[This document was created around 1999 by Peter Holte, who served briefly as the second Adopt-An-Area Coordinator. He now works for the Redmond park system. This version has been edited to correct spelling and usage, but otherwise reflects Peter's vision. We believe that this valuable document should now be re-examined as a starting point for re-invigorating the planning process among volunteers and Park Staff dedicated to the restoration of Discovery Park **]**

Discovery Park Adopt-An-Area Principles, Guidelines, and Practices

PURPOSE AND SCOPE

This document sets out the principles, objectives and guidelines for Discovery Park's Adopt-An-Area program until a more formalized set of objectives can be drafted via a public process. As such, its purpose is twofold. First, this document acts as a source of information for future land managers and current and future volunteers. Second, it clarifies and puts into writing many of the principles, guidelines, practices, and policies that until now have been expressed only informally.

Use of this document should be tempered with the acknowledgement that it has not undergone the scrutiny of a public process, nor has it undergone peer review. It summarizes our current practices, and puts into writing the current goals of our restoration efforts. As our restoration effort evolves and changes, through a process of adaptive management, these changes will be recorded as an addendum so that this work will contain not only current information, but a history what has come before.

Though this document spends a good deal of time discussing invasive plants, it does so only because these plants exist within a habitat that can support a wider array of species within the Park's landscape. Indeed, in the portion of this document concerning goals, the reader will notice that much of what is discussed is our desired outcome. In this discussion we try to avoid defining what we *do not want*, and instead attempt to explain *what we hope to accomplish*. For example, rather than stating that we wish to limit the fragmentation of the Park, we instead hope to increase connectivity of like habitats. This distinction is important because it takes the focus away from invasives and our need to control them, and instead, places our focus on what landscape we hope to help create, how we can justify creating such a landscape, and what tasks we need to accomplish to meet this goal.

DISCOVERY PARK: AN URBAN WILDERNESS WITH IT OWN UNIQUE HABITAT PATTERNS

Discovery Park encompasses approximately 760 acres, but the City of Seattle manages 534 acres of this area. The difference is made up of in-holding managed by the U. S. Army Reserve, the United Indians of All Tribes (UIATF), the U.S. Coast Guard, the U.S. Navy and King County.

The park was created to become an "urban wilderness" in 1972. This unique classification makes it unlike other parks in Seattle, yet also makes it unlike greenbelts and other open spaces that are connected together or else bordered by less urban surroundings.

As we attempt to increase habitat within the Park, we need to keep this unique character in mind. We will never be able to return the region's landscape or landscape in the Park to what it once was -- the ancient forests that were once here were their own unique ecological systems, originating at a time with when the Northwest's climate was much different than it is today. Instead of trying to restore what was once here, we are instead trying to acknowledge a history that is reflected in the landscape and build a new landscape that is both aesthetically interesting and a viable refuge for native plants and animals.

LANDSCAPE HISTORY

At the time of settlement by Europeans, the Magnolia Bluff was largely a late successional coniferous forest that had existed in this configuration from anywhere between 200 and 500 years. These forests contain patches of ancient forest, but also encompassed young stands and middle aged stands. Combined and placed within the context of the region, to which it is part, the bluff most likely looked something like an old blanket with a number of patches on it. The blanket itself was made up of forests dominated by numerous long living tree species such as old growth Coast Douglas Fir, Western Red Cedar, Grand Fir, Sitka Spruce, and Mountain Hemlock. The patches on the blanket were made up of open meadows, wetlands, Red Alder, young Douglas fir, and Big Leaf Maple groves. This blanket and its patches, however, over time switched places. Younger forest stands matured and faded into the blanket. Older forest stands underwent some from of disturbance, regenerated, and then stood out as patches. Ecologists call this pattern of continually small shifting patches of differing habitats in a more or less continuous blanket of like habitat a "shifting mosaic."

It is likely that the Native Americans in the Pacific Northwest did alter this mosaic through management practices. Their actions likely influenced the quantity of individual species, and in some cases, also altered the structure of entire ecological systems (Boyd 1986). But even though it not known the extent to which Native American practices changed the land, their management is not thought to have greatly influenced habitat patterns in what is now western Washington. And moreover, the land management practices used by Native Americans had much less effect than those that settlers of European descent would later bring (Norse 1990, Agee 1998).

The Europeans who settled the West Point's bluffs brought with them a great amount of change. Some settlers logged the old growth forest for profit. Others simply cleared the land to plant crops. In 1880, the 13 individual landowners gave the federal government 760 acres near the West Point bluffs and the Government created Fort Lawton.

With the creation of the fort, came considerable change to the area's landscape. The Army erected buildings, built roads, created an infrastructure of pipes and wires, built housing for

Army families, and continued removing old growth forests. When the Fort was decommissioned and the land turned over to the City of Seattle in 1972, much of the Army's work was removed, though portions of it still remain. So in summary, the area called Discovery Park went from ancient forest to Army base and to its current designation as "urban wilderness."

