Design Elements

Sector: Agriculture

Site Analysis
Site: Skagit Wildlife Area Original ecosystem type: estuarine fringe wetland, tidal freshwater, riparian wetland Natural disturbance regime: floodplain, coastal, seasonal flooding, winter storms Current state: grain fields planted for birds, hunting preserve, system of dikes Matrix: Agriculture, Skagit Bay
Environmental Functions
Important historic functions: Habitat, detrital export, storm energy dissipation Functions lost or diminished: Habitat, biodiversity, storm dissipation Potential function: Nutrient removal
Impact on Historical Ecosystem
Conversion to agriculture River disconnected from floodplain and much of delta by levees. Diking along bay Flap-valves allow sloughs to drain fresh water through dikes; salt water excluded.
Constraints
Hunters oppose Farmers contend waterfowl will feed in their fields after loss of refuge fields. Restoration plan proposes levee removal. Disposal of removed levee material Farmers contend salt water intrusion will ruin fields. Site may not be salty enough to suppress invasive plants (reed canarygrass, cattails)
Predicted level of repair possible
With salinities > 2 ppt, good chance of conversion to emergent estuarine vegetation. Coastal systems near intact sites often re-vegetate passively. Locations with lower salinity will have invasive plant problems
Likelihood of autogenic repair
Nearby coastal strip has estuarine emergent plants; will probably colonize restored area. Freshwater tidal and estuarine scrub-shrub will need to be planted.
Range of restoration options
Low: Breach dikes, do not plant, do not manage plants High: Remove dikes, plant emergents, plant woody species, manage invasives. Pilot distributary channels may be excavated. Habitat structures may be added. LWD may be added

Estimated requirements:
Track hoe, dump trucks, bulldozer Plant material including *Carex lyngbyei, Scirpus acutus, Scirpus americanus, Myrica gale, Triglochin maritimum, Eleocharis palustris.* Plant on 2 ft. centers. (5,445 plants per half acre). Time required for sprigging: three persons for five days per half acre plot. Half acre is 147.6' x 147.6'
Site design
Site design will be dependent upon depth and salinity. At this river-dominated site, salinity will probably be low and variation will be low. From elevation 6' to 8' (above MLLW), plant *Scirpus americanus*. At elevations above 8' use other herbaceous spp. At freshwater sites at 10' or above, plant woody *Myrica gale*. *Myrica* may be planted into logs if they are prepared correctly. LWD is appropriate at higher elevations. Pilot channels may be excavated along expected drainage patterns.
Sequencing and timing
Pilot channels for drainage, if they are to be created, should be excavated before levees are breached. LWD, if it is to be trucked into site, should be installed before the levees are breached. Excavation of levees should take place in spring and summer, after the season of high probability of storms. In sites with salinity > 2 ppt, land newly opened to tidal flows may be left fallow without fear of colonization by invasives. There is, however, the invasive saltmarsh species *Spartina alterniflora* in Skagit Bay. If it appears, it should be controlled using a herbicide like Rodeo. Emergent species should be planted in April and May to give them a chance to establish root systems and develop foliage. Coastal emergent plants do much of their growth early in the season and senesce in August. Snow geese are heavy grazers of the species that are to be planted; they leave in late April. Installation should either wait until they leave, or goose exclosure netting or fencing should be used.
Continuing activities
Monitor for invasive plants (reed canarygrass, cattail, *Spartina*). Replace plant material that dies, is lost or eaten. Monitor for goose grazing, and construct exclosures if it occurs.

