material should be locally adapted and provide as much genetic diversity as possible. *Keep in mind that the collection of wild plant material, particularly fully grown plants, can negatively affect the donor wetland.* The next section, Selecting Plant Stock, lists a number of collection guidelines.

CLASSROOM PROPAGATION PROGRAM

Another method of obtaining aquatic plants is to develop a classroom propagation program where students from local schools grow aquatic plants from seed. This is an effective way of supplying a large number of plants at a reasonable cost and contributes to educational programming. For this program to be successful, there must be a least 10 to 12 months of careful planning. The first step is to collect seeds from nearby wetlands. Researchers have found that certain plant species grow better than others in a classroom setting. Some of these include cattail, soft-stemmed bulrush (*Scirpus validis*), black bulrush (*Scirpus atrovirens*), joe-pye weed (*Eupatorium maculatum*) and white boneset (*Eupatorium perfoliatum*). The seeds are then cleaned and undergo several months of stratification (cold storage). The section on Seed Collection, Cleaning and Propagation provides detailed information on seed processing procedures. Each classroom receives a planting kit which includes an instruction manual, two dish-pans, several potting trays, seeds and a small bag of soil. The kits are distributed sometime in February or March.

Patricia Chow-Fraser

Students from Sam Sherratt Public School with their planting kits.

After six to 14 weeks of growth, teachers return the seedlings to a greenhouse for storage until planting. With each kit, it is possible to grow at least 50 plants. It is not uncommon to grow four to seven thousand plants from 200 kits. The number of plants returned from the classrooms tends to vary depending upon the viability of the seeds and the conditions under which the plants are grown. This type of program helps to promote wetland conservation, as well as provide students with hands-on environmental experience. It also provides an opportunity for students to plant their own seedlings, giving them a personal connection to the overall restoration project.

For further information on this type of program, please contact:
Bay Area Restoration Council (BARC), Life Sciences Building, McMaster University, Hamilton, Ontario, L8S 4K1. Tel: (905) 525-9140, ext. 27405. Email: barc@mcmail.cis.mcmaster.ca

Gord MacPherson, Toronto and Region Conservation Authority, 5 Shoreham Drive, Downsview, Ontario, M3N 1S4. Tel: (416) 661-6600, ext. 246

Patricia Lowe, Oshawa Second Marsh Project Coordinator. Central Lake Ontario Conservation Authority, 100 Whiting Avenue, Oshawa, Ontario, L1H 3T3. Tel: (905) 579-0411.

Nurseries

There are several advantages to using nurseries, such as their ability to provide quality healthy plants, to supply large quantities, and to deliver materials in suitable planting condition.[4] In addition, assuming that seeds or stock plants are collected following good conservation practices, there will be minimal negative affects on natural habitats. Several nurseries are now set-up to supply aquatic plants grown from locally collected seeds (refer to page 22 for a list of native aquatic plant growers). Issues to consider when dealing with nurseries:

A sufficient amount of lead time is necessary for ordering plants.

It is not uncommon for restoration projects to use 20,000 plants during the planting season; therefore,

Planting Stock

Plant Stock	Description	Collection Time	Planting Time	Relative Cost	Relative Survival Success
Seed 	A propagule with a protective outer coat. Mainly available from a donor wetland.	• early summer to late autumn	spring or autumn	lowest	low
Tuber 	Large, swollen underground stems that provide food storage for the plant.[5] Available from a wetland and nursery.	• spring or autumn	early spring or late autumn	moderate	high
Rhizome or rootstock 	Underground stems that usually grow horizontal to the surface, providing food storage for the plant.[6] Available from a wetland and nursery.	• spring or autumn	early spring or late autumn	moderate	high
Container (propagated seedling) 	Young plants that have their roots surrounded by soil in a peat, fibre or plastic pot. Available from nurseries.	• not applicable	spring or summer	high	high
Bare root 	Young plants with very little or no soil surrounding roots. Available from nurseries.	• spring to mid-summer	spring or summer	intermediate	moderate
Transplants	A single or group of plants (including soil and root systems) dug from one wetland area and planted in another.	• no restriction	spring, summer or autumn	low if done by volunteers, high if paid labour.	high

