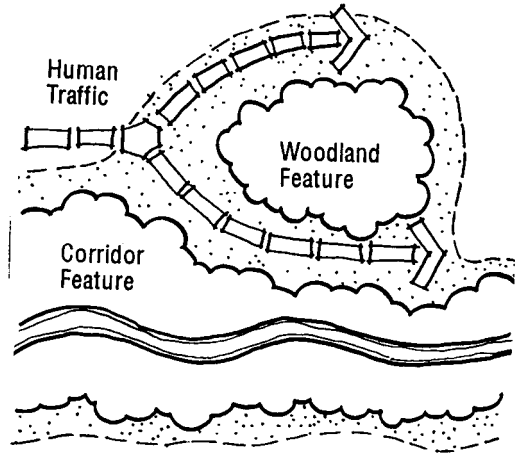


Incorporating land adjacent to a protected natural area can also help to dissipate the impacts of human use. Other reasons for doing so are:

- human traffic can be more easily routed around sensitive natural features;
- additional natural areas may provide a corridor for some species;
- land is secured; later plans can incorporate it into specific restoration objectives.



Rerouted traffic around sensitive areas

Caution

A drawback to incorporating adjacent land dissimilar to a core of sensitive vegetation is that habitat is maintained for edge predators and parasites, which then have a foothold for forays into the adjoining sensitive habitat. For example, researchers have observed Brown-headed Cowbirds, a nest parasite, using hedgerows as perches from which to monitor nests in grasslands, in order to detect the optimum moment for laying their eggs.

c) Identify what habitats to enhance and where to create new habitats

This is the stage where objectives are tied to specific areas of the site, locations for different habitat types are identified, and relative size is determined. When selecting the locations for new habitat types, consider the physical conditions of the site (identified in Step 2) that determine what habitat types are possible. The following points provide useful guidance in identifying areas for locating new habitat types.

- Communities considered candidates for restoration include sites dominated by planted introduced species and where the diversity of both wildlife and plant life is very low. Examples include

groves of Austrian pines or Norway maples and lawns planted with commercial fescues.

- Prior to cutting down any trees, check with community groups and the municipality to see if opposition is likely or if approvals or permits are required. Involve the public where necessary.
- Plant communities in an early stage of succession are often not considered significant and are frequently suggested as candidates for restoration to different habitat types. Examples include old fields, small cattail stands, and disturbed riparian meadows.

Reasons for this dismissive attitude toward early succession habitats include:

- the high value placed on trees, especially by urban dwellers;
- the scarcity of mature woodlands relative to successional lands;
- the fact that most successional vegetation on abandoned agricultural land is common and there is a high introduced species component;
- the need for deep-rooted woody vegetation for engineering purposes (to combat erosion, for example);
- the desire to provide habitat for forest-dwelling wildlife;
- the perceived "untidy" look of successional landscapes compared to manicured lawns;
- the perception that successional land will eventually grow into forest in any case;
- possible public pressure to revegetate abandoned quarries and other sites having impoverished soils, since they are often considered unsightly.

Public attitudes toward early successional communities, however, are changing, and preserving meadows does not have the low priority it did in the past. Reasons for preserving early stages of succession include:

they create a greater diversity of plants and animals than conventional landscaping;
old fields are resilient to trampling and other disturbances and can therefore sustain relatively heavy use with little harm to the vegetation. Old fields and open floodplains are often popular

walking spots and are perceived as attractive by a growing number of people;

- ♦ there are some common wildlife species of successional lands that appear to be undergoing long-term declines (e.g. Brown Thrasher, Gray Catbird);
- ♦ as early successional lands are frequently used for development, once-common species decline in developing areas. For example, bird species of larger grasslands, such as Upland Sandpiper and Grasshopper Sparrow, are now rare in the Greater Toronto Area.

d) Human access and impacts

Once the general layout of habitat types has been plotted, other considerations may further refine the design. Objectives relating to recreation, educational opportunities, and other considerations may influence boundaries, access points, trails, lighting, setbacks, boardwalks, and viewing areas.



Restricting public access may be required to ensure the integrity of sensitive habitat features. This may be accomplished through the use of fencing, or other barriers such as branches and logs. Buffering sensitive areas with tree or dense shrub planting can also discourage access. Public education via signage can be used where indiscriminate access may harm the natural environment.



Properly designed trails and boardwalks can provide access while limiting damage to the natural environment. In areas with large adjacent human populations, it is easier to establish desirable use patterns at the outset, rather than try to change established ones.

e) Restoring degraded habitats

The physical conditions of a site may indicate that changes to hydrology, soil compaction, and depletion of organic matter in the soil have occurred. Other indicators include:

- lack of diversity;
- presence of invasive introduced species;
- densely growing early successional species that will impede the regeneration of desired species;
- impacts such as trampling of vegetation.

