1994 Native Plant Seed Collection: Development of a Locally Collected Source of Native Plant Materials for the Portland Metropolitan Area

Final Report

prepared for

Metropolitan Greenspaces Program
Restoration Enhancement Grants

by

Geralyn Larkin
The Nature Conservancy
Oregon Field Office
1205 NW 25th Avenue
Portland, Oregon 97210

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Metro Greenspaces Project
1994 Seed Collection - Final Report

I. Introduction

Two hundred years ago, the confluence of the Willamette and Columbia Rivers was bordered by broad bands of wet meadows and deciduous riparian corridors. Dense evergreen forests rose up from the low wetlands to the surrounding hills, occasionally mixed with deciduous trees and interrupted by grassy meadows on rocky outcrops and shallower soils. Historical records of the natural landscape of the Portland metropolitan area prior to European settlement are very limited to non-existent. But it is certain that the remaining natural areas within this urbanized region are dramatically different in many ways from pre-settlement conditions. Logging, agriculture, grazing, and fire suppression impacted the landscape and native flora and fauna. In conjunction with this was the introduction of non-native plant and animal species (both accidental and intentional), alteration of hydrologic regimes, and conversion of the region to an urban landscape.

The Portland metropolitan area has been so completely urbanized that little of the original native habitat remains. Remnants of our natural vegetation are less diverse and highly fragmented. The Metro Greenspaces Program was created in part to provide long-term protection of these remaining natural areas and to assist local governments, non-profit organizations, and neighborhood groups restore some of the green and open spaces that are now degraded natural habitats. To date, restoration projects in the Portland metropolitan area, as in many parts of the state, have been constrained by a limited source of local plant material. Greenspaces managers are forced to use commercially available plant material that may have evolved under different environmental conditions. The use of non-local plant material for local restoration projects has two important consequences. First, non-local genetic strains of native species may not be well-adapted to local environmental conditions. This may increase the failure rate of plantings and the long-term cost of maintaining restored habitats. Second, the introduction of native plants from non-local genetic strains may contaminate, and possibly eliminate, local genetic strains due to cross-pollination, thereby reducing genetic diversity. The obvious solution is to use plant materials from local native stock with the genetic makeup adapted for the specific local environment.

II. Project Description

The objective of this project was to develop a source of native plant materials for restoration projects in the Portland metropolitan area and in the process both 1) assess plant material needs of these restoration projects and 2) determine the feasibility of establishing a locally-collected native plant materials production garden. A list of target species was developed from site information and interviews with local ecologists. Collection sites were identified and permission to collect seeds was secured. Volunteers were recruited to assist with plant collection and cleaning. Plant materials were collected, cleaned, and stored for future cultivation and planting in a native seed garden or in a restoration project.

III. Goals and Benefits of Project

The project was the first step in developing locally collected and grown native plant materials for natural area restoration projects in the Portland metropolitan area. It has provided information on the feasibility of collecting local native seeds, identified sites and species for future collections, and provided a limited source of native plant seeds for current restoration projects or production gardens. The project increased local greenspace managers' awareness of the importance of locally-collected native plant materials for restoration projects. It educated project volunteers about the importance of native species and ethical seed collection methods. The Nature Conservancy's long-term goal for this project is to initiate the establishment of a production garden within the metropolitan area to use as a local plant materials source for Greenspaces restoration projects. This ultimately will improve the quality of restoration projects undertaken in the Portland metropolitan area by increasing Greenspace managers' knowledge of genetically appropriate native plant materials and encouraging local growers and horticulture program educators to include more local native plant materials in their own production programs.

IV. Work Tasks and Timelines

Plant Species Collection List (March - June 1994)

The first priority for this project was to select target plant species that would be the most appropriate to collect and use in restoration projects in the Portland metropolitan area - to create a plant species collection list. The Nature Conservancy (TNC) sent a questionnaire to 37 Metro Greenspace site or restoration project managers regarding native plant material needs for restoration at their sites. Included were questions on plant materials previously used and their sources, site descriptions and plant inventories, and future or potential plant needs for restoration projects. Only seven responses were received, and only a few of these contained useful information or input with which to target species for collection.

The seed collection project coordinator then conferred with local ecologists/botanists regarding potential species to collect. These people included TNC stewardship staff, Oregon Natural Heritage Program staff, Berry Botanic Garden and Leach Garden botanists, and private ecological consultants. These specialists also provided input on the local availability of targeted species. Plant lists and inventories for various local natural areas were also consulted. A list of 108 plant species for potential collection was developed. This "long list", grouped by habitat type, includes information on plant locations, approximate collection dates, and germination and growing requirements, of some species (Table 1). From this list two plant communities were targeted for seed collection. Wetland meadows and upland meadows were chosen for the following reasons: 1) each is rapidly disappearing as a result of human disturbance and development; 2) there are only remnants left of the original communities within the region; and 3) several of the current local restoration projects involve these plant community types. Many of the plant species found in these two communities were minimally available, if at all, from local growers and perhaps not of local genetic stock.

Collection Sites (May - July 1994)
The next step was to locate sites within the Portland metropolitan area to search for targeted plant species. Once again, recommendations came from TNC staff and other local ecologists/botanists. We reviewed Metro Greenspaces project grants and other regional reports and inventories for site descriptions and plant lists. We identified 40 potential collection sites (Appendix A) and contacted land managers and private landowners to arrange site visits. Thirty-four potential sites were visited to look for targeted plant species. We also spent time scouting rural areas for potential collection sites for native plant species. Plant specimens were collected and identified, and then confirmed with TNC botanists. Collection sites were then selected based on plant species present (including the species' population size and condition), accessibility to the site, permission to collect, and the habitat condition. Of the 34 sites explored, seed was collected at 23 sites (Table 2, Figure 1).

Volunteers (June - September 1994)
Volunteers to collect and clean seeds were recruited from the Oregon Native Plant Society, the Portland Audubon Society, and The Nature Conservancy by announcements at local chapter meetings and in organizational newsletters. The Volunteer Coordinator for TNC also contacted potential volunteers from TNC members, organized evening seed cleaning work parties, and assisted in setting up the seed collection volunteer effort.

Five seed collecting work parties were organized, three on weekend days and two on weekdays. These included trips to West Linn, the Sandy River, Kingston, Sauvie Island, and Vancouver Lake, and totaled almost 130 hours volunteer time for 17 participating volunteers (Table 3a). Less than half of the time was actual seed collection time (56 hours); time was also spent training volunteers in plant identification techniques, seed collection methods, and data collection procedures. An additional seed collecting effort was undertaken by a TNC volunteer and fellow students who were participating in a wetlands class field trip to Crystal Lake.

Seed cleaning work parties occurred during late August and throughout September. These were held on weekday evenings at The Nature Conservancy. Five seed cleaning work parties involving 18 volunteers totaled 100 hours volunteer time (Table 3b). Participants learned seed cleaning techniques and natural history information on the plant species being cleaned, and held informal discussions on restoration ethics.