Design Elements

Sector: Livestock

Site Analysis
Site: Creek drainage northwest of Ellensburg Original ecosystem type: Shrub-steppe with sagebrush, agropyron spicatum, festuca idahoensis. Natural disturbance regime: fires, grazing by native ungulates, drought, hard winters, insects. Current state: Grazing pasture. Riparian zone of small creek has been heavily grazed by cattle and creek banks and flood plain are compacted and devegetated. Matrix: Grazing land.
Environmental Functions
Habitat for many shrub-steppe plant species: sagebrush, rabbitbrush, bluebunch wheatgrass, Idaho fescue. Intact vegetation controls wind erosion; riparian corridors provide unique habitat.
Impact on Historical Ecosystem
Heavy grazing has decreased species diversity and increased the prevalence of invasive plants. Streambank structure has been compromised and creekside riparian vegetation has been simplified.
Constraints
Stream corridors must be fenced but cattle must have access points for water. Invasive species have become widespread. Native grasses have diminished; cheatgrass is widespread over great areas of the Columbia Basin. Wildfires are common, and fire helps increase cheatgrass.
Predicted Level of Repair Possible
Good cover of woody species can be expected if site is protected: Crataegus douglasii, Symporicarpos albus, , Potentill gracilis, Prunus virginiana, Amelanchier alnifolia
Likelihood of Autogenic Repair
If the native woody species are absent in the watershed, especially upstream, the taxa should be planted.
Range of Restoration Options
Low: Fence riparian corridor Medium: Fence corridor and install woody species High: Add herbaceous species after woody species are established.
Estimated Requirements

Fencing, at approximately 90 cents per linear foot. Bank stabilization materials such as coir or jute netting. Herbicide Bare root and container material for woody plants.
Site Design
Creek flood zones will dictate species selection. Predicted soil moisture levels from winter snowfall may also be used.
Sequencing and Timing
Shrub-steppe dries out early and depends on melting snow for early growth. Installation may be required in fall; early spring installation depends on site accessibility.
Continuing Activities
Fire in this ecosystem accelerates the invasiveness of cheat grass. Minimizing disturbance may be a necessary strategy.

Design Elements

Sector: Forest Practices

Site Analysis
Site: Cedar River Watershed Original ecosystem type: montane forest…hemlock, Douglas fir, Pacific Silver fir Natural disturbance regime: fire, windthrow, landslides. Current state: commercially logged but now in mid-succession. Matrix: forest
Environmental Functions
Important historic functions: watershed, habitat Functions lost or diminished: old growth characteristics. Potential function: old growth characteristics.
Impact on Historical Ecosystem
Site has been logged and commercially thinned.
Constraints
Some old growth characteristics will take time to develop.
Predicted Level of Repair Possible
A number of old growth characteristics are possible to simulate. Large wood and massive nature of some old growth features difficult to attain.
Likelihood of Autogenic Repair
Would require hundreds of years and a hands-off policy.
Range of Restoration Options
Low: close off area and let time produce old growth. High: thin, plant, work on understory, bring in wood.
Estimated Requirements
Commercial logging equipment or low impact methods required for thinning. Tree nursery Large salvage wood. Volunteer crews for planting.
Site Design
Design for spatial variability; create skips and gaps; leave variable space between trees. Thin a 40-60 yr. old forest by 40-50%. Leave deciduous trees. Underplant with shade tolerant cedar, hemlock, Pacific silver fir. Create numerous vertical canopy layers. Never cut big trees. Create pit and mound topography.

Leave fallen trees on ground and in streams. Create species and age diversity.
Sequencing and Timing
Restoration activities such as thinning and creating snags can be undertaken whenever the site is accessible; depending on location there is snow during the winter that would make access impossible.
Continuing Activities
Planting, bringing in wood, creating nesting features.