Enhancement of existing habitat can consist of remedial measures to restore proper physical conditions, management techniques to control introduced species and enhance desired species, and planting. *For specific techniques consult the technical section for each habitat type in this document.*

For new habitat areas, identify what steps need to be taken to create the physical conditions necessary to establish these habitats successfully. Measures may involve changes to drainage patterns, addressing soil conditions and constraints, establishing buffers against road salt or wind, addressing erosion problems.

Other considerations that influence the approach to restoration or the techniques used include available budgets, who will implement the plans, and who will manage and maintain the restored area.

f) Prepare the detailed restoration design

Once appropriate physical conditions are in place for the selected habitat type, determine which techniques are to be used and refine the layout of the design based on how these techniques are to be implemented. For example, if the habitat type is wetland, not all parts of the proposed wetland will necessarily be planted.

Where a combination of techniques is used, it is helpful to:

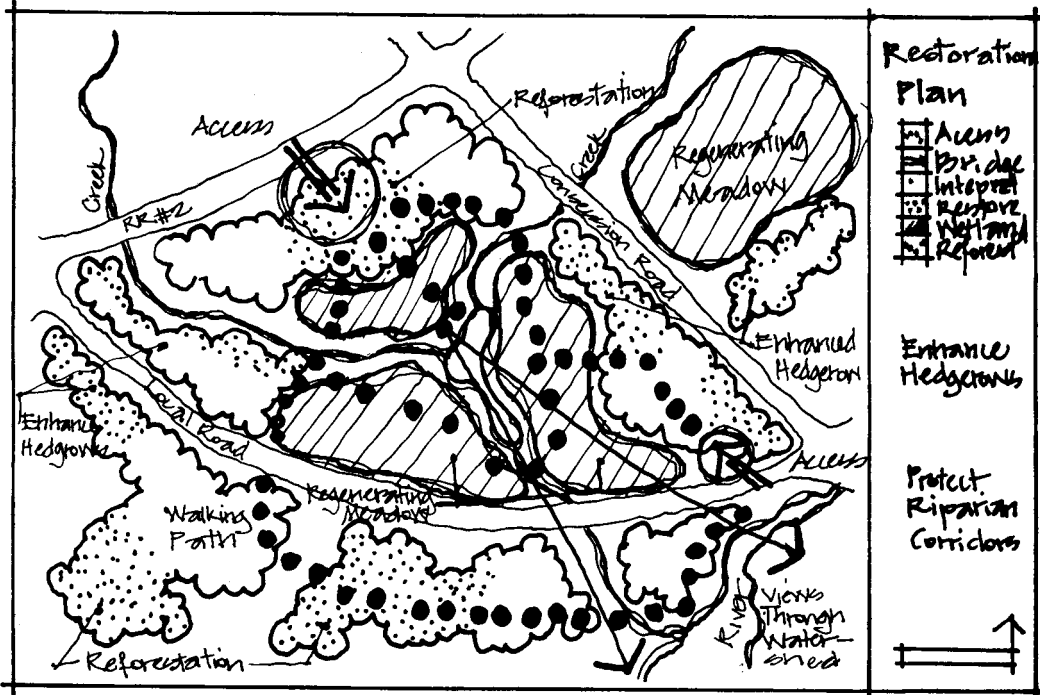
- identify where each technique will be applied;
- identify the location of planting, seeding, and natural regeneration;
- create a plant pallet for each planting zone;

- check that plant material is available. If it cannot be obtained from commercial nurseries, other arrangements, such as contract growing, can be made if sufficient time is available.

The detailed restoration design focuses on the creation of the physical environment and identifies the relative mix of species, spacing, quantities, and size of plant material on the plan. At this point, the need for mulch, staking, and fencing must be reviewed. For some restoration projects aesthetics are important, so plant selection and arrangement must address visual criteria.

Step 4 Summary

The preparation of an overall strategy and detailed design for restoration brings together all the natural and human elements identified up to this stage—an understanding of regional context, the specific opportunities of the site, and the establishment of objectives. The site design identifies those habitats that should be protected, those that require restoration measures, and the human activities that must be accommodated.



Sample restoration plan

STEP 5 IMPLEMENT, MANAGE AND MONITOR

The last aspects of a restoration design to consider are the implementation, management and monitoring of the site. How the restoration is implemented may affect the chosen approach. Management and monitoring will ensure the ongoing success of the restoration and provide direction where adjustments need to be made.