Seed Collecting (June - September 1994)
Prior to seed collection at any site, permission to collect was obtained from land owners or managers of the site. We then determined the approximate date of seed maturity for the targeted species at the site. This sometimes required additional visits to the site to check plants for mature seeds. Seeds were then collected for 28 different plant species with 59 separate collections or seed lots (Table 2 and Appendices B and C). Collection amounts range from less than 250 seeds to over 1,500,000 seeds. At each site, collection was limited to 5-10% of the available seed in order to ensure that the communities from which seed was being collected were not detrimentally affected.

Three different methods were utilized to collect seeds: clipping, shaking, and stripping -- each with advantages and disadvantages. Clipping involves using a garden clipper or pruner to cut a stem containing a flower head with mature seed. Shaking involves shaking the seed from the flower head into a collection bag. Stripping involves gently pulling or manipulating the flower head to loosen and collect the seed. With the clipping method, the entire stem containing the seed head is collected and seed continues to ripen and mature for a short period following collection. However, immature seed is collected along with mature seed and the seed takes much longer to clean because there is more plant material to remove. The shaking method is only appropriate for fully mature and nearly dry seeds that are easily released from the flower head. With the stripping method, seeds generally will not come off the flower head unless they are mature, so there is a decreased chance of collecting immature seed. Also, immature seed is left at the site to mature and potentially propagate. A disadvantage to this method is that manipulating the seed during collection can potentially damage it.

Seed Cleaning (August - November 1994)
Seeds were initially air dried in open paper bags, using a large floor fan to help circulate the air. The seeds were then manually cleaned by TNC staff and volunteers using a variety of techniques to remove the excess plant material and chaff from the seed. Seed that had been collected by clipping was stripped from the flowering head or gently crushed to break apart the head. Other seed was separated from plant material by shaking, sifting, winnowing, panning, blowing, manually separating, or any innovative technique that accomplished the task. Once the seed was cleaned, rough qualitative and quantitative estimates were made by subsampling seed from each seed lot to determine the condition of the seed and the amount available for propagation or restoration. Subsamples were examined under a dissecting microscope and dissected, when possible, to determine seed maturity (Appendix C).

The seed was then prepared for storage. It was placed in paper envelopes, labeled, and delivered to the Berry Botanic Garden's desiccation chamber to be thoroughly dried in a controlled environment. The seeds will then be placed in airtight containers and held at the Berry Garden's storage facility. This will allow for long-term storage of three to five years.

Final Report (November - December 1994)
Accurate record-keeping is a vital component to the seed collection process. Information on seed collection site descriptions, target plant species for each location, the actual plant species collection list, the seed collection and cleaning log, and the original long list of plant species considered for collection are all on file at The Nature Conservancy. The final report is being submitted to the Metro Greenspaces Program.

V. Project Budget

	TNC Match	Metro	Total
a) Personnel			
Director of Stewardship	$3533	0	$3533
Administrative Assistant	$ 250	0	$ 250
Project Coordinator	$1767	$3637	$5404
Restoration Ecologist	$1500	$1500	$3000
b) Supplies	0	$ 38	$ 38
c) Mileage	0	$ 900	$ 900
c) Volunteer Labor Hours (286 hours @ $4.75)	$1358.50	0	$1358.50
d) Indirect Costs/Overhead (19.4%)	$2809.61	0	$2809.61
Total Funds	$11,218.11	$6075	$17,293.11

VI. Project Staff, Volunteers & Partners

The Nature Conservancy /Metro Project staff
1. Director of Stewardship (Cathy Macdonald)
2. Metro Project Coordinator (Geri Larkin)
3. Metro Project Restoration Ecologist (Jude Rubin)
4. Administrative Assistant - TNC newsletter article (Lynn Gooch)

Other TNC staff who contributed to project
1. TNC Volunteer Coordinator (Sarah Clausen: 22 hours)
2. Oregon Natural Heritage staff - plant identification, site location recommendations, use of maps and dissecting scope (Jimmy Kagan, John Christy, Dick Vander Schaaf, Sue Vrilakas, Peter Zika: 12 hours)
3. TNC Field Ecologists - plant list recommendations, seed collecting advice, data management (Ed Alverson, Darren Borgias: 14 hours)
4. TNC Technical support/computer advice (Dan Salzer, Eddie Huckins: 20 hours)

Volunteers
1. Questionnaire design and mailing (Doria Mateja - 25 hours)
2. Seed collecting (25 individuals - 160.5 hours)
3. Seed cleaning (18 individuals - 100.5 hours)

Partners
Technical assistance was provided by specialists who gave recommendations on the plant species collection list, potential collection sites, and seed cleaning and storage methods.
1. Berry Garden (Ed Guerrant, Jack Poff)
2. Leach Garden (Bonnie Brunkow)
3. Ecological Consultants (Ester Lev, Mark G. Wilson, Russ Jolly)

Public land managers and private landowners gave permission to collect seeds and/or provided field tours of potential collection sites.
1. City of Hillsboro (Pat Willis and Susan Cross - Jackson Bottom)
2. Hillsboro Parks Department (Mary Ordell - Noble Woods)
3. Kingston private landowner
4. Oregon Department of Fish and Wildlife (Sue Bilke - Burlington Bottom, Terry DeFore - Sauvie Island)
5. Oregon State Parks (Margie Willis - Rooster Rock)
6. Peach Cove private landowner
7. Portland Bureau of Parks and Recreation (Jim Sjulin - general approval, Jim Morgan - Smith & Bybee Lakes, Ralph Rogers - Oaks Bottom, Elk Rock Island)
8. Washington Department of Fish and Wildlife (Brian Caulkins - Vancouver Lake)

VII. How Project relates to Greenspaces Program

This project was consistent with the Metro Greenspaces Program's goals of protecting a mosaic of natural areas, creating greenway corridors, and restoring fish and wildlife habitats and natural areas. By using local native plant materials, the overall success of restoration efforts is increased by insuring that the plant materials used at a given restoration site have the genetic adaptability for that specific environment.

The project provided a number of educational opportunities to promote the importance of protecting the natural diversity of species within habitats and genetic diversity within a species. These opportunities included: 1) increasing local Greenspaces manager's awareness about the importance of locally collected native plant materials for restoration projects; 2) educating project volunteers about the importance of native species and of ethical seed collection methods; and 3) providing a feature story in The Nature Conservancy's membership newsletter that is sent to 18,330 members, including approximately 10,000 members in the Portland metropolitan area, to increase public awareness of the need for locally collected plant material.

Opportunities for partnerships with multiple jurisdictions, agencies, and citizen groups were created. The long-term goal of establishing a native plant materials production garden and encouraging more local growers and horticulture program educators to include more native plant materials in their production programs will provide a source for managers seeking plant materials for restoration work. In addition, implementing restoration projects with locally collected native species will provide interpretive opportunities on natural areas throughout the metropolitan area.