Design Elements

Sector: Water and Power

Site Analysis
Impoundment for water storage is one impact that the water and power industry can have on natural ecosystems. Impoundments can have impacts upstream and downstream. Upstream: Stream channels, flood plains, and abutting hill-slopes are inundated. In storage reservoirs (not "run-of-the-river" dams that have little storage), pool levels can undergo extreme annual variation. Downstream: Stream pulsing (annual floods, storm-event floods) is damped out. Sediment is removed in reservoirs, making release water very erosive; sediment picked up downstream may be deposited on spawning gravels. Some downstream reaches may have no flow. Decreased flushing downstream may result in increased BOD Dams also impede fish migration, either completely or to some lesser degree. Release water may alter downstream temperature and lower dissolved oxygen. Site: Shoreline of a "run-of-the-river" dam on the Columbia River. Original ecosystem type: The shoreline of the Columbia River and tributaries supported trees like Betula occidentalis, Juniperus scopulorum, Morus alba, Populus tremuloides, Populus trichocarpa, Prunus virginiana, Salix amygdaloides, S. exigua, S. lasiolepis and shrubs like Amelanchier alnifolia, Artemisia tridentata, A. tripartite, Atriplex spinosa, Chrysothamnus nauseosus, C. viscidilorus, Cornus stolonifera, Philadelphus lewisii, Purshia tridentate, Rhus glabra, Ribes aureum, Sambucus cerulea. Natural disturbance regime: flooding. Current state: flooded Matrix: grazing land, Columbia R.
Environmental Functions
Initial flood plain and riparian zones acted as a resource, corridor, habitat, cover, water source, food source, cooled stream, contributed litter and invertebrate fall. It also served as a buffer, capturing sediment and other substances.
Impact on Historical Ecosystem
The floodplain and historical riparian zone were flooded by the dams. Rapids were also eliminated
Constraints
Floodplain no longer exists. Sloping upland now intersects lake edges. Water fluctuation

is minimal. Water quality and hydrology are modified.
Predicted Level of Repair Possible
Fringing wetlands could be created along the lake edge.
Likelihood of Autogenic Repair
Little likelihood because of morphology of lake basin. No flat places.
Range of Restoration Options
High: removal of dam Low: creation of lake fringe wetlands to create ecological functions and replace some of lost functions.
Estimated Requirements
Backhoe or Traxcavator, dump trucks, rip-rap, plant material.
Site Design
Excavate a bench back into shore. It should have an elevations that ranges from 6” below to 6” above lake level.
Sequencing and Timing
Excavation can occur at any time. Planting should begin at start of growing season.
Continuing Activities
Check for erosion. Replace dead material.

Design Elements

Sector: Brownfields

Site Analysis
Site: former Montlake Landfill, now known as Union Bay Natural Area. Original ecosystem type: the landfill was placed on a deltaic fringe wetland that was exposed when Lake Washington was lowered in 1916-1917 to allow the operation of the Chittendon Locks on the ship canal. Natural disturbance regime: urban Current state: landfill closed and leveled in 1968. Matrix: residential, Lake Washington, disconnected Yesler Creek and Ravenna Creek.
Environmental Functions
Important historical functions: shoreline wetland, providing habitat for migratory and resident fish, waterfowl. Current functions: bird habitat, urban wildlife area, experimental outdoor laboratory. The site supports wetlands, shoreline, grasslands, woodlands, and swamp. Potential functions: may be modified to increase shoreline wetland functions.
Impact on Historical Ecosystem
Draining of lake, filling of resultant wetland.
Constraints
Capped landfills often have restrictions on the planting of trees, but this one does not. The cap was created with material excavated for freeway construction, and is not a clay cap. The soil layer that has developed over the landfill is thin, and has low available soil water in the summer. Trees on thinner soils are subjected to windthrow. After capping, non-native pasture grasses were sown over the site; Himalayan blackberry subsequently began to colonize much of the grassland. The site is used by birders and is a major campus access route; any restoration or maintenance activities must be explained by on-site interpretive signage. Necessary mowing must be limited to August, when nesting activity by birds is minimal.
Predicted Level of Repair Possible
Simplified communities are possible including wetlands, prairie, woodlands, swamp, shoreline. The open area is valuable for shorebirds, migratory waterfowl, raptors.
Likelihood of Autogenic Repair
Appropriate native plant materials other than weedy species are not likely to colonize the site. Rampant blackberry invasion has required mowing and herbicide application for a number of years.