This step contributes to the following elements of the restoration plan:

	REPORT	ILLUSTRATIVE MATERIAL
	<i>Introduction</i>	
<i>STEP 1</i>	<i>Determine Regional Context</i>	<i>Context maps</i>
<i>STEP 2</i>	<i>Inventory and Evaluate Site Conditions</i>	<i>Site inventory maps Photos</i>
<i>STEP 3</i>	<i>Set Restoration Objectives</i>	
<i>STEP 4</i>	<i>Draw up Restoration Plan</i>	<i>Restoration drawings and documents</i>
<i>STEP 5</i>	<p><i>Implement, Manage and Monitor</i></p> <p>a) Implement the restoration plan:</p> <ul style="list-style-type: none"> ◆ installation. <p>b) Prepare management plan:</p> <ul style="list-style-type: none"> ◆ short-term management (maintenance practices during establishment phase); ● long-term management (periodic intervention required to manage and/or maintain habitats). <p>c) Monitoring.</p>	<p><i>Contract documents</i></p> <ul style="list-style-type: none"> ◆ detailed working drawings; ◆ technical specifications. <p><i>Management plan</i></p> <ul style="list-style-type: none"> ◆ detailed plan showing specific management treatments for different site areas.

a) Implement the restoration plan

During the preparation of a detailed restoration plan, it is important to know early on whether the project will be carried out by the community or involve a contractor. Some restoration techniques requiring large equipment or expertise may not be suitable for implementation by local communities. At the same time, community plantings are likely to be the prevailing method in the foreseeable future.

Contractor installation

The benefits of professional installations include:

- they permit a variety of restoration techniques to be used;
- they result in a reliable, guaranteed product;
- technically appropriate techniques can be selected for different situations.

Drawbacks include:

- the need for working drawings and specifications that are costly to prepare;
- an installation is likely to be considerably more expensive in the short term than volunteer effort.

For a successful contractor installation, prepare detailed working drawings and technical specifications. When preparing the specifications, consider that few contractors have expertise in natural restoration techniques. While the level of expertise is improving, improper installation can result in erosion and a poor plant success rate. Pre-qualification of contractors or invited bids can ensure that only experienced firms are asked to bid on the restoration work. As with all construction projects, regular site inspections will be essential at critical times during the process.

Community installation

The benefits of community-based projects include:

- more can be accomplished for less money;
- projects can involve people in a meaningful educational and community-building experience;
- projects instill a sense of responsibility and stewardship in the participants.



Drawbacks include:

- project techniques must be simple, flexible, and easy to learn;
- plants may be poorly installed. Lack of maintenance may compromise the effectiveness of the project;
- projects must be small enough to be accomplished in a half day. Larger projects should be phased, or organized with successive groups of people;
- community plantings require considerable organization and coordination to be successful.

Goals for citizen involvement must be balanced with the success of the planting itself. The following are some steps to be considered:

- nurturing community experience in planting techniques. Leadership in training local people through nongovernment organizations (i.e., the Evergreen Foundation, Tree Canada) has value where planting remains a community initiative over a number of years;
- workshops on restoration philosophy, ecology and techniques are required for the staff of municipal departments (parks, works, roads, etc.), who may have had little or no experience in ecological restoration, plant selection and propagation, nongovernment organization management, retraining of personnel, community involvement, or in developing collaborative agreements with other departments;
- the involvement of municipalities and other government agencies in community projects is essential for coordination between agencies, obtaining approvals, supplying plants, mulch, water, short- and long-term management;
- partnerships between conservation authorities or other government agencies and volunteer groups or private landowners have been very successful. Government staff provide the technical expertise and assist the volunteer groups or private landowners with the restoration program.

Organizing community planting days

Before embarking on a community planting day, the organization sponsoring the planting event should make a commitment to maintain the planting during the first 3 to 4 years.

Checklist for community planting:

Obtain public agency approvals for planting on agency lands and address liability/public safety (steep slopes, near or within highway right-of-way, etc.).

Obtain plant materials:

- ♦ resolve funding and acquisition of the right plant material and transport to site;
- ♦ consider site storage requirements;
- ♦ bundle different species for different site type.

Provide mulch:

- ♦ supply by parks departments, other;
- ♦ on-site storage;
- ♦ application.

Provide tools:

- ♦ spades, forks, buckets;
- ♦ supply by parks departments or by citizen organizations.

Provide water:

- ♦ available sources, hydrants, supply valves, water truck.

Provide amenities:

- ♦ refreshments and washrooms are needed if the planting is to take more than a half day.

Site layout is important for the success of community planting days. Different site types should be laid out on the ground, identified with a number or letter, and appropriate plant groupings bundled and identified for each site type:

- ♦ steep slopes;
- ♦ wet areas;
- ♦ dry areas;
- ♦ areas for mixed associations of plants (i.e., woodland mix);
- ♦ areas for single species (i.e., sumac on steep slopes).