VIII. What worked & what didn't - helpful hints

Species Collection List

The creation of an appropriate species collection list was the task we struggled with the most in this project. We had no guide or focus for selecting plant species because there were no target restoration sites for which to collect seeds, and no requests for plant materials from land managers. We therefore made some assumptions regarding plant species most likely to be useful for some of the Greenspaces restoration projects, and particularly those species that were limited in availability from local growers. The species for which seed was collected may or may not be appropriate for a specific restoration site.

Collection Sites

When identifying collection sites, we chose those that were most accessible, with the largest, healthiest populations of the particular species to be collected. But plants of apparent lower vigor, growing in marginal quality environments may have better adaptability to the disturbed conditions at a restoration site. Ideally, a seed collection project should have a known target environment or restoration site prior to collection so that the environment from which the seed is collected can be matched more closely with the environment where the seed will eventually be grown. In such a situation, collectors could give more attention to microhabitat conditions

of both the collecting site and the planting site to insure similar selection pressure for genetic adaptations to the micro-environment.

Collection Records

Unfortunately, we do not have complete records of microhabitat conditions at the collection sites for this project. More detailed collection site records should be kept of microhabitat conditions such as north- or south-facing slopes, soil type (sandy, loam, or clay), and full sun versus partial or entire shade so that these could be matched with the planting site. The resulting genotypes would be better adapted to the local conditions and have greater vigor and competitive ability and overall higher planting success rate at the site.

Seed Collection Timing

Appropriate timing in the collection of mature seeds is obviously an essential ingredient to this type of project. Because plants have such a wide range of seed maturation periods, the field season for seed collection begins in April and continues through October in the Pacific Northwest. The main field person for this project was only available from early June to mid-August during the peak production period and therefore many plant species were not considered for collection outside of this window. Also, because we began the season with a somewhat indefinite list of collection species, we missed some earlier-maturing plants. The best scenario would be to have a collection list developed prior to the onset of the field season and to have field personnel available at least part-time throughout the seven month collection period.

Collecting Methods

The various seed collecting methods used in this project were described previously in the Work Tasks and Timelines section, as well as the pros and cons of each method. The use of volunteers to collect seeds enabled us to increase the amount of seed collected per unit time in the field during work parties. But much more staff time was required to organize and prepare for the work parties and to provide training in collection methods. The best situation would be to have a handful of trained, committed volunteers who could be available throughout the field season to participate in seed collection on short notice.

Seed Cleaning

The manual cleaning of 59 lots of collected seeds with 28 different plant species was a much more labor intensive task than we initially realized. Fortunately, a large portion of the work was accomplished by volunteers in a group setting that provided a social environment to make the task seem less arduous. One consequence of using volunteer help to clean seed was that the job was done in a less thorough, conscientious manner than when staff worked on the task. The volunteer product had more remaining plant debris and less net seed retained from the collected material than that cleaned by staff.

General

General recommendations of how to collect seed, where to collect seed, and the production of seed to increase the odds of successful restoration are well-defined in the article "Starting from Seed: Genetic Issues in Using Native Grasses for Restoration" by Eric E. Knapp and Kevin J.

Rice in the Summer 1994 issue of Restoration & Management Notes. They state that "Obtaining the best germplasm for restoration will in many cases be most easily accomplished by matching the seed collection and increase process to a particular restoration project" (Knapp & Rice 1994 p.45).

Another recommendation from Knapp and Rice (1994) is that in growing native seed in a controlled setting to increase seed yield, propagators should always use originally collected seed to plant a seed-increase field, rather than seed from a previous seed-increase plot. Individuals with genotypes that do best in controlled horticulture plots may not be the same as those that do best in restoration site conditions. Genetic shifts can occur when a population is grown in a different environment than its native site for many generations. The length of time that plants are grown in a controlled setting will impact the adaptability of these plants that are ultimately destined for restoration sites.

IX. Advice for other project managers

Project managers should be aware of the original source of the plant materials that they obtain for planting at restoration sites. They should request information on the seed source if the plants were grown in a nursery setting and how many generations the particular genetic strain has been out of its native habitat. If plants were collected from native habitat, information on the collection site location and environmental conditions is important, including elevation, latitude and longitude, sun versus shade, and slope orientation.

In making the selection of plant species for restoration, managers should select species that will survive at the restoration site with its present environmental conditions rather than those conditions that the restoration effort is attempting to recreate several years in the future. There needs to be enough individuals of a given species that future mating and reproduction on the site is less likely to occur among related plants and the offspring have a varied genepool to prevent inbreeding.

Managers need to decide what level of natural conditions the restoration effort will reach and be maintained. If the goal is to create open space for recreational use by local residents, the importance of the genetic issues is not critical. If the restoration effort is intended to create an urban sanctuary and permanently establish an ecosystem that has viable populations with the genetic adaptability to continue to evolve (or the restoration is in close proximity to such a protected site), then the selection of plant material with the appropriate genetic makeup for the restoration site is a much more critical issue.

X. Project Future

The ultimate fate of the seed collected for this project has not yet been determined. There are two options to be considered for the immediate future, including seed propagation versus long-term storage (or a combination of these). Several methods of seed propagation are possible: 1) seeds could be grown in a greenhouse or plant nursery setting for eventual transplanting to a

restoration site; 2) seeds could be sewn in multiplication or seed increaser plots from which greater quantities of seeds could then be harvested for restoration use; or 3) seeds could be sewn on-site at one of the active restoration project sites in the Metro Greenspaces program. Alternatively, the seeds collected in 1994 will remain viable for at least three to five years if properly packaged and stored in an appropriate environment.

Another consideration is whether there is a need for an additional field season for seed collection. This decision would be based on the determined need for specific plant species at an active restoration project or a project for which a target species list has been defined. It is recommended that future seed collections be linked with perceived needs for current or future restoration projects rather than as a general seed source for native species.

There was some discussion of potential seed propagators in the Portland metropolitan area. The consensus was that it would be preferable to have a public agency agree to take on the task of propagating locally collected native plants in conjunction with their own and other site mitigation and restoration requirements. Potential candidates include the Natural Resources Conservation Service (formerly Soil Conservation Service), the Bureau of Environmental Services, the Unified Sewerage Agency, Portland Bureau of Parks and Recreation, the United States Forest Service, and the Northwest Service Academy.

A potential project in association with the locally collected seed project is a handbook/booklet discussing native seed collection and use. This could include information on why it is important to use local genetic stock, what needs to be considered when acquiring plant materials for restoration, ethical guidelines for collection and restoration, and methods and timelines for collecting seed. Another useful document would be a description of the native vegetation for specific plant communities within the Portland metropolitan area. This could be either in the form of a wish list of what the site should ultimately look like or perhaps a historical description of the pre-settlement plant communities.