This history of land use can be found in the current landscape. The lumberjacks and the U.S. military altered the composition of tree species. By logging and not replanting, they increased the number of mature Alder stands and the large number of Big Leaf Maple found in the park. In addition, the military also altered the types of habitats found in the Park by creating the large open spaces that were once coniferous forests, but are now the North Bluff and the South Meadow.

As a result, rather than looking like the blanket described above, the Park instead looks more like a giant quilt. In other words, rather than a more or less continuous blanket with patches on it, the park is instead a blanket created entirely of patches. Portions of the Loop Trail near the horse patrol (now removed) for example, look much like other mid-aged mixed coniferous forests found throughout the Pacific Northwest. Other areas that are dominated by invasives and seem to be in a much more simple "steady state" -- a state in which one or few plants dominate an area -- show a comparatively low complement of species, and show great resistance to change (May 1975). Still other areas, such as the old Big Leaf Maple stands near the beginning of the Hidden Valley Trail, are unlike forests found elsewhere, but nonetheless display a degree of complexity.

HOW LANDSCAPE PATTERNS EFFECT WILDLIFE

In a general sense, the unique patterns found in the park can create a number of effects on native plants and animals that live there, but here I briefly discuss only two. The first effect is called the *"Island Biography Effect*" (MacArthur and Wilson 1967, Harris 1984). The second is the called the *"Edge Effect."*

"Island Biography Theory" simply states that smaller more isolated landmasses have a lower rate of immigration and therefore higher rates of localized extinction. A lack of immigration routes into a fragmented and isolated habitat means that certain species will have a limited genetic base with which to work. Over time species might inbreed, eventually losing their ability to reproduce, and finally go extinct (Shaffer 1981).

Habitat isolation occurs for two reasons: 1) because a landmass is surrounded by water; or 2) because our land use practices separate the habitat from other like masses of habitat (Harris 1984). In a terrestrial setting, habitat fragmentation has been particularly hard on certain species, and less harsh—and even beneficial—to other species. Species such as giant salamanders, red voles, spotted owls, and northern flying squirrels, for example, all evolved to live in a landscape dominated by late successional forests and cannot function in highly fragmented forest landscapes. Other animals such as rats, raccoons, Roosevelt Elk, and cowbirds, however, may actually benefit from fragmentation because they can thrive in a wider range of habitats or else thrive in disturbed sites.

Applying this theory to Discovery Park, the Park appears as an isolated habitat (a habitat island), surrounded by an "ocean" of urban development. Kiwanis Ravine to the park's Northeast and the railroad tracks to the North act as the sole potential corridor for more specialized, non-flying wildlife to immigrate into the Park. But further, Fort Lawton's elaborate road system breaks the park's habitat into smaller discontinuous sections, isolating habitat patches within the park from one another. As a result, we have a large piece of land placed in a sea of houses and development; and within that piece of land we have a series of smaller and less isolated, but nonetheless fragmented habitats. This brings us to the second effect.

This second effect compounds the first. An "edge effect" alters a habitat's character, creating an abrupt edge between areas of different character (Murcia 1995, Yahner 1988). Roads within the Park create drastic and abrupt differences between the forested areas and the pavement that adjoin them. The forest induces a cooler, moister environment and maintains more uniform, stable temperate variations. The open areas and pavement induce warmer, dryer conditions and greater fluctuations in temperature. Difference in the amount of light, air moisture content, and soil create micro-climates on both sides of the edge. This promotes the growth of some plants and inhibits the growth of others. Likewise, some animals thrive in these altered areas while others recede from it. This ultimately results in an affected area (an edge) that displays its own habitat characteristics.

A certain amount of "edginess" in a habitat is a good thing. It promotes diversity by creating a set of conditions that benefit certain species. Too much edge, however, can be problematic. Discovery Park has a great number of edges and because the Park is already somewhat fragmented, the edge effects further reduces the amount of habitat for species that require a forest habitat or other specialized habitat.

At this time, we do not know to what extent the many edges in the park affect its wildlife. We know it has some effect. Song sparrows and other birds, for instance, are affected because the edge promotes the presence of cowbirds and starlings. Cowbirds are particularly interesting because they are brood parasites, meaning they lay their eggs in the nest of other birds and let "foster" parents raise their young. Once hatched the cowbirds, because they are more aggressive than their "foster" siblings, out-compete "forest bothers and siblings" for the food supplied by the "foster" parents.

Moreover, the edges create pathways for invasive plants to enter the Park. Edges often supply invasive plants with just the set of conditions they need to become established. Hence at the edges in the park, we find a great deal of Himalayan Blackberry, Scot's Broom, Herb Robert, and other invasive plants.

The combination of these effects makes it very difficult for certain native species to thrive within the Park. Certain animals found in the area will probably never make a return. But, if we want to keep those species we now have and at some point see the return of others, we need to

minimize these effects. We need to: 1) connect like habitats creating larger continuous segments of habitat with in the park; 2) control the influence of invasive plants and opportunistic animals; and 3) reduce the amount of edge in the park. Such actions will move the Park's landscape away from being a fragmented habitat island, and move it toward becoming a somewhat independently functioning "urban wilderness".