** Information for this table was adapted with permission from Environmental Concern Inc.[7] and the U.S. Army Engineer Waterways Experiment Station.[8]*

Negative Collection Effect	Advantages	Disadvantages
• low	• minimal planting effort, can be broadcast or incorporated into soil mixtures • low labour and costs • suitable for large sites • can be stored for several years • increases genetic diversity	• wide range of viability, reliability and success • restricted harvest and planting time • special storage requirements (i.e., no pests, cold, wet) • long stratification period for some species • predation of seed • low germination rates for some species • seed can easily wash away from planting site
• high	• minimal planting effort	• large tubers difficult to extract from soil • susceptible to washout • some species susceptible to predation • reduced genetic diversity, may be clonal • difficult to obtain a large number of plants without causing excess damage
• high	• minimal planting effort • maximizes use of plant materials	• susceptible to washout • generally requires cultivation • reduced genetic diversity, may be clonal • difficult to obtain a large number of plants without causing excess damage
• low	• easy to plant, ideal for volunteers • can store in greenhouse or nursery • allows flexibility in coordinating project design and planting • high level of genetic diversity if seeds are collected properly • bare root material is easier to handle and transport	• requires planning and preparing in advance • susceptible to trampling and predation by wildlife
• low		
• high	• rapid establishment • increases probability of success • stabilizes soil rapidly	• very labour intensive • may be difficult to dig, transport and plant • causes damage to the donor site • difficult to obtain a large number of plants without causing excess damage

Note: All information is highly species dependent.

Seed Collection, Cleaning and Propagation

To minimize the negative effects of collecting plant material, propagate plants from seed. Collecting seed, when done properly, has few long or short-term effects on the donor site, and offers the best chance for success. It is important to realize that seed collection can have severe consequences if done improperly. This is especially true when dealing with annuals or species that produce few seeds or seed only infrequently. Consider the following when collecting seed:

- *Collect from many plants over a large area.*
- *Collect no more than 50 per cent of the seed of each plant.*
- *Collect no more than 10 per cent of seeds from any given site, even less if planning to collect from the same place next year.*
- *Collect seed from a number of different plants ranging in size and habitat location.*

Also, review the section on Selecting Plant Stock before collecting seed.

Seed Collection

Most wetland species release seed in the late summer and autumn, with some notable exceptions. For some species the window of opportunity for collecting is quite small (two weeks), while others can be much longer (three to four months). It is important that seeds not be collected until they are nearly ripe since immature seeds have reduced viability. After developing a checklist of plants for the project, conduct a literature search for each species to determine what time of year the seeds should be collected and how they should be stored to obtain maximum germination (see Seed Processing and Propogation chart).

Andy Hagen

Collection of softstem bulrush seeds.

Before collecting seed the following items should be prepared:

- *A paper bag to store the seeds while collecting (plastic gets too hot).*
- *A cool dry protected place to clean the seeds.*
- *Seed cleaning equipment (e.g., sieves)*
- *Containers that will keep seeds moist while stored (e.g., margarine tub)*
- *A fridge to keep the seeds between 1°C–5°C for several months or until ready to sow.*

When transporting seeds from the collection site be sure to keep them as cool as possible. High temperatures can reduce the viability of the seeds.

Cleaning

Seeds do not have to be cleaned before storage, but it is a good idea. Separating flower parts from the seed makes it easier to store and sow them. It also tends to limit the amount of mould that will grow during storage. Many species will require a day or two of drying before the seeds can be separated from other floral parts. This is easily done by spreading the flowers over newspaper on a table top. Make sure the area does not reach high temperatures on sunny windless days as this will adversely affect viability of the seeds. This area will also need to be protected from strong winds as some wetland seeds are quite small and easily scattered. After drying, it is much easier to separate the seeds from the inflorescence (cluster of flowers) by rubbing a handful between your hands or shaking them vigorously in a bag. Different species will require different treatments to separate the seed (see Seed Processing and Propagation chart).