XI. Project Sites Map

Table 1. Plant species "long list" of potential plants to collect, including all species considered for collection in 1994.
Table 2. Plant species list for which seed was collected in 1994.
Table 3. Log of volunteer time devoted to seed collection and cleaning for this project.
Figure 1. Metro area map with seed collection sites used in 1994.

XII. Related Documents

The following documents relating to the Metro Greenspaces seed collection project in 1994 are being retained in The Nature Conservancy Files at the Oregon Field Office.

Appendix A. Site Descriptions - Actual and Potential Seed Collection Sites
Appendix B. Seed Collection List - 1994
Appendix C. Seed Collection and Cleaning Log

Table 1. The list of potential plants considered for seed collection in 1994 for the Metro Greenspaces project, referred to as the "long list", is grouped by habitat type. The "x" in the first column indicates that the species was collected in 1994. Locations are listed of species occurrence in the metro area, most of which correspond to the sites shown in Figure 1. The Notes/Comments includes information from 1993 seed collection and germination work done by Ed Alverson of TNC in the southern Willamette Valley. Germination tests are for two treatments (fresh/desiccated); collection dates include notes as to the collection timing being E-early, R-right on time, or L-late for the 1993 season. The estimated collection (est. collect) time period is given for collecting seeds in the Portland metropolitan area and additional notes on species propagation are included. This table is not meant to be a complete listing of appropriate species for collecting, collection locations, nor propagation information.

SPECIES		COMMON NAME	LOCATIONS	NOTES/COMMENTS
WETLAND GRASS-LIKE				
x	*Carex aperta*	Columbia sedge	Vanc Lake; Burl Bot; Oaks Bot; Sauvie Island	est. collect: late June - July
	C. aurea	golden sedge		60%/62% germination tests 6/14/93 ER collection (Alverson)
	C. densa	dense sedge	Crystal Lake; Sandy River	
	C. feta	greensheathed sedge		
	C. interrupta	greenfruit sedge		
	C. leporina	hare sedge		8%/6% germination tests 7/17/93 R collection (Alverson)
x	*C. obnupta*	slough sedge	Peach Cove; Rooster Rock	est. collect: August
	C. retrorsa	knot-sheath sedge	Burl Bot	Peter Zika - too rare to collect
	C. rostrata	beaked sedge		
x	*C. stipata*	stalk-grain sedge	Crystal Lake; Burl Bot; Sandy River; Rooster Rock	est. collect: August
	C. unilateralis	one-sided sedge	Washougal	1%/13% germination tests 7/17/93 R collection (Alverson)
x	*C. vesicaria var. major*	inflated sedge	Burl Bot; Peach Cove	est. collect: July - August
	C. vulpinoides	fox sedge		
	Eleocharis ovata	ovoid spikerush		Peter Zika recommends

Table 1 (continued)

SPECIES		COMMON NAME	LOCATIONS	NOTES/COMMENTS
	Eleocharis palustris	creeping spikerush	Burl Bot; Vanc Lake; Rooster Rock; Beggar's Tick Marsh; Springwater	0%/0% germination tests 10/27/93 L collection (Alverson)
	Scirpus cyperinus	wool-grass	Sandy River; Rooster Rock	est. collect: mid August - September
	Scirpus microcarpus	small-fruited bullrush	Peach Cove; Burl Bot; Leach Garden	Spreads quickly - boggy areas or areas with high water table that dries in summer.
x	*Scirpus validus*	soft-stem bullrush	Vanc Lake; Sauvie Island; Rooster Rock	est. collect: August - September
	Juncus acuminatus		Rooster Rock	est. collect: August
	Juncus bufonius	toad rush	Rooster Rock	Peter Zika recommends est. collect: August
x	*Juncus effusus var. pacificus*	common rush	Crystal Lake; Peach Cove; Burl Bot; Hillsboro; Sauvie Island; Vanc Lake; Rooster Rock; Beggar's Tick Marsh	est. collect: August
x	*Juncus ensifolius*	three-stamen or dagger-leaf rush	Sandy River	est. collect: August
x	*Juncus oxymeris*	pointed rush	Rooster Rock	est. collect: mid August
	Juncus tenuis	slender rush		3%/0.4% germination tests 7/10/93 R collection (Alverson)
WETLAND FORBS				
x	*Alisma plantago-aquatica*	American water plantain	Jackson Bot; Sauvie Island; Vanc Lake	est. collect: August
x	*Bidens cernua*	nodding beggar-ticks	Sauvie Island; Rooster Rock; Salmon Creek, Clark Co.; Beggar's Tick Marsh	est. collect: September
	Gentiana sceptrum	pacific gentian		7%/19% germination tests 9/10/93 R collection (Alverson) Grow seeds or rooted stem pieces.

Table 1 (continued)

	SPECIES	COMMON NAME	LOCATIONS	NOTES/COMMENTS
	Ludwigia palustris	water purslane	Leach Garden; Springwater	
	Menyanthes trifoliata	buckbean	Peach Cove	Easily grown from pieces of rhizome; may not flower at lower elevations.
	Nuphar polysepalum	Indian pond lily	Peach Cove	
	Polygonum amphibium	water smartweed	Smith/Bybee Lake; Sauvie Island	
	Polygonum coccineum	water smartweed	Vanc Lake	
x	*Polygonum hydropiperoides*	swamp smartweed	Smith/Bybee Lake; Vanc Lake; Sauvie Island; Rooster Rock	est. collect: late August - September
	Potentilla palustris	purple cinquefoil		
x	*Sagittaria latifolia*	wapato	Burl Bot; Sauvie Island; Vanc Lake; Rooster Rock	est. collect: August
	Sparganium emersum	simplestem bur-reed	Burl Bot; Sauvie Island; Peach Cove; Rooster Rock	est. collect: September
	Typha latifolia	broad-leaf cattail	Hillsboro; Peach Cove; everywhere	Germination 40% of seeds stored dry; reduced oxygen increased germ. est. collect: June - July
	Veronica scutellata	marsh speedwell	Peach Cove	
	Veratrum Californicum caudatum	false hellebore	Springwater	
UPLAND FORBS				
x	*Achillea millefolium*	Yarrow	West Linn; WA Hwy 14; Little Rock Isl.	0%/0% germination tests 8/31/93 R collection (Alverson) High seed germ with alternating moderate incubation temps. est. collect: late July

Table 1 (continued)