PLANTS, ANIMALS AND HABITAT TYPES

Those that know the Park know that despite all the challenges that it faces, and despite the altered natured of its landscape patterns, the Park provides habitat for a number of plants and animals. In general, we can divide the Park's habitat types into four large categories: forest, meadow, ponds, and beach. All the forests, however, are not the same and can be divided into smaller habitat types. The same can be said for each of the other habitats. A recent nature-mapping project by the Seattle Habitat Project (http://www.DiscoveryParkHabitat.org/DiscoveryParkHabitatMap.pdf) clearly illustrates this.

In some cases, we have done a good job monitoring the plants and animals found in the Park. We have for example, a lot of information about bird sightings in the park. We could and should, however, do a better job of monitoring other animals that reside here. For instance, we should do a better job looking for salamanders, frogs, and rodents. The problem here, however, is how to look for and count these animals in a way that is both systematic and at the same time gentle and non-disruptive. A list of animals found in the park can be found in Appendix A. Bird lists, native plant lists, and wildlife lists can also all be obtained at the Visitor Center's front desk.

GOALS, OBJECTIVES AND SHORT-TERM GUIDES TO ADOPT-AN-AREA ACTIONS

The unique character of the Park requires an equally unique management strategy; one that accounts for its urban nature, yet also acknowledges the ecological processes found in an area larger than the typical urban open space. The Park's Master Plan guides what we can and cannot do in the Park. Many of the specifics concerning land management within the Park, however, have yet to be worked out. A Reforestation-Habitat Restoration Plan is now in the works and will hopefully work these details out.

In the Adopt-An-Area program we have worked with a set of informal goals that have done a fair job of acknowledging the Park's unique character and also consistent with the Park's Master Plan. The following summarizes these, until now, informal goals that have guided our actions.

GOALS

Our actions are given by six goals:

1) to increase citizen stewardship of the Park;
2) to control invasive plant species;
3) to increase native plant diversity;.
4) to increase potential habitat for wildlife;
5) to increase the beauty of the Park;

6) to educate the public regarding biological diversity within the Park; and
7) to minimize the need to actively manage the Park habitat.

OBJECTIVES

We have not as yet created objectives for our restoration projects. As mentioned, however, the Park is currently beginning this process. The objectives defined in our planning process will not be exactly the same as those we set for the Adopt-An-Area. The two sets will at times overlap. The two sets, however, should complement one another, and if they do not, something is amiss.

Future objectives will likely include our in need to:

*Match volunteers within areas of the Park to act as long term land stewards

*Work within a planning process to:

Identify what type of vegetative communities we wish to have in various area of the Park;

The schedule for such a process;

The appropriate levels of management (intensive, moderate or monitoring) needed in various areas of the Park; and

To clarify the roles of the grounds crews and AAA volunteers

*Maintain a monitoring program that records the presence of rare plants, animals, and fungi

*Develop a monitoring program that will allow volunteers to learn from mistakes and successes (i.e. implementing adaptive management.)

*Use the AAA program as an opportunity to educate by:

Providing youth groups and school groups an opportunity for service learning;

Providing our volunteers with the materials and training they desire; and

Using AAA events as an opportunity to educate the public about our restoration events.

*Increase connectivity among like habitats by removing invasive plants and planting native plants

*Increase structures within habitat communities that will increase native diversity

*Reduce the Park's isolation by encouraging people outside the park to use wildlife friend landscaping practices

*Recognize and honor the work completed by Adopt-An-Area Volunteers

The above list is of course preliminary and will change as the Reforestation-Habitat Restoration Plan unfolds and with further input from Adopt-An-Area volunteers. These objectives also can be written more concisely and concretely for specific areas of the Park. For example, at some future point the objective, "Increase structure in habitat communities that will increase native diversity," can and should be written with a much more specific intention specific to a particular habitat. In this instance, a more specific objective for the forest might be: "Increase coarse woody debris loads to 15% of the total area of forested area to provide habitat for micro-fauna;" or "Create a multi-layer canopy

consisting of ground cover, forbes, shrubs, sub-canopy trees, and dominant canopy trees." These specifics are to come later as the planning process unfolds. But to bridge the gap until we can formally finalize goal and objectives, the following briefly discusses some of the issues that we now face and must make decisions about until such time as a forest plan arrives.

SHORT TERM GUIDES FOR ADOPT-AN-AREA ACTIONS

Addressing the need to determine the location of habitat communities

To date we have worked under the assumption that the North and South Meadows will remain an open area, but that tree planting could take place in much of the other areas of the Park. Indeed, realizing that trees provide habitat and also help control Scot's Broom and Blackberry, we have planted trees in open areas as a method of control. At this point in time is it very important that we take a step back from this practice. We need to stop placing trees into open areas until we hold a public forum to determine what we want to do with open areas that are currently dominated by invasive plants. This is a public Park and land changes in it require public input.