Joe Minor

A sieve and several species of seeds stored in sealable containers.

Planting

Site conditions play a significant role in plant establishment. As noted earlier, wetland hydrology and substrate are very important. Aquatic plants adapt to certain water depths, and durations and frequencies of flooding. As an example, a submergent species such as tape grass (*Vallisneria americana*) requires permanently inundated conditions while an emergent such as Canada bluestem (*Calamagrostis canadensis*) prefers seasonally or regularly inundated to saturated conditions. When planting, it is necessary to match a species with the appropriate water regime. *A Wetland Planting Guide for the Northeastern United States* and *Techniques for Wildlife Habitat Management of Wetlands* outline water regime requirements for a number of aquatic plants.

If existing conditions are not conducive to supporting aquatic plants they may have to be altered before or concurrently with plantings. This can involve establishing appropriate water depths through digging or dredging or improving substrate conditions. At Second Marsh in Oshawa, Ontario, an unconsolidated silty-clay substrate made it difficult to walk and plant emergent bare root propagules. To address this problem, the planting area was stabilized by placing large mats of Geocoir fabric on top of the sediment; this organic fabric also protects root systems from herbivory. Keep in mind that natural or human induced changes in water levels can affect planting success. High water levels can impede emergent plant establishment, while lower levels can facilitate planting success.

Keith Discipline

A volunteer preparing bare root plants.

Timing is everything. Although planting can be successful at any time of the year, earlier planting increases chances of success. Planting in the mid to late spring is ideal because it gives the plants a long growing season and provides lots of time for both root and shoot growth. Planting later than the middle of August results in small plants with minimal root growth. This can cause problems since many of the rhizomes of wetland plants are somewhat buoyant and dislodge easily in loose soils. Plants that are not well rooted when spring floods occur are more prone to being washed away. For this reason, it is also risky to plant dormant roots in the early spring and late autumn. However, at these times it is easier to handle and plant dormant roots and therefore if the conditions permit (heavy soils in areas not susceptible to excess flooding), this option is most economical. Also, consider cutting emergent plants close to ground level when planting late in the growing season (late summer or autumn). This will help prevent the removal of plants from ice movement.[9]

There is also the question of which species to plant first. Some species (pioneers) are better suited to growing in newly disturbed sites and will be taken over later by more dominant species. It may be a good idea to start with these species because they tend to establish themselves quickly and stabilize the substrate.

When plant material arrives at the site it should be planted as soon as possible. If this is not feasible, store the material in the shade to keep it cool and moist.

Techniques

Planting techniques will vary with the species, the type of plant material and the planting site. Become familiar with the growth habit of the species being planted. Does it grow in monotypic stands, scattered clumps or individually? These characteristics will help in deciding how much space to leave between each plant. Keep in mind that the distance between each plant will affect the amount of time a species takes to fully cover an area. It will take a short period of time for plants to cover an area if they are placed closer together; however, this requires the use of more plants and leads to an increase in costs.

Plants with fast growth rates or the ability to spread quickly using rhizomes or rootstocks can be planted farther apart. Planting at a standard density of 0.5 to 1 metre centres is suitable for most plants. Plant spacing and growth rate characteristics for a number of wetland species are detailed in the *Wetland Planting Guide for the Northeastern United States*. It is quite possible that the original layout or design of the plantings will change over time as conditions at the site and the adaptive nature of each plant will ultimately decide the composition of the vegetation community. Also, most plants (excluding submergents) must have a portion of their stems (green part) above the water line to grow.

Additional information on planting techniques is available from several books (see the asterisk * in the Reference and Resource sections). When planting in and around water, safety is particularly important. Always plant in teams of at least two or more, wear suitable clothing and have plenty of liquid on warm summer days.