	SPECIES	COMMON NAME	LOCATIONS	NOTES/COMMENTS
x	*Allium amplectens*	slim-leaf onion	Kingston	est. collect: late July
	Aster subspicatus	Douglas's aster	Little Rock Isl.	
	Camassia leichtlinii	Leichtlin's camas		Plants of both species come easily from seed; flower in 4 years.
x	*Camassia quamash*	common camas	West Linn	Wetland or vernal wet meadow; est. collect: late June - early July
	Collinsia grandiflora	large-flowered blue-eyed mary	West Linn	Meadows & rocky/grassy slopes.
	Collinsia parviflora	small-flowered blue-eyed mary	Ridgefield Wildlife Refuge; Columbia River Gorge	Open meadows & rocky/grassy slopes.
	Delphinium spp.			
	Epilobium paniculatum	autumn willow-weed	West Linn; Little Rock Isl.	16%/17% germination tests 9/24/93 R collection (Alverson) Willow-herbs come easily from seeds.
	Geum macrophyllum	largeleaf avens	West Linn; Noble Woods; Leach Garden; Springwater	85%/61% germination tests 9/15/93 L collection (Alverson) Seeds of this species germinate without pretreatment. est. collect: August
x	*Lotus formosissimus*	seaside lotus	Sauvie Island	est. collect: August
	Lotus micranthus	small-flowered deervetch	West Linn; Little Rock Isl.	
	Lotus pinnatus	meadow or bog deervetch	West Linn	1%/1% germination tests 7/18/93 R collection (Alverson)
x	*Lotus purshiana*	Spanishclover	WA Hwy 14; West Linn	13%/6% germination tests 9/8/93 R collection (Alverson)
	Lupinus polyphyllus	bigleaf lupine	Wilsonville; Gresham - vacant fields	Seeds germinate well when steeped 12 hr in water brought to boil; pioneer plant in bare soils. est. collect: July

Table 1 (continued)

SPECIES		COMMON NAME	LOCATIONS	NOTES/COMMENTS
	Mentha arvensis	field mint	Peach Cove	
x	*Mimulus guttatus*	yellow monkey-flower	West Linn; Sandy River; Kingston	est. collect: late July
	Montia spp.			
	Oxalis oregana	Oregon oxalis		
	Oxalis suksdorfii	western yellow oxalis		
	Penstemon serrulatus	coast penstemon	WA Hwy 14; Sandy River	est. collect: August
	Potentilla glandulosa	gland cinquefoil	Little Rock Isl.	
x	*Potentilla gracilis*	slender cinquefoil	Kingston	est. collect: late July
x	*Prunella vulgaris var. lanceolata*	self-heal	West Linn; Little Rock Isl; Kingston; Noble Woods	8/23/93 R collection; Easy to propagate from seed. est. collect: July - August
	Psoralea physodes	California tea		
	Sidalcea campestris	meadow sidalcea	Springwater; Foster Rd near 190th in fence rows	Easy to propagate from seed.
	Sidalcea cusickii	Cusick's checker-mallow	further south in Willamette Valley	8%/32% germination tests 8/17/93 L collection (Alverson)
	Sidalcea virgata	rose checker-mallow		Peter Zika recommends
	Sisyrinchium angustifolium	common blue-eyed grass		Offshoots of the short rhizome or tufted leaf rosette transplant well; seed germination is low (10-20%).
	Thermopsis montana	mountain thermopsis	clearcuts in Bull Run Watershed	
	Urtica dioica	stinging nettle	Peach Cove; Sandy River; Burl Bot	

Table 1 (continued)

SPECIES		COMMON NAME	LOCATIONS	NOTES/COMMENTS
	Veronica americana	American speedwell	Little Rock Isl; Hwy 217; Leach Garden; Springwater	
	Zigadenus venenosus	meadow deathcamas		25%/24% germination tests 6/30/93 R collection (Alverson)
UPLAND GRASS-LIKE				
	Alopecurus geniculatus	water foxtail	Hillsboro	2%/3% germination tests 6/23/93 ER collection (Alverson) est. collect: August
	Beckmannia syzigachne	American sloughgrass		26%/21% germination tests 9/8/93 L collection (Alverson)
x	*Carex deweyana*	Dewey's sedge	Noble Woods, Peach Cove	mesic woodlands; est. collect: late July - mid August
x	*Danthonia californica*	California danthonia	Sandy River; WA Hwy 14; West Linn; Kingston; Little Rock Isl	3%/4% germination tests 7/6/93 R collection (Alverson); est. collect: early July
x	*Deschampsia caespitosa*	tufted hairgrass	Crystal Lake; Kingston; Sauvie Island; Washougal	est. collect: late July
x	*Elymus glaucus*	blue wildrye	Sandy River; Columbia R Hwy; WA Hwy 14; Burl Bot; Elk Isl; Little Rock Isl; Forest Park	Seeds give satisfactory germ w/o pretreatment. est. collect: late July - August
	Eragrostis hypnoides	creeping eragrostis		
	Festuca			Fresh seed: cold-moist strat 5 days is recommended before incubation.
	Festuca idahoensis	Idaho fescue	Elk Isl; Kingston; Hillsboro	Not highly germinable. est. collect: late June - July
	Festuca occidentalis	western fescue	West Linn	
x	*Festuca rubra*	red fescue	Hillsboro Airpt; Sandy River; Little Rock Isl; Kingston; Wilsonville; Noble Woods	63%/84% germination tests; 7/17/93 R collection (Alverson); est. collect: late June - July

Table 1 (continued)

SPECIES		COMMON NAME	LOCATIONS	NOTES/COMMENTS
x	*Glyceria occidentalis*	northwestern mannagrass	Peach Cove	4%/8% germination tests 7/1/93 L collection (Alverson) est. collect: late July
	Hordeum brachyantherum	meadow barley	Kingston	est. collect: late July
x	*Paspalum distichum*	knotgrass	Sauvie Island; Rooster Rock	est. collect: September
	Stipa lemmonii	Lemmon's needlegrass		
SHRUBS				
	Acer circinatum	vine maple		Grown from seed or rooted branches.
	Cornus stolonifera	red-osier dogwood		Underground stems sucker easily.
	Crataegus douglasii	black hawthorn		
	Holodiscus discolor	oceanspray		Seeds require cold stratification.
	Oemleria cerasiformis	Indian plum		Easy to grow from seed or twig cuttings.
	Philadelphus lewisii	mockorange		Easy to propagate from cuttings taken mid-July.
	Physocarpus capitatus	Pacific ninebark		Easy to start from cuttings; slow from fall-sown seeds.
	Rosa nutkana	Nootka rose		Seeds germinate slowly; outside winter strat. helps; small offsets from roots transplant easily.
	Rosa pisocarpa	peafruit wild rose	Jackson Bot; Burl Bot; Sandy River	Macerate hips in hot water to remove seed (flotation); 40 F strat.
	Sambucus cerulea	blue elderberry		Propagation by seeds sown in the fall or by cuttings.
	Sambucus racemosa	red elderberry		

Table 1 (continued)

SPECIES	COMMON NAME	LOCATIONS	NOTES/COMMENTS
Spiraea douglasii	Douglas's spirea		Grown easily from seed, cuttings, or offshoots of underground stems.
Symphoricarpos albus	common snowberry		Grown easily from suckers of offshoots; possibly cuttings.
TREES			
Arbutus menziesii	pacific madrone	West Linn; Little Rock Isl; Hoyt Arboretum; Elk Isl	Best to plant seed on site rather than transplant; to propagate remove flesh from dry or fresh fruit, stratify 33-40 F moist for 60 days. est. collect: late October
Fraxinus latifolia	Oregon ash		
Populus tremuloides	quaking aspen	West Linn	
Populus trichocarpa	black cottonwood		
Quercus garryana	Oregon white oak	West Linn; Little Rock Isl; Willamette Park; Vanc Lake	Store acorns in moist humus. est. collect: September
Salix fluviatilis	Columbia River willow		cuttings
S. lasiandra	pacific willow		cuttings
S. piperi	Piper's willow		cuttings

Table 2. Plant species grouped by habitat type, collection locations, and dates (month/day) when seed was collected in 1994 for the Metro Greenspaces seed collection project.