Ecological processes and land management decisions both take place at various spatial scales. In our case, one scale can encompass the entire Park; another scale can encompass smaller habitats within it. At larger scales we will decide if an area is to remain an open meadow, a forest, or something else (i.e. a butterfly and hummingbird demonstration garden, a nature-scaping garden, work location for storing soil, compost and plants, etc.). And yet at still smaller scales we will decide how to create elements in a habitat that foster a greater complement of native plants and animals.

It seems very unlikely that existing broad scale habitats will be greatly altered by future plans. The meadow will remain open. The forest will remain forest. ***With that in mind, our present guideline limits actions that will result in large-scale change and instead promotes the small-scale changes***. Actions consistent with this guideline include: maintaining existing planting, and removing or planting in a manner that will not change one vegetative community into an altogether different type. It does not mean that we need to stop removing invasives in areas that have already been replanted, or in areas where the removal will not radically alter the habitat type—for example, removing ivy and holly in a forest. It does mean, however, that we need to stop removing invasives and replanting with trees in open areas as method to control invasives until we have undergone a public process and a more rigorous biological assessment.

We will work at smaller scales to increase the ability of an area to act as habitat. This is done by increasingly creating a multi-layered canopy in the forest, by increasing diversity within habitat islands in the meadow, and by creating cover in and near wetlands

In the forested areas of the Park where native propagation does seem to be occurring at levels we desire, we should, for example, plant shade tolerant trees such as Western Red Cedar, Western Hemlock, Pacific Yew, Dogwood, and Vine Maple. Additionally, where necessary, we should also clear smaller areas of invasive native plants (i.e. wild blackberry near health path trail), and plant sub-canopy species and forbs. In the meadow, we should plant thickets (i.e. Nootka Rose and Snowberry) that can provide shelter for birds and rodents species as we remove blackberry.

Aesthetic Considerations

We need to consider two levels of aesthetic considerations***. First, we should attempt to make our restoration sites reasonably clean. Second, should think about where we are planting flowering plants and other plants that are considered to have an aesthetic appeal.***

We will take reasonable efforts to place burlap sacks and mulch piles in places where they are less visible to the public. Admittedly, sometimes this will be easily done, while other times the work required will not be worth the effort. This also means we will attempt to find centralized locations to place piles of removed invasive so that they can be quickly taken from the Park.

Education

We will continue to use free walks as an opportunity to educate people about our restoration efforts. We can also use work parties as a chance to educate people. Additionally, the AAA program has been used an opportunity to provide service learning for youth, and this should be continued. Eventually it would be wonderful to extend this program and create a more systematic approach to service learning. This approach would integrate a service learning program with other educational programs offered at the Park—oh, but for the time to do such things**.**

Determining the Degree of Management

Some areas will require yearly, or even bi-yearly ongoing intensive management. Even without determining the type of community we would like in various areas, we can still acknowledge that some areas need more or less attention than others. The meadow, for example, will require intensive management to keep the broom and blackberry out. We will pull broom out as it sprouts up, and we will most likely have to do this for the next 80 years (unless we again try to use bio-solids again -- see the Shoreline Improvement Funds Report, 1986.) We will also likely have to continue mowing once a year in certain areas to control invasives (see mowing map, in the files under maps). We should also attempt to decide who and how we will manage areas that need intensive management. Will the grounds crew take responsibility for certain areas?

Other areas will require less management. Areas infested by laurel and holly need less management. After the holly and laurel roots has been killed or removed we need to maintain monitoring. Likewise, in certain areas (i.e. the health path area) we also need to check on the status of trees planted in amongst the wild blackberry to make sure that they can overcome this aggressive native.

Ideally some areas will only need monitoring to make sure that natural propagation occurs at the desired levels, that the forest is developing a multi-layer structure we desire, and that invasives are not making their way in. There are areas near this state in the Park (i.e. the loop trail near the (removed) horse barns), but even theses areas—at this point—still need invasives removed and sub-canopy trees planted.

Finding ways to obtain or propagate native plants

The increase in the use of native plants by the Department of Parks and Recreation has created the need to search for new was to obtain native plants. ***With this in mind we have to start applying for grants to obtain these plants, and also look to propagate our own native plants***. This means we will have into work at making a better-stocked nursery and volunteers to run it. Currently we are working with a Ballard High School teacher to develop a propagation program that will use high school student to grow seedlings and also teach others to grow seedlings.

CHALLENGES WE FACE WHEN TRYINGTO MEET OUR GOALS: INVASIVES AND CURRENT USE PATTERNS

In order to implement the goals above we will have to meet many challenges. The previous discusses some of the challenges that our restoration project faces, but does so in a somewhat abstract manner. The way these challenges manifest, however, can be much more concrete (pun intended). In some cases, this means we will have to respond to situations that have already arisen. In other cases, we need to act so that we do not find ourselves continually attempting to work in with a landscape whose patterns foster the creation of future problems. Actions that fall into the first category include such things as the removal and/or control of invasive plants, and the maintaining area already re-planted. Action that falls into the later category included such things as removing roads and helping forest to continue through a most or less expected successional course.