Direct Seeding

Consider the possibility of seeding directly onto the site. Although seed germination can be unpredictable, it is very cost effective and is one method of increasing the diversity of species without the cost of buying relatively expensive plants. The same consideration is needed to determine the best locations and method to sow seeds as is used in a planting project. Remember that many seeds are buoyant or wind dispersed, and care must be taken to ensure that the seeds come in contact with the soil. Seeding is most successful in the early summer after water levels and spring storms have subsided. If there is exceptionally dry hot weather after seeding, it may be necessary to water the area.

Transplanting

Transplanting involves collecting seedlings, single or clumps of adult plants, or rhizome sections from a donor wetland and planting them directly into a new site. It is best to transplant species in clumps with numerous stems and soil surrounding their roots.[10] This will help weigh down the plant and provide a stable base for the root mass. Also, be sure there are no exotic species present in the soil. Another approach involves placing the roots and substrate of a plant in a small burlap bag. The bag is tied at the top to contain the plant and has small incisions along the bottom to facilitate root growth.[11] This helps contain the root and soil, and weigh down the plant. Placing a stone in the bag will provide additional weight for the plant.

Andy Hagen

Transplanting cattails.

Transplants can be removed by hand or shovel. A shovel works best for plants with dense root systems (e.g., cattail). Place submergents, floating-leaved and free-floating plants in a container with water when transporting them to the planting site; some emergent species (e.g., cattail, giant bur-reed, bulrush) can be transported without water. Try placing transplants in similar water regime and substrate conditions, as this will help them adapt to their new environment. All plants should be planted as soon as possible. Leave 95 per cent or more of the donor vegetation patch to regenerate the site. Whenever possible, salvage plant material from a wetland that is facing destruction or when plans call for the removal of existing vegetation from within the project site (e.g., to change flow characteristics). If the addition of organic substrate is part of the design, consider using local sources, as seeds within the soil mixture

will be local in origin. *Restoring Natural Habitats* provides a further overview of transplanting aquatic macrophytes. This method is well suited to small restoration projects; however, for larger areas it is best to collect seeds and grow them at a nursery.

The plug cutter is an effective tool for obtaining transplant plugs. It is similar in design to a golf course cup-cutter and is made out of rebar and a metal cylinder. The cylinder is welded to the lower end of a shovel-like rebar handle. The bottom of the cylinder has a sharpened edge for cutting through plant roots. It is relatively easy to make and use. First the leaves and stems of an aquatic plant are pulled through the metal cylinder. The cylinder is then pushed down into the substrate cutting through the root mass. The plant remains safely inside the cylinder when the plug cutter is lifted out. Transplant plugs can then be placed on a tray for transport to the planting site. The cutter is useful for a number of plants including cattails, sedges and rushes.

Tubers, Rhizomes and Rootstocks

Dormant roots (tubers, rhizomes, rootstocks) must be securely planted. Dig a hole with a shovel, bare hand or by pounding holes in the sediment with a stake. Push the root into the hole approximately five centimetres below the surface. Make sure to firmly pack soil over top of the root. When planting dormant roots at the end of the growing season, some species (e.g.,cattail, bulrush) will require the old stalk to remain above the water surface to allow for respiration.

Container and Bareroot Plants

Ensure that container and bareroot materials are firmly planted. Again, they should be planted at least five centimetres into the sediment. This is very important when working in unconsolidated sediment and if the new plants will be inundated and exposed to wind. It is a good idea to trim the plant to 15 centimetres in height before planting. This will help the plant avoid damage from wind and wave action and reduce stress.