SPECIES	COMMON NAME	LOCATIONS AND 1994 COLLECTION DATES
WETLAND GRASS-LIKE		
Carex aperta	Columbia sedge	Vancouver Lake 6/2; Burlington Bottom 6/21; Sauvie Island 8/3
Carex obnupta	slough sedge	Peach Cove 8/8; Rooster Rock 8/11
Carex stipata	stalk-grain sedge	Rooster Rock 8/11
Carex vesicaria var. major	inflated sedge	Burlington Bottom 7/19; Peach Cove 8/8
Scirpus validus	soft-stem bullrush	Vancouver Lake 7/27; Sauvie Island 8/3; Rooster Rock 8/11
Juncus effusus var. Pacificus	common rush	Sauvie Island 8/3; Vancouver Lake 8/10; Rooster Rock 8/11
Juncus ensifolius	three-stamen rush	Sandy River 8/4
Juncus oxymeris	pointed rush	Rooster Rock 8/11
WETLAND FORBS		
Alisma plantago-aquatica	American water plantain	Jackson Bottom 8/1; Sauvie Island 8/3; Vancouver Lake 8/10
Bidens cernua	nodding beggar-ticks	Sauvie Island 8/3, 9/4
Paspalum distichum	knotgrass	Sauvie Island 9/4
Polygonum hydropiperoides	swamp smartweed	Vancouver Lake 8/10
Sagittaria latifolia	wapato	Vancouver Lake 7/27, 8/10
UPLAND FORBS		
Achillea millefolium	common yarrow	West Linn 8/1
Allium amplectens	slim-leaf onion	Kingston 7/20
Camassia quamash	common camas	West Linn 6/25
Lotus formosissimus	seaside lotus	Sauvie Island 7/31
Lotus purshiana	Spanishclover	West Linn 6/25
Mimulus guttatus	yellow monkey-flower	Kingston 7/20

Table 2 (continued)

SPECIES	COMMON NAME	LOCATIONS AND 1994 COLLECTION DATES
Penstemon serrulatus	coast penstemon	Sandy River 8/4
Potentilla gracilis	slender cinquefoil	Kingston 7/20
Prunella vulgaris var. lanceolata	self-heal	Kingston 7/20; West Linn 8/1
UPLAND GRASS-LIKE		
Carex deweyana	Dewey's sedge	Peach Cove 8/8
Danthonia californica	California danthonia	West Linn 6/25; Kingston 7/8; Sandy River 7/16
Deschampsia ceaspitosa	tufted hairgrass	Crystal Lake 7/19; Kingston 7/20; Sauvie Island 7/31
Elymus glaucus	blue wildrye	Burlington Bottom 7/19; Elk Rock Island 6/22; Sandy River 6/28, 7/16, 7/18, 8/4; Columbia River Hwy 7/26; Forest Park 8/2
Festuca rubra	red fescue	Hillsboro 6/22; Sandy River 7/16; Little Rock Island 7/12; Kingston 7/8; Wilsonville 7/8
Glyceria occidentalis	northwestern mannagrass	Peach Cove 8/8

Table 3a. Log of volunteer time donated to collecting seeds for The Nature Conservancy's Metro Greenspaces project during the 1994 field season.

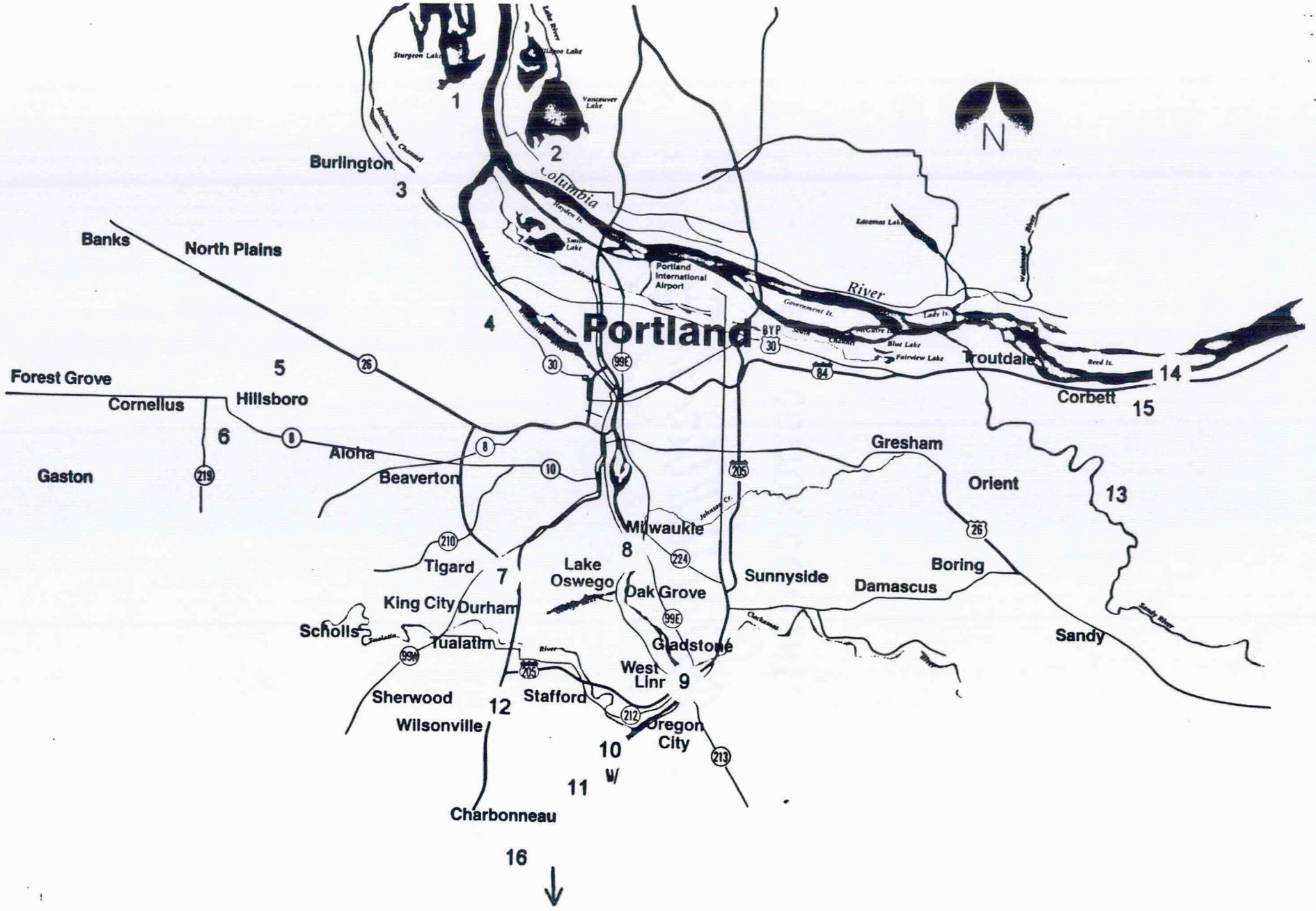
VOLUNTEER NAME	SEED COLLECTION DATE (MONTH/DAY) & HOURS WORKED								TOTAL HOURS
	6/25	6/28	7/8	7/12	7/16	7/31	8/2	8/10	
Larry McAllister	5				3.5				8.5
Rita Freadman	5				3.5	3			11.5
Jessica Wade	5								5
Michael McKeag	5				4.5				9.5
Carrie Stilwell	5				4.5	5.5		4	19
Cynthia Stilwell	5				4.5	5.5		4	19
Beth Wheeler		6					2		8
Paula Thiede			7.5						7.5
Jane McGary			7.5						7.5
Tom Voll				3.5					3.5
Judy Skelton					2				2
Tijuana Judd					2				2
Karen Hout					4.5				4.5
Paula Sauvageau					3.5	3.5		4	11
Becky Phillips					4.5				4.5
Denise Howard						3			3
Mary Christian						2.5			2.5
wetlands class - Doria Mateja 7/19									32
TOTALS	30	6	15	3.5	37	23	2	12	160.5