INVASIVE PLANTS

Invasive plants are plants which aggressively take over an areas in such a manner that if left unchecked, they would not allow to us to increase native plant diversity or provide wildlife habitat for a larger compliment of species. If left unchecked, these plants tend to create biologically less diverse habitats that show a great resistant to change (a steady state habitat).

The fact that many invasive plants do well in disturbed areas causes particular problems for us here at the park because: 1) we work in an area that has been greatly altered by human actions,

and 2) we want to accept and accommodate change as it occurs naturally. This second point can be very difficult, and as the wise former Adopt-an-Area coordinator, Julie Luthy, once pointed out, "the successional patterns in Discovery Park all seem to end in blackberry and Scot's broom" (personal communications 1999.)

As a result, we have to be persistent, adaptive, and inventive if we are going to maintain a landscape that is ascetically interesting and biological diverse. This means we will have to different techniques for different invasive plants and different techniques for the same invasive plant when it is found in different settings.

General thoughts about removing invasive plant

The first rule of removing invasive plants is patience. The second rule is persistence. It will take us a great long while to control invasive plants here at the park; on the order of decades rather than years. This in mind, it is important to remember that we need to act at a pace that matches our abilities and matches the biological need of plants and animals in the park. We want remove invasive plants, replant, and then care for the restoration site until such time as it can function alone *or* until we reach a place where an area requires only an anticipated amount of maintenance.

The Nature Conservancy suggests using the ***Bradley Technique*** as one way of creating such a pace. This method will not work in all areas of the park, but will work good many areas:

> This method consists of hand weeding selected small areas of infestation in a specific sequence, starting with the best stands of native vegetation (those with the least extent of weed infestation) and working towards those stands with the worst weed infestation. Initially, weeds that occur singly or in small groups should be eliminated from the extreme edges of the infestation. The next areas to work on are those with a ration of at least two natives to every weed. As the native plants stabilize in each cleared nature area, work deeper into the center of the most dense weed patches. This method has great promise on nature reserves with low budgets and sensitive plant populations (The Nature Conservancy 1998).

As with most things in ecology, restoration does not tend to fit into "one size fits all categories**."** ***The third rule (definitely not the last rule) of removing invasive plants is flexibility***. Ecological systems are complex and the conditions that allow invasive plants to take over an area huge in number. We need to remain flexible and we need to learn form our mistakes. We want monitor our actions—something we greatly need to work on—and act with a great amount of humility (Franklin et al. 1988, Botkin 1990, Maser 1992). When taking restorative actions, it is probably best to work from the assumptions that:

1) we cannot know everything about complex ecological systems;
2) we probably harbor unconscious assumptions about how and why complex ecology systems function;
3) our actions may result in unexpected results;

4) we will need to monitor the consequences of our actions to see how they change and develop over time; and
5) we will need to adapt our techniques to meet changing circumstances.

Sharing information is an essential part of this flexibility. There is not a large body of information telling us how to deal with invasive plants. I feel we have done a fairly good job of doing of sharing information in the Adopt-An-Area program. I often learn from the volunteers who have noticed something as they work in the field, and often shared things that I have learned form a variety of sources. We need to continue to share information and to find ways to better share information.

Exotic Invasive Plants

These aliens are not from out space, they come from other places on this planet. But like the fictional aliens from outer space, these plants will "conquer" the park (and maybe even the planet) should we let them. Additionally, some plants should be removed as a priority. Some should be steadily removed, and others removed as less priority. Here letter designate to which category these plants belong: (P1)= remove immediately, priority, (P2) = second priority, remove steadily and (P3) = third priority, remove as time and ability allow. The King County Noxious Weed Listing can greatly aid in determining what priority we should give these alien invaders.

Himalayan Blackberry (P2)

Thus far only two factors seem common to the success of controlling Himalayan blackberry: 1) volunteer's persistence and patience and 2) a mature coniferous forest canopy that limits the available light. Examples of successes do exist, but even in these cases to declare total victory would be a mistake.

The Nature Conservancy (1998) divides methods for controlling blackberries and other invasive plants into three categories: biological controls, chemical control, and mechanical control. Biological control for blackberries cannot legally be used in the U.S. because the use of an imported insects or disease would likely effect commercial berry plants and other close relatives.

Chemical control is controversial, but has shown some effective results. Broadcast spraying with Roundup (glyphosate), 2,4,5-T, and other herbicides seems ineffective. While this method kills the plant above ground, it leaves the root intact and the plant will simply re-sprout from the root. Painting individual stems with Roundup or other herbicides 5 to 10 minutes after they are cut has proved successful, as has injecting blackberry with variety of herbicides (The Nature Conservancy 1998.)