Range of Restoration Options
Low: stabilize site and keep dust from blowing. High: Create native plant communities in an number of ecosystem types; provide habitat for and attract birds, small mammals, amphibians. Provide shoreline habitat for migrating fish.
Estimated Requirements
About $600 worth of plant materials are used each year. Some supplemental seeding is used. Arborist's mulch is stockpiled, then transferred to installations. Woody debris is donated by campus arborist.
Site Design
Wetlands: Remove invasive plants (loosestrife, reed canarygrass, nightshade). Improve hydrology (low berms, outlet structures, pipes. Plant native wetland species. Grasslands: Mow to suppress blackberry. Woodlands: Plant fast-growing, drought-tolerant tree species to create shade, which creates a disadvantage for blackberry and reed canarygrass. Add woody debris and snags. All woody species installations require heavy mulching with arborist chips to maintain soil moisture through summer drought. Shoreline wetlands and drainageways: Live stake with willow to create shade and suppress reed canarygrass. Swamp: Install habitat structures (nesting poles, bird boxes)
Sequencing and Timing
Work is done in winter and fall. There is heavy reliance on bare root material which must be in the ground before spring.
Continuing Activities
Site must be monitored for invasive plants; an IPM technician applies herbicide for blackberry, Canada thistle, reed canarygrass, tansy ragwort, yellow loosestrife. *Gallerucella* beetles have been cultured on site and released to control purple loosestrife. Grassland must be mowed at least once a year to suppress blackberry. Site is large and restoration must be approached incrementally. Installed restoration plots must be weeded and dead plants replaced.

Design Elements

Sector: Mining

Site Analysis
Site: McLaren Gold Mine, Beartooth Mountains, Cooke City, Montana. Mine was operated from 1938-1952 and closed with no restoration planned. AuCuAs veins with minor PbAgZn veins. Original ecosystem type: montane quaking aspen, subalpine and alpine zones, 8,000 to 10,000', Rocky Mountains. Natural disturbance regime: winter snows and avalanches. Dry summers. High altitude Current state: abandoned surface mine Matrix: alpine and aspen vegetation
Environmental Functions
Habitat, erosion control, stream headwaters, water supply
Impact on Historical Ecosystem
Shaft mining, then strip mining removed existing vegetation. Pyritic ores have resulted in acid runoff into streams that drain the area.
Constraints
There is no soil. At the elevation where the mine is located, the growing season is short. The site is dry. Pyritic surface materials will generate acid. Frost heave and ice crystal formation is common and will kill seedlings. Soil organic material and nutrient pools are difficult to establish.
Predicted Level of Repair Possible
Stabilization can be achieved. Soil may need to be amended.. Low vegetation, mostly native grasses, can be established but will not be productive.
Likelihood of Autogenic Repair
Would not happen in this century.
Range of Restoration Options
Low: soil stabilization High: restoration of historic vegetation community
Estimated Requirements
Native plant seeds Soil amendments: straw, manure, peat. If organic material with high C:N ration is used, add nitrogen fertilizer.
Site Design
Soil restoration is the critical goal. On organic disturbed soils, no amendment is

necessary. On mineral disturbed soils, organic amendments and fertilizer application is required. Native alpine grass should be planted as seed or as small container plants. Nitrogen fixers such as lupine and astragalus should also be included in plantings. Roughen soil or use a protective organic mulch.
Sequencing and Timing
Site is open May through October. Site preparation must take place during this time. Live plants should be installed in May or June. Seeding may be done in fall.
Continuing Activities
Nutrient pools are difficult to sustain at sites similar to this. Fertilization should be continued for at least five years. Supplemental water may be necessary for survival of plants during first year or two