Pedestrian routes should be marked out for access to planting areas to avoid trampling. Areas should be marked out for storage of plant material, mulch, tools, water.

b) Prepare the management plan

A management plan consists of those procedures necessary to ensure the success of the restoration over time. Management objectives can be varied and can serve to reinforce the restoration strategy. Some objectives are common to all habitats, others specific to distinct habitat types. Specific management procedures are discussed in more detail under individual habitats discussed in Sections 3 - 8.

Every project is different, and a management program needs to be adapted to the individual circumstances of a project. While management strategies for wetlands, woodlands, or meadows will differ, there are also differences *within* habitat types. Not all wetlands are identical. Management treatments must therefore be modified to suit particular site conditions and restoration objectives.

Other factors to be considered are:

- who will be responsible for management?
- what financial and human resources (technical expertise and manpower to carry out management plans) are available?
- what is the role of the public?
- is there a need for public involvement in management plans?
- what are the requirements for public access?

Completion of the restoration plan will result in:

- a clear understanding of existing conditions and the desired outcome of the project;
- short- and long-term management objectives that reflect habitat types and the restoration procedures being undertaken.

Short-term management

The establishment phase must contain procedures to ensure the success of the restoration. Depending on the habitat type involved and the type of restoration procedures implemented, short-term management may last between one to five growing seasons. This phase includes:

- maintenance practices such as watering during dry periods in the first year;
- replacement of plant material where the mortality rate is excessive;

- control measures to minimize damage from rodents, deer browse, insects or disease;
- removal of introduced plant species and undesirable vegetation to reduce competition.

Long-term management

A long-term management plan is especially important for plant communities such as woodlands that take a long time to develop. Long-term management plans for highly dynamic communities may have to be updated regularly, as site conditions change.

c) Monitoring

Monitoring should include biological parameters (plants and wildlife), physical parameters (i.e., water quality), and evaluating the effectiveness of cultural initiatives, (i.e., barrier planting or trails to reduce human impacts on a particular habitat).

As part of the ongoing management of restored areas, the following broader questions need to be asked:

- were the techniques successful?
- did the restoration achieve the desired objectives?
- is there a need for remedial works or wholesale change?

Measuring success

Monitoring can measure the success of restoration techniques and provide valuable information on the health and status of natural habitat. This information can then be incorporated into the ongoing management strategy for the site.

Monitoring procedures must reflect the type of habitat restored, specific restoration approaches, and techniques used (i.e., monitoring of erosion on steep slopes; assessment of water quality of streams and wetlands during initial years).

Record of a site's development over time

Before beginning restoration work, baseline data need to be established against which the project can be assessed. For water quality issues, this may require testing for a variety of parameters with the help of experts. Vegetation, wildlife, bird or fish surveys can

provide a useful baseline against which to judge results. Photographs, especially panoramas, taken from an easily identifiable point can record change over time. In most instances, the site inventory and the evaluation of the site context (Steps 1 and 2) will provide the necessary baseline data for monitoring results.

Human use and impacts

Other aspects of monitoring relate to human use and potential impacts from surrounding land uses. Assessing human use patterns is particularly important in urban areas where a large population can lead to overuse. Access and safety may be issues in isolated areas.

Undesired species

Monitoring undesired species, such as purple loosestrife in wetlands and Norway maples in woodlands, is an ongoing factor in their control. Native species can also be considered undesirable when a certain stage of succession is to be maintained. Information gained from the monitoring process will help to assess the need for new management strategies, further restoration work, or remedial measures. The management strategy must therefore be flexible enough to incorporate new information about the site.

Monitoring limitations

Monitoring can put a strain on the dwindling resources of public agencies. Due to lack of funds and staff to carry out evaluations, restoration projects are often not reviewed. Frequently, it is unclear who is responsible for monitoring and no formal mechanisms require the evaluation of projects. As a result, the opportunity to learn from previous successes or failures is not followed up. The need for monitoring must be determined at the outset and be accounted for in budgetary allowances. Where restoration is related to proposed urban development, the cost of monitoring should be the responsibility of the proponent.

Community Involvement

The role of the public in monitoring is becoming more extensive. Naturalists and community groups can contribute a useful information base and ongoing monitoring. For example, the Canadian Wildlife Service involves volunteers for their forest bird and marsh bird monitoring. Wildlife and amphibian protocols guide volunteers in those monitoring activities. Naturalist groups, such as the Federation of Ontario Naturalists, track bird migration and nesting and keep yearly records.

Step 5 Summary

Successful restoration of natural landscapes requires an ongoing commitment to the project throughout the planning and implementation phases. As the site matures, management and monitoring programs are extremely important to ensure the success of the restoration and identify new concerns that may arise over time. The commitment to management and monitoring should be taken into consideration during planning phases of the restoration project. The monitoring program needs to identify who will carry it out and what parameters and critical indicators should be measured to assess the health of the site.