Mechanical techniques include mowing, clipping, digging out roots, or using domesticate animals to physically remove blackberry. This is not an easy process and has provided mixed

results. The berry's unique physiology combined with the energy it requires to machanically control blackberries has led us to a dilemma that we at the park jokingly term, "the blackberry conundrum." Blackberries produce great numbers of seeds that readily sprout in disturbed areas. They also grow bulbous roots containing a great deal of starch and readily re-sprout. Hence the conundrum: do we dig out the roots thus creating more disturbances, or do we allow the root to remain and allow it to re-sprout?

The amount of energy needed to control blackberry by mechanical means plays into this dilemma. Letting the bulbous root remain requires less time in the short term, but will require volunteers to return continually. Removing the root initially takes more time and will still require volunteer to return to remove young plants that have grown in the newly disturbed area.

Currently in the park we use mechanical methods to remove blackberries. To get around the "blackberry conundrum" a middle ground might prove best. ***Remove the bulbous portion of the roots and leave smaller roots.*** This method will still require continuous removals within an area, but hopefully will require less than had we removed none of the roots. This entails a smaller degree of disturbance, but seedling and re-sprouting plants will likely be smaller and weaker than those that would re-sprout from a bulbous root.

Begin by clipping or mowing the blackberries as low as possible near the root. The clipping can be flatten and compacted by foot, or removed for composting. Use a polaski to remove the bulbous roots as discussed previously. These roots should be removed and composted elsewhere. Two to three months later return to the area, and remove blackberries again by clipping and digging roots. Repeat as necessary. It will likely be necessary!

When it is finally time to plant, the place the plants, then place burlap or cardboard around the planting and apply 3-4 inches of wood chips as a mulch. This should help control the blackberry, giving the native plants the opportunity to establish without being taken over. The area will again need to be visited continually and the blackberries clipped back until the native plants that have grown to a point where they can shade out the blackberries. This might take a very long time.

At some point in the near future, we need to make a decision regarding the use of herbicides to control blackberry. Should we use herbicide, "cutting and dabbing" seems the to be both the most effective and environmental responsible method of chemical control. Chipping and mowing, and using mulch may also eliminate a number of weak plants and thus even further reduce the amount of herbicide that needs to be applied***. Should a "cut and dab" approach be use, it should be applied in mid and late September, the time when the blackberry plants send sugar and nutrients below to the roots. The application should be make on the stocks 5-10 minutes after the cut.***

Nesting season should be taken into consideration when removing all invasives plants in the park, including blackberry. Large blackberry thickets should not be remove from late march

until the end of July. Re-sprouting plants, however, can be clipped at this time, though special consideration as to how entry into an area will affect nesting birds. We do not want to disturb nesting habitat, but July also might be the best time to mechanically remove the blackberry; the plant is a its weakest spending energy to produce blooms. Most birds will have fledged by the end of July, but there is no substitute to observation and common sense.

Scot's Broom (P3)

Scot's Broom thrives in open, disturbed spaces. Luckily removing this plant proves easier than removing blackberry. Keeping an area free of broom after removal is a different story. Scot's broom grows quickly, creates a great number of seeds, and disperses these seeds ingenuously. The seeds can remain viable for up to 8O years and responds well to disturbance. This mean that the seed load can be quite high in an area where broom has been present for only a short period of time. One researcher states that the load in Discovery Park was the highest seed load she had ever seen (B. Swift, personal comm. with J. Luthy-Tubbs 1996.)

Our management of Scot's broom is guided by the plant's physiology, by biological considerations, and by the limits of our own restorative efforts. Currently we remove broom in selected areas. In other areas, such as the area just north of the South Parking Lot we have chosen not to remove broom at this time because removal would be more disruptive to habitat than we judge acceptable, and would also likely open the area up to infestation by blackberries.

Generally we manage broom in two different ways. We manage using one method for areas where we will eventually restore a closed canopy. We managed another way in open areas that are to remain open.

In open areas constant removal will have to continue indefinitely. ***When removing broom from an open area, pull all broom with a stem less than ¾ inch in diameter. If larger than ¾ inch in diameter cut it as close to the roots as possible. While younger plants grow back when cut, the older broom does not. This method reduces soil disturbances. Broom can be left on the ground to rot if it does not contain seedpods. Return to sites once or twice yearly to remove new growth.*** Because seeds can remain in the ground viable for decades, we will have to return for decades, even if the area is re-planted with trees.

In areas that will eventually include a closed canopy, the broom can be slowly be replaced by trees and shrubs. Broom does not seem to reproduce well in shaded areas, so although shade might not kill off broom it does help keep it from proliferating. Understanding this a volunteer named Doug Bergman came up with the idea of planting trees in amongst broom. We called this ***the Bergman Technique,*** in honor of Doug. This process will take a great deal of time; years into decades. ***Remove small areas of broom and plant coniferous trees in amongst the broom. As time progresses, more and more broom can be removed as trees, shrubs and ground covers are planted.*** In the end, a closed canopy in will replace the broom. You can think of in terms of a mosaic like shift; that is: a shift were a more or less continuous blanket of broom is slowly removed and taken over by patches of conifers. This technique might work particularly well

with Douglas fir as this tree grow faster when in the presence of nitrogen fixing plants, and broom happens to be a nitrogen fixing plant.