Design Elements

Sector: Roads and Highways

Site Analysis
Site: A wetland in western Washington near Covington. The wetland was created when highway 18 was built; the highway is now being widened and the wetland must be filled. Original ecosystem type: highway initially intercepted many riparian zones and wetlands; flow was diverted by highway construction. Natural disturbance regime: flooding. Current state: wetlands adjacent to highway, Matrix: highway, agricultural land.
Environmental Functions
Functions performed: Wetlands originally created by the highway performed a number of functions: water quality improvement, sediment removal, flood storage, habitat.
Impact on Historical Ecosystem
Functions lost: The original highway truncated the continuity of riparian and wetland corridors associated with small streams. Land adjacent to highways is less valuable as habitat. The latest widening will remove the mature habitat that had grown back since the previous construction.
Constraints
Mitigation wetlands for highway projects should either be located adjacent to the damaged wetland, or nearby in the same watershed. Sites appropriate for wetlands are limited. Surrounding vegetation is highly agriculturalized. Highway construction often results in large areas of compacted, engineered substrate along the road edges. Such substrate is not appropriate for plant growth or restoration.
Predicted Level of Repair Possible
With an adequate and dependable water supply, good levels of structural restoration should be possible.
Likelihood of Autogenic Repair
Wetland sites along roads are often colonized by cattails, which are a native species and are generally acceptable for restoration, if not desirable. It there is much reed canarygrass upstream, autogenic repair is unlikely.
Range of Restoration Options
Low: hydromulch and leave High: use live stakes, container plants. Irrigate site during plant establishment period. Plant diverse species, and use woody and herbaceous plants.

Estimated Requirements
Earthmoving equipment. Existing wetland and wetland edge plants should be salvaged and stockpiled. Coppice and plant live-stake material from riparian zone (willows, red-osier dogwood, cottonwood). Site species diversity should be enriched, if necessary, with container plant material from local nurseries.
Site Design
Transportation design should recognize the proximity to wetlands, and where damage cannot be avoided, a minimum area should be subjected to filling or removal. Compacted roadbed soils should be ripped and organic material added. New area should be contour graded to create elevations similar to those in the filled area. Salvage existing wetland vegetation and wetland edge vegetation and soil; store on site until ready to plant. Minimize damage to roots of salvaged plants by removing roots and soil in blocks (using front-end loaders or side-mounted buckets). Install any needed irrigation at new site and in holding areas. Use mulch on slopes.
Sequencing and Timing
Do excavation and grading when it is dry and plant when it is wet or starting the wet season. Plant each moisture zone at time of year that is best for plant survival; driest zones should be planted immediately before historical rainy period.
Continuing Activities
Monitor for invasives and remove. Continue irrigation until plants are well-established. Replace dead plant material.

Design Elements

Sector: Recreation

Site Analysis
Site: Subalpine trail system, Paradise Meadows, Mt. Rainier Nat. Park Original ecosystem type: alpine and subalpine parkland; short growing season. Natural disturbance regime: heavy winter snowpack Current state: historic and unwise use of fragile meadows for recreation, added to continuing heavy use by hikers, has resulted in loss of vegetation and erosion of soil along pathways and in closed campgrounds and road rights-of-way. Matrix: subalpine parkland and recreational facilities. Heavy use of lodge and meadow; heavily loaded hikers at higher elevations.
Environmental Functions
Important historical functions: unique alpine and subalpine habitat. Functions lost or diminished: vegetation lost, erosion continuing Potential function: reverse erosion and return to historical vegetation structure.
Impact on Historical Ecosystem
Alpine tundra and subalpine meadows are very slow growing. Unwise use of such areas for camping, parking and hiking has damaged or destroyed vegetation, and on steep slopes the loss of vegetation has resulted in soil loss, down to bedrock in places.
Constraints
Short growing season, slow-growing species, species not available in commercial nurseries. Hard winters with ice heave. Limited access to site; materials must be packed in. Wilderness area restrictions: plant materials must be from local materials, and soils must be sterilized if imported.
Predicted Level of Repair Possible
Physical damage to site can be repaired using back-country trail construction techniques. Biological damage to plant communities is slow to repair and requires rigorous installation procedures and ongoing attention.
Likelihood of Autogenic Repair
Unattended sites, even when the cause of damage is removed, may seem unchanged for fifty years. Sites with soil loss down to the bedrock will not recover.
Range of Restoration Options
Low: Repair areas of erosion and seed with native species. High: Repair eroded areas. Collect seeds of appropriate native species. Install topsoil, plant small container plants and seed around them. Protect sites with fabric reinforced mulch padding. Institute a visitor control and education program to discourage foot traffic.