Table 3b. Log of volunteer time donated to cleaning seeds collected for The Nature Conservancy's Metro Greenspaces project during 1994.

VOLUNTEER NAME	SEED CLEANING DATE (MONTH/DAY) & HOURS							TOTAL HOURS
	8/24	8/29	9/7	9/8	9/14	9/21	9/28	
Nicole Powers	3.5				3	3		9.5
Jeff Lafer	2.5				2.5			5
Cindy Herr	2.5				3	2		7.5
John Bondurant	2.5		3		3		2	10.5
David Coffey	3							3
Gary Orth	3		3		3	3	1.5	13.5
Katherine Voll		1.5						1.5
Terry Kandle			2.5		2.5			5
Shirley Elliot			3.5			3.5		7
Kathy Zawislak			3.5		3	3	3	12.5
Bob Dawson				2				2
Lisa Ekman					1.5	1.5	1.5	4.5
Alice Clark					1			1
Kirsten Lee					3			3
Kathy Baker-Katz					2	2.5		4.5
Scott Waichler						2.5	1.5	4
Wendy Sims						2.5	2	4.5
Chris Morgante							2	2
TOTALS	17	1.5	15.5	2	27.5	23.5	13.5	100.5

Figure 1. Map of Portland Metropolitan area with 1994 seed collection sites for The Nature Conservancy's Metro Greenspaces project. Seeds were collected from a total of 23 sites. Some locations have two or more collection sites associated with one location name. The locations are numbered on the map as follows:

1 - Suavie Island (2 sites)
2 - Vancouver Lake (3 sites)
3 - Burlington Bottom (2 sites)
4 - Forest Park
5 - Hillsboro
6 - Jackson Bottom
7 - Crystal Lake
8 - Elk Rock Island
9 - West Linn
10 - Little Rock Island
11 - Peach Cove
12 - Wilsonville
13 - Sandy River (4 sites)
14 - Rooster Rock
15 - Columbia River Highway
16 - Kingston (east of Salem - not on map)