When removing broom in the meadow, careful consideration should be paid to ground nesting birds. Large groups should not be used to remove broom in the meadow from the end of April to the end of July. Individuals going into the meadow to remove broom should be extremely careful of nesting birds**.** In other areas such as the area near the chapel, broom removal can usually occur without disrupting nests. Once again, however, there is no substitute for common sense and observation. If savanna sparrows or other ground nesting birds are nesting in the area, wait until they have raised their young.

Holly (P2)

When removing holly it is best to first attack smaller plants that can be taken with a weed wrench. Remove as much of the root as possible. Some volunteers have tried cutting at the base of the plants, but this results a "scourer's apprentice scenario," (reference to the scene in movie Fantasias where scourer's apprentice cuts down the a wildly out of control magical broom only to creating hundred of smaller other out control magic brooms.) Cutting holly at the roots stimulates the plant's roots. It then sends out numerous shoots. Hence where there was once one holly plant, there are now several. Some volunteers believe it is easier to attack the re-sprouted holly than to initially take the entire root. I am not convinced this works but will continue to monitor areas where this method has been used.

For the moment we remove small holly plants whose roots are easy to take out. We are attempting a few other techniques and will see how well they work larger plants. Chemical control has worked in other places, but is not used here at this time because it invokes controversy. Previous attempts to *girdle* (a process where the cambien is removed in a ring entirely around the tree) large holly trees have failed. Timing, however, may be a factor in failure. We will try girdling larger holy trees just before they are ready to flower because at this time the trees have spent a great deal of energy in the production of reproductive organs. Girdling the plant and applying a herbicide to the cambien might be yet another option for larger trees. If this option is to be used, applications of herbicide are best made during the fall.

Pulled holly can be left on the ground to rot or removed and composted. The removal of ivy should be timed so that it does not coincide with nesting season for ground nesting birds. Additionally, we need to coordinate entry into the forest with ongoing Song Sparrow research that is occurring in the park. This makes many areas with holly infestations off limits from late march to the middle/end of July.

Laurel (P3)

Follow the ***same procedures as with holly***. This plant too can turn from one "magic broom" into hundreds when cut at the base.

Ivy (P2)

Again, patience and persistence seems to be the rule. Ivy is easily removed by pulling at the roots. This plant, however, shows an incredible ability to re-sprout from the roots, from portions of roots, and seemingly even from the smallest speck of ivy particle. ***Remove as much of the plant as possible. Shortly after this first removal (2-3 weeks), it is necessary to revisit the site and remove ivy again. This might have to be done numerous times before planting. When planting the use of wood chips helps greatly. Ivy will grow through the chips, but is easily removed from chips.***

The removal of ivy should be timed so that it does not coincide with nesting season for ground nesting birds. This makes ivy off limits from April to the end of July.

Remove ivy from the area to be composted. It is easiest for the grounds crew to pick up ivy when it is rolled in small balls that can be lifted with a hayfork.

Herb Robert (P1)
This plant is easily to pulled, and should be removed before it flowers. Remove it from the area and do not compost. The unusual smell of Herb Robert (a.k.a. Stinky Bob) is possibly a natural herbicide. Additionally this plant produces a great number of seeds that resist a thermal kill of a compost heap and are too small to sift out effectively.

Use care to remove Herb Robert in a manner that goes not disturb nesting birds. This can often be done through out the year along side trails. Removal further into the interior of the forest should be restricted during nesting season (March through July.)

Poison Hemlock (P2)
Control this annual by pulling before its seeds set. I am not sure it can be composted. Removal is best done in the early spring.

Garlic mustard (P1), Field Mustard (P2)
Control this annual by pulling before its seeds set. It can be composted. Best done in the early spring.

Canadian Thistle(P2, maybe P1?)
The finches love it, but it can be quite invasive. Because the birds enjoy it so much it might be best to control spreading rather than completely remove this plant. ***Control by removing before seed sets. When removing make a conscious decision on how much you want to leave " for the birds."***

Sycamore Maple (P3)
This maple looks much like big leaf maple accept that the leaves are less clefted and have more pronounced vanes***. Remove by pulling with a weed wrench. If seeds are not present, compost. If seed are present, it should not be composted.*** Girdling looks to be an option for large tree and

once more there is some evidence that mountain beavers like to strip the bark for food. Let's hope so. The area near five corners is an excellent spot to monitor this behavior.

Giant Hogdeweed (P1)
This plant has a photo-active sap that can chemically burn human skin. Contact grounds to remove this plant. They will come out with protective clothes on and remove the plant.