Estimated Requirements
Off-site greenhouse or hoophouse facility, with manpower for seed collection and other propagation methods. Timbers and tools for scarifying eroded areas and building silt barriers and wooden cribbing. Crushed rock for leveling eroded gullies; sterile topsoil for replacing eroded soil
Site Design
Eroded trails are closed and signed. The gullied paths are then scarified and cribbing is installed to hold stone and gravel. Topsoil is spread over the top of the stone. Container plants are installed and seeding is done. Mulch mats are tacked down over the site around container plants.
Sequencing and Timing
The window of snow-free working time is small. Snowdrifts will still cover some sites in June. Work should be accomplished after snow is gone, and installation and seeding should be done in September to minimize moisture stress.
Continuing Activities
Further erosion must be monitored, and physical barriers and other methods used to stop it. Plant mortality should be followed and dead plants replaced. Mulch material may need to be replaced in the first year of growth.

Design Elements

Sector: Urban

Site Analysis
Site: Arboretum Creek mouth at Duck Bay, Washington Park Arboretum Original ecosystem type: Native forest (disregard lake level rise) Natural disturbance regime: Fire, windthrow, beaver. Current state: An unmanaged area on the periphery of the arboretum. Matrix: Lake Washington, weedy natives, collection of forest trees from around world.
Environmental Functions
Important historic functions: historically a mixed coniferous forest, with impacts on climate, water retention, carbon sequestration, erosion prevention. Functions lost or diminished: clearcut, reducing inherent forest environmental capabilities. Species that colonized are weedy, and a mix of natives and non-natives. Potential function: mature coniferous forest functions.
Impact on Historical Ecosystem
The site was clearcut in 1890. Land was collected and the site was organized first as a park around 1904, then as the Arboretum in 1935. Around 60 acres just to the west and north of the creek was used for the R.H. Thompson expressway ramps. The Arboretum is managed as a living collection of primarily non-native trees and shrubs, and so native species, though common colonizers, were not considered as welcome residents.
Constraints
The site has been historically disturbed and has existed within an urban matrix for a century.
Predicted Level of Repair Possible
Repair to a native forested ecosystem type has a good prognosis; a forest canopy already exists and so many of the usual weed species are suppressed.
Likelihood of Autogenic Repair
If it were not a management objective, native species would be removed. Since the new objectives include restoration of native communities, the site has good prospects.
Range of Restoration Options
Low: remove invasives and allow for native plant colonization. High: remove invasives and aggressively plant and maintain a wide variety of native species.
Estimated Requirements
Volunteers, mulch, containerized plant materials.

Site Design
Site is in partial shade from the trees surrounding Duck Bay. Logical restoration goal is a forested lakeside plant community with forest edge species and some wetland and wetland edge species. Forest understory species are also appropriate. Police request that site lines be maintained through the installation area so that they can monitor any illegal activity. The Arboretum prefers to plant larger caliper trees and shrubs, so plants in one gallon containers will be used for much of the installation. Trees will be planted on at least 6' centers, maintaining site lines. Shrubs will be planted on 4' centers.
Sequencing and Timing
The site is heavily invaded with blackberry, so cutting and grubbing will be required. The general timing of restoration at a site like this is removal of invasives in the winter and mulching and installation of plant material in the spring. Since container plants are used, and the site is quite moist, planting can continue through the entire growing season during most years.
Continuing Activities
Whenever blackberries are grubbed out, parts of the plants remain in the soil and will sprout. Continued removal of emerging blackberry or spot application of herbicides may be required.

Design Elements

Sector: Wetland Dredge and Fill

Site Analysis
Site: Duwamish waterway Original ecosystem type: brackish coastal marsh Natural disturbance regime: river flooding, storm surges from Elliot Bay. Current state: channelized navigation and industrial waterway with a few pockets of native brackish marsh vegetation. Matrix: Industrial
Environmental Functions
Important historic functions: habitat, detritus for food chain, native fishing grounds, erosion abatement. Functions lost or diminished: most vegetation is gone. Some fishing habitat left, though the waterway and its sediment are polluted. Potential function: the area of *Carex lyngbyei, Schoenoplectus acutus* and other brackish wetland species can be increased to improve habitat.
Impact on Historical Ecosystem
The Duwamish was a tidal river with islands and tidal flats. Channelization and deepening was accompanied by the creation of filled areas with the excavated material and the construction of bulkheads and piers. The flow of the Duwamish was changed with the re-routing of the Cedar River, and the upper Green River was dammed to create the Howard Hansen Reservoir.
Constraints
Extensive areas at the correct tidal elevations no longer exist. Adequate populations of donor plants for passive revegetation are gone. Natural substrates are gone. The Duwamish is polluted. Tributary streams that historically fed the lower Duwamish have been eliminated or their historic watersheds modified. Canada geese are common on the Duwamish and graze on restoration plants.
Predicted Level of Repair Possible
With the proper elevations and correctly matched vegetation, areas can be revegetated.
Likelihood of Autogenic Repair
Without recontouring of a number of sites, and without the planting of desired species, the area is not likely to repair itself.
Range of Restoration Options
Low: Revegetate existing areas that have the correct salinity and tidal elevation. Protect from geese.

High: Excavate benches that have a range of correct tidal elevations. Plant appropriate native brackish marsh species. Build exclosures to keep out geese.
Estimated Requirements
Land for sites must be acquired. Derelict vessels, construction debris, and other abandoned junk must be removed. Excavator, dump truck to remove fill material. Plant materials from nursery. Exclosure supplies (chicken wire, metal fence posts, nylon twine, mylar ribbon to scare birds). Volunteers
Site Design
Benches that have a slope of about six inches per hundred feet toward the water must be excavated. Salinity at any prospective site must be measured over the course of a year, and if possible, historical data about seasonal fluctuation of salinity should be gathered. Wetland plants must be matched to salinity regimes. *Carex lyngbyei* and *Schoenoplectus acutus* do well from 0 to 10 ppt salinity. *Scirpus maritimus* does well from 10-15 ppt. *Triglochin maritimum* will grow from 0 to 20 ppt. *Salicornia virginica* and *Distichilis spicata* tolerate salinities from 15 to 25 ppt.. *Scirpus americanus (Schoenoplectus pungens*) will grow in a broad range of salinities, but does well at lower tidal elevations at any given site.
Sequencing and Timing
Benches should be excavated, and if in a site without erosive currents, will sit and wait for planting. If salinity is lower than 5 ppt, however, there is a likelihood that cattails will colonize, so planting of exposed substrates should occur immediately. Sprigging should be done as early in the spring as plant material is available, because most of the coastal plants grow in the early summer then senesce. It is desirable to get as much root growth the first season as is possible.
Continuing Activities
Effectiveness of goose exclosures must be continually monitored during growing season. Goose intrusions must be countered by modification of the wire or twine. *Spartina alterniflora* is an invasive, so if it appears it must be removed. Plant material that dies, is washed away or is eaten should be replaced.