N
Burlington
Banks
North Plains
Forest Grove
Cornelius
Hillsboro
Gaston
Aloha
Beaverton
Portland
Portland International Airport
Columbia
River
Troutdale
Corbett
Gresham
Orient
Milwaukie
Tigard
Lake Oswego
Oak Grove
Sunnyside
Boring
Damascus
King City
Durham
Scholls
Tualatin
Gladstone
Sandy
West Linn
Sherwood
Stafford
Wilsonville
Oregon City
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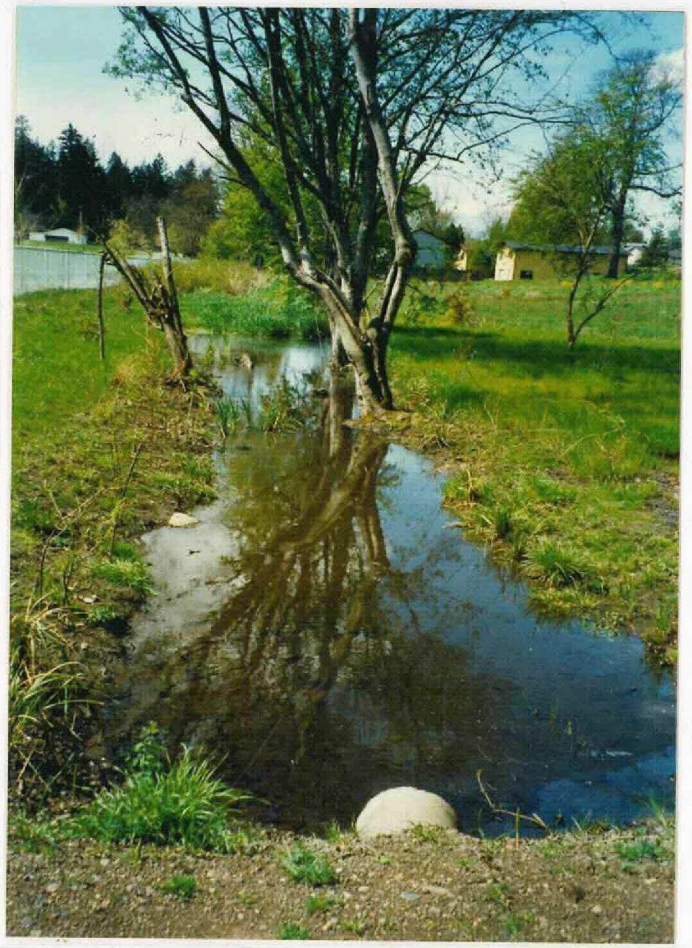
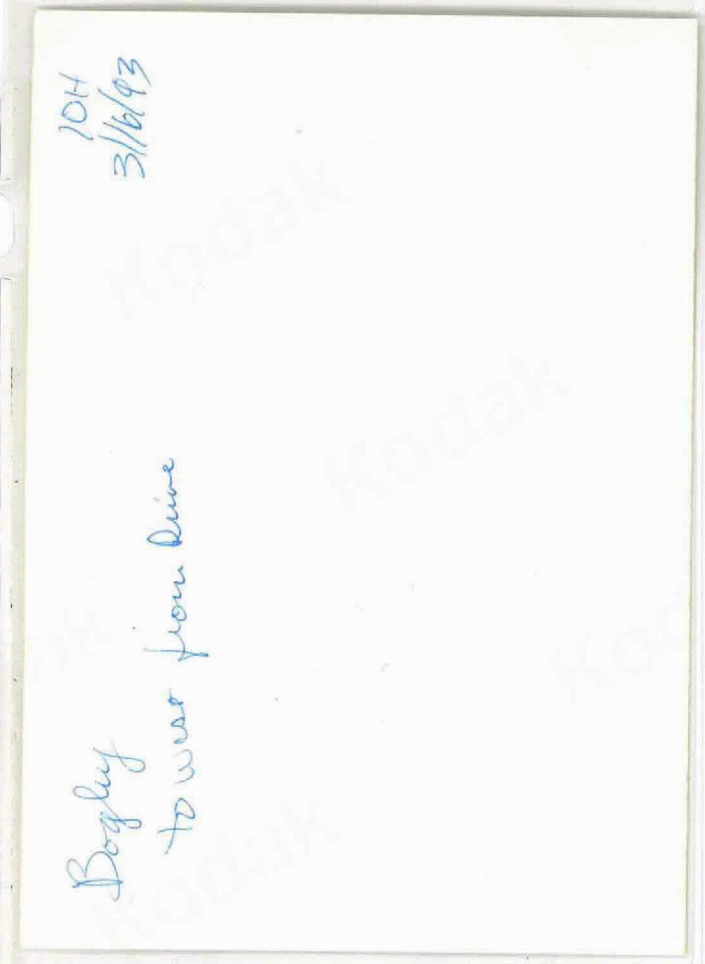
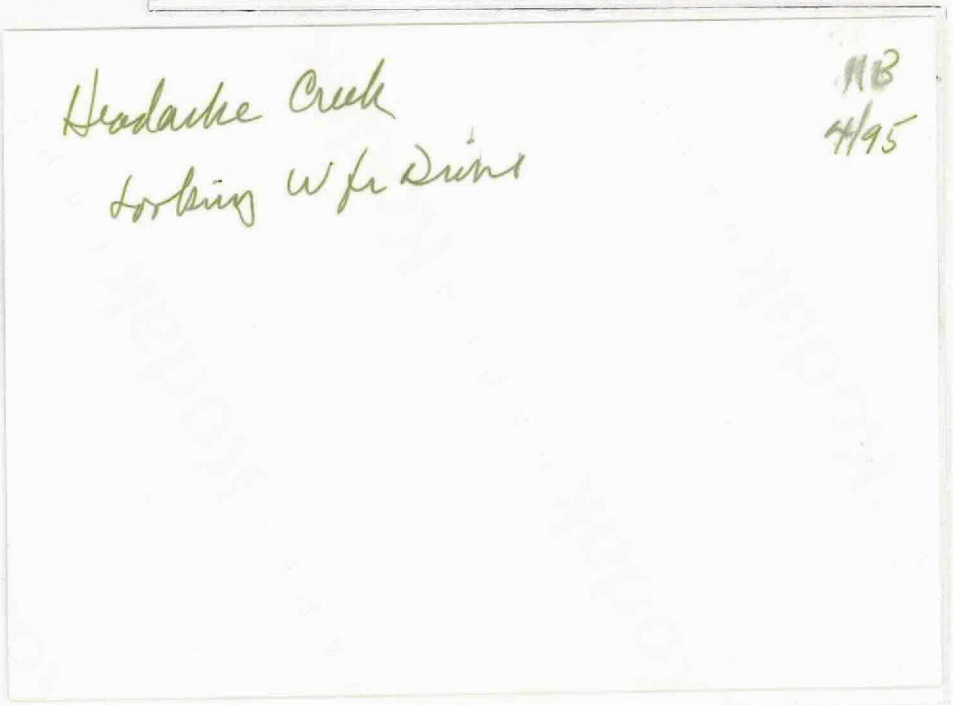
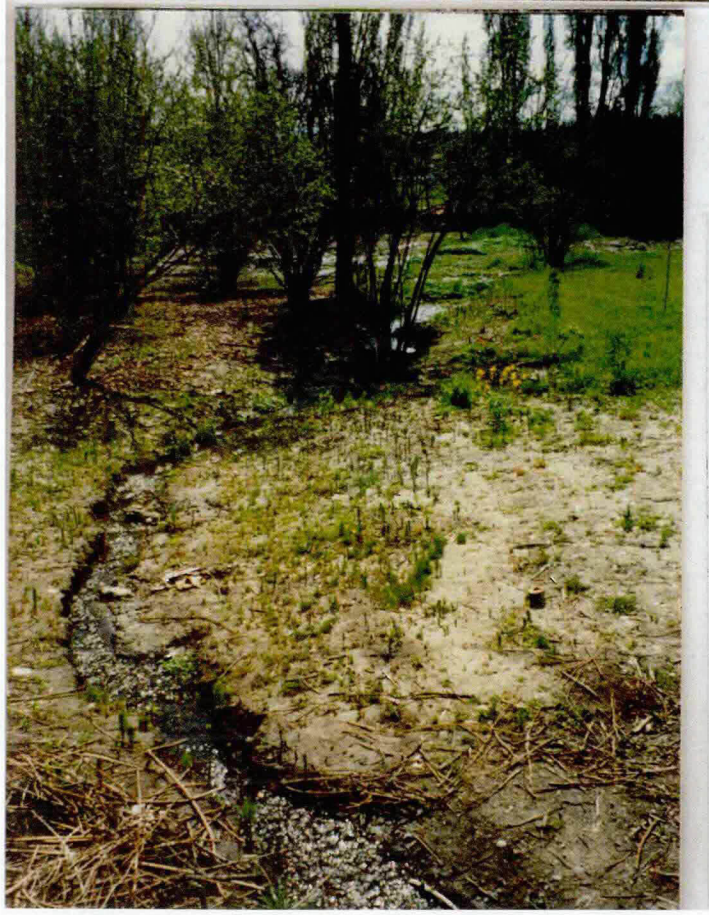



10H
3/16/93
Bogley
to west from Dine


Creek, W side
11A
10/24/44


Headache Creek
looking W fr Dine
11B
4/95

10Z
9/1/94
Creek W/ road



10H
3/16/93

Bayley Nr Nicholson Rd
S fr ~~Nicholson~~ Rd

Headache Creek
- S fr Nickolson Rd

11B
4/95

E side
Creek fr Nicholson Rd

10X
8/17/94

11A
10/29/94

Creek Nr
Nicholson Rd

Creek,
Parking S

10B
9/17/94

Seed pond,
Plantings

11A
10/29/94

Beckwith pond -
Seed

10Z
9/17/94

Headache Creek
Pond +
Skunk cabbage.

11B
4/95