Dewatering

Dewatering or drawdown focuses on removing water from some area within a wetland to promote plant growth. As water levels drop, mudflats become exposed and the wetland begins to dry. This dryer environment provides more ideal conditions for seedbank germination and plant growth. The resulting plant community will depend on the species of seed present in the soil. However, in order for germination to occur there must be a sufficient seedbank present. Dewatering is also useful for facilitating planting activities if there is no seedbank; dry mudflats make it easier to manoeuvre over the planting site. An extensive discussion on the use and effect of drawdowns is provided in *Techniques for Wildlife Habitat Management of Wetlands*.

There are generally two main types of water control: permanent and short-term. Permanent structures can be very costly and usually require large-scale dykes and weirs to manipulate water levels. This technique tends to signify the long-term management of vegetation. Short-term techniques are relatively less expensive and are much smaller in scale. One small-scale technique involves the use of a

Protection of Plants

There are several possible problems that can limit plant establishment. These include: poor water quality, damage caused by wind and wave action, uprooting by fish (mainly carp), and trampling and herbivory from wildlife (e.g., deer, muskrat, rabbit, raccoon and various waterfowl). Although one objective of establishing new plants is to provide a source of food and habitat, it is necessary to maintain a plant population level that can sustain these uses. This level may be difficult to achieve with a large or steadily increasing fish and wildlife population.

If large populations exist, it may be best to plant less palatable or desirable species. At Second Marsh in Oshawa a large area was planted with arrowhead, soft-stemmed bulrush, giant bur-reed, pickerelweed and water plantain (*Alisma plantago-aquatica*). After one to two months of growth, all plants except giant bur-reed were grazed. It is important to note that the desirable species and type of herbivores will vary from one site to another. Conducting trial plantings is useful for determining which plants are more susceptible to herbivory.

In addition to selecting species that are less palatable, a number of techniques will help protect plants and minimize their loss; however, the long-term effects of these techniques are unknown. The selection of a protection technique will vary depending upon site conditions and the species being planted. It may be best to use a combination of these techniques to achieve maximum results. A monitoring program should also be implemented to help identify the level of plant protection necessary and the species of wildlife that are consuming or trampling the plants.

Exclosures

Experience from several rehabilitation projects indicates that the use of exclosures will improve the survival of aquatic vegetation. One design for a fish, wildlife and sediment exclosure consists of four panels (2.43 metre square) made out of metal T-bars, weld-wire fencing and geotextile. The T-bars provide a frame to secure the fencing and geotextile. When assembled it resembles a pen-like structure keeping the plants safe from predators. The geotextile helps to reduce turbidity and wind and wave action within the exclosure. One of the shortcomings of this technique is the limited area that can be protected at one time. As well, it is difficult to predict what will happen to the vegetation when the exclosures are removed. For more details on exclosures, see *Carp Control Techniques for Aquatic Plant Establishment*.

Plastic fencing is another useful material for building exclosures. Installing plastic fencing is not as labour intensive because of its light weight, but it is less durable than metal fencing as muskrat can chew through the plastic links. When waterfowl are a concern, exclosures must be small enough to prevent landing. A standard sized exclosure (e.g., 2.43 metres square) will prevent the majority of waterfowl from entering. Plastic fencing makes it easier to section off larger areas (e.g., 10 square metres), but at this size waterfowl are able to land inside. To prevent landing, string nylon rope or flagging tape in parallel rows across the top and through the centre of the exclosure area. Then attach additional flagging tape or metal pie-plates at one metre intervals. This will help to scare away wildlife. If rope is used, regular monitoring is required to ensure that waterfowl do not become tangled. Rope and tape will also work if strung from nearby trees, shrubs or brush. It has been found that wildlife will become tolerant of the pie-plates, tape and rope after some time. For this reason, it is important to change these tactics every few weeks. Herbivores tend to be deterred by new objects.