Morning Glory (P1)
REMOVE AS SOON AS YOU SEE IT! Attempt to minimize soil disturbance. Do not compost. You will need to revisit the area and remove again and again. This plant can grow from even small pieces than ivy and produces a ton of seeds.

Native Invasive Plants
Not all invasive plants are exotic. In certain places of the park we have changed the landscape in a manner that has caused certain native plants to become overly aggressive. And if our invasive exotics are something like aliens bent on conquering the park, then these native plants must be something like zombies, who placed under an evil spell are capable of destruction and mayhem.

Native blackberry
Native blackberry (also known as trailing blackberry) is one such plant. For some unknown reason, native blackberry in the southeastern portion of the park has aggressively taken over under the shade of mature alder trees. In recent years we have begun to plant red cedar and hemlock in these areas because the area lacked natural propagation of shade tolerant species. Without monitoring and control, the native blackberry will smother out these planting. Should this continue, the alders will eventually die off, the canopy will be left open, and Himalayan blackberry will likely invade the area. ***These planting need to be cleared yearly until such time as the trees can grow above the low growing native blackberry. When shade tolerant tree establish, we will have to return likely once again, clear the native blackberry plant native shrubs to increase native plant diversity and foster a more complex forest structure***.

Bedstraw
Bedstraw is an annual native that seems to be taking on aggressive behaviors. At this time we do not remove this plant, but we do need to continue to monitor it, and determine if this plant is lowering native diversity.

Salmonberry
Salmonberry can be overly aggressive and take over large area. We do not remove salmon berry and in some case have even planted this plant. We need to be careful when placing this plant in the park, using it with caution.

MINIMIZING WORK OVER THE LONG TERM

As the previous discussion should indicate, the restoration of the park will take a lot of energy and a good deal of time. Given the task before us we obviously want to reduce the amount of work it will take us to sustain habitat that display a diverse compliment of native plant and animals. Several actions can help us minimize our workload. The current lay of the land invites infestations of invasive plants and additionally the current condition of mature alder forests in the park in regards to the amount of natural propagation occurring beneath the canopy.

Addressing Fragmentation

We want to create as large a piece of habitat as possible and do so in a shape that produces as little edge as possible. But to do this is easier said than done. Unfortunately there are a host of practical, economic, social, and even political factors all need to be taken into account in figuring what roads we should remove in the park, and how we should go about promoting habitat beyond the park's boundaries.

The first thing we want to do is obviously maintain current connections between like habitats. In the park this should not be difficult as it matches the goals of the master plan. This is most obviously done by consciously choosing to work in areas adjacent to already well established and reality large tracts of habitat. In these areas we want to work form the inside out, using the current associations and habitat structures to build outward—see the Bradley Technique mentioned above.

Additionally, removing roads we can create larger continuous portions of habitat, but what roads to remove and how much of the roads to remove is a difficult decision. Because these roads contain pipes and drains beneath them and because the army did an excellent job building these roads to last, we need to determine whether we want to remove the entire road or portions. Removing only a portion of a road or nearing the road into a bike path might meet our goals in a particular area.

Additionally, we also will want that we create pathways in areas from on type of type to another. In these areas a corridor around or through a developed area will help animals disperse between habitats. This can also be accomplished by creating a series of small patches of habitat might act as "stepping stones" allowing animals to move between habitats.

The use of a Geographic Information System such as ArcView could be extremely helpful in this task. Using this tool we can layer one map atop another, giving up a method to prioritize areas based on whatever criteria we choose. The city has various coverages for an ArcView system. The military likely also has a number of maps that we can use to this end. The Seattle Urban Habitat Project also has useful information.

Dealing with issues outside the park this is a much more difficult task because we have no authority beyond our ability to educate and appeal to the landowners for help. Probably the most realistic goal for us given what we have to work with is to encourage and educate landowners

about landscaping practices that will extend habitat beyond the boundaries of the park. The National Wildlife Federation has an excellent backyard habitat program, as does the Washington Department of Fish and Wildlife and King County.

Addressing Understory Tree Propagation

Yet another action that we can take to reduce the amount of work we need to accomplish to meet our goals is to determine the amount of natural propagation occurring within the forested areas of the park. Should we not see the number of sub-canopy trees that we desire in an area we should plant. This will ensure that the canopy remains closed and thus does gives the forest the chance to move long a more or less continuous successional path. This process takes part in our re-forestation/restoration plan.

PLANTING AND ESTABLISHING NATIVE PLANTS

We have learned a lot more about removing invasive plants than we have about planting natives. This will change over time as we begin to see what we need to do to help plants establish. But there are a few pearls of wisdom we have harvested ourselves and collected elsewhere. Here are eight rough rules that might be helpful when establishing plants. Some of these rules pertain to trees, others to forbes and scrubs, and other to both.

.

The first rule of successful establishment: take clues from nature. When looking to place forbes and shrubs examine the site, locate existing patches and try