Another exclosure method using string and wooden stakes is effective at deterring Canada geese and other waterfowl. Stakes are driven into the ground so they encompass the planting area. Several lines of string or thin rope are attached to the stakes creating a fence-like barrier. The first line of string should be started approximately 0.3 metres from the ground with each additional line being 0.3 metres above.[12]

A Final Thought

Wetland restoration is a complex process requiring a considerable amount of time, effort and planning. This guide identifies a number of issues to consider when establishing aquatic vegetation. Throughout this guide are references and contacts to people and organizations who can offer further assistance. Some of the best insight on plant establishment is available from individuals involved with wetland restoration projects. The guide also includes a list of references and resources for further assistance.

It is important to realize that planting is not always appropriate or the only option. Sometimes it is best to facilitate natural colonization. If planting is preferred, remember to use materials that are native, of local origin and plant them in suitable habitats. When obtaining plant material, be sure to limit any adverse effects on the donor site. Remember, it is best to collect seeds and have them grown at a nursery. Stay informed of other restoration projects in the local area to limit collection from the same sites and follow the plant material collection guidelines.

Wetland restoration projects have the potential to involve various organizations and the surrounding community. Volunteers can help with collecting seeds, growing seedlings and planting. These types of projects help educate the community on the value of wetlands, build community support for their long-term protection and give individuals a personal connection to the community project. Above all, remember to have fun. The right attitude will get you through various dilemmas and help to ensure a successful project.

Common Marsh Plants

Emergent:	
water plantain	*Alisma plantago-aquatica*
swamp milkweed	*Asclepias incarnata*
sedges	*Carex* spp.
turtlehead	*Chelone glabra*
spike rushes	*Eleocharis* spp.
water horsetail	*Equisetum fluviatile*
wild blue flag	*Iris versicolor*
rushes	*Juncus* spp.
pickerelweed	*Pontederia cordata*
arrowhead	*Sagittaria latifolia*
hard-stemmed bulrush	*Scirpus acutus*
black bulrush	*Scirpus atrovirens*
softstem bulrush	*Scirpus validus*
green fruited bur-reed	*Sparganium chlorocarpum*
giant bur-reed	*Sparganium eurycarpum*
cattails	*Typha* spp.
American brooklime	*Veronica americana*
Submergent:	
coontail	*Ceratophyllum demersum*
waterweed	*Elodea canadensis*
watermilfoil	*Myriophyllum exalbescens*
sago pondweed	*Potamogeton pectinatus*
pondweed	*Potamogeton richardsonii*
bladderworts	*Utricularia vulgaris*
tape grass	*Vallisneria americana*
Floating-leaved:	
yellow water lily	*Nuphar variegata*
white water lily	*Nymphaea odorata*
water smartweed	*Polygonum amphibium*
variable-leaved pondweed	*Pontamogeton gramineus*
floating pondweed	*Pontamogeton natans*
Free-floating:	
common duck weed	*Lemna minor*
star duckweed	*Lemna trisulca*
greater duckweed	*Spirodela polyrhiza*

Common Exotic Marsh Plants

Emergent:	
flowering-rush	*Butomus umbellatus*
great manna grass	*Glyceria maxima*
yellow flag	*Iris pseudacorus*
moneywort	*Lysimachia nummularia*
purple loosestrife	*Lythrum salicaria*
*reed canary grass	*Phalaris arundinacea*
marsh cress	*Rorippa amphibia*
*common reed grass	*Phragmites australis*
Submergent:	
Eurasian watermilfoil	*Myriophyllum spicatum*
curly pondweed	*Potamogeton crispus*
Floating-leaved:	
European frog-bit	*Hydrocharis morsus-ranae*
floating heart	*Nymphoides peltatum*

** Species with both exotic and native genotypes. It is difficult to distinguish these genotypes from one another, therefore it is better to avoid planting this species.*

Selected Growers of Native Aquatic Plants in Southern Ontario

This is not intended to be a complete list of native aquatic plant growers. Check local area listings for additional growers.

Big Creek Biota, R.R. #1,Walsingham, Ontario, N0E 1X0. Tel: (519) 586-2603 Fax: (519) 586-2447. Big Creek Biota maintains an abundance of wetland species (all grown from seed) in various vegetative forms including: tree, shrub, emergent, submergent, floating-leaved, free-floating and seed. Big Creek Biota will custom collect and contract grow native seeds. As well, site analysis and consultation services are available.

Chalk Lake Greenhouses, R.R. #4, Uxbridge, Ontario, L9P 1R4. Tel/Fax: (905) 649-5384. Chalk Lake Greenhouses has several species of wet meadow, emergent, submergent and floating-leaved plants available. Chalk Lake will also contract grow seeds.

Moore Water Gardens, P.O. Box 70, R.R. #4, Port Stanley, Ontario, N5L 1J4. Tel: (519) 782-4052 Fax: 1-800-728-6324. Moore Water Gardens maintains several species of emergent, submergent and floating-leaved aquatic plants.

Pterophylla, R.R. #1, Walsingham, Ontario, N0E 1X0. Tel/Fax: (519) 586-3985. Pterophylla provides native, local southern Ontario wet meadow and riparian species. They also have expertise in restoration and collecting and contract growing native seeds.

Picov's Water Garden Centre and Fishery, 380 Kingston Road East, Ajax, Ontario, L1S 4S7. Tel: 1-800-663-0300 Fax: (905) 686-2183. Picov's specializes in providing various species of herbaceous aquatic plants. All plants are propagated from seed and are available in many different forms. Contract growing is available. They also provide restoration and site analysis services.

Royal Botanical Gardens, 680 Plains Road West, Hamilton, Ontario, L8N 3H8. Tel: (905) 527- 1158 Fax: (905) 577-0375. The native aquatic plant nursery grows a variety of swamp, marsh and wet meadow species for restoration purposes. Seed is collected and grown on a contract basis. Consultation is sometimes available for wetland, forest and grassland restoration.

*(*REMEMBER: Use local native plant material)*

References

*(*reference or resource provides information on planting techniques)*

1. Ontario Ministry of Natural Resources and Ontario Ministry of Municipal Affairs. 1992. Manual of Implementation Guidelines for the Wetlands Policy Statement. Toronto: Ontario Ministry of Natural Resources. p. 5.
Available from: Ontario Ministry of Natural Resources, Natural Resources Information Centre, Room M1-73, Macdonald Block, 900 Bay Street, Toronto, Ontario, M7A 2C1. Tel: (416) 314-2000.

2. Society for Ecological Restoration, Board of Directors. 1995. Definition of Ecological Restoration [working definition]. Madison: Society for Ecological Restoration.
Available from: Society for Ecological Restoration, 1207 Seminole Highway - Suite B, Madison, WI 53711 USA Tel: (608) 262-9547. Email: ser@vms2.macc.wisc.edu

3. *U.S. Army Engineer Waterways Experiment Station, Environmental Laboratory. 1978. Wetland Habitat Development with Dredged Material: Engineering and Plant Propagation. Vicksburg: U.S. Army. p. 69.
Available from: National Technical Information Service at (703) 487-4650. ADA # 073493.

4. Hammer, D. A. 1992. Creating Freshwater Wetlands. Boca Raton: Lewis Publishers. 298 pp.
Available from: Times Mirror Publishing, 130 Flaska Drive, Markham, Ontario, L6G 1B8. Tel: 1-800-268-4178.

5. Hartmann, H. T., D. E. Kester and F. T. Davies. 1990. Plant Propagation, Principles and Practices. Englewood Cliffs: Prentice Hall. 647 pp.
Available from: Prentice Hall, 539 Collier MacMillan Drive, Cambridge, Ontario, N1R 5W9. Tel: 1-800-567-3800.

6. Hartmann, H. T., D. E. Kester and F. T. Davies. 1990. Plant Propagation, Principles and Practices. Englewood Cliffs: Prentice Hall. 647 pp.

7. Environmental Concern Inc. Table from Wetland Mitigation course materials. pp. 13.

PLANTING THE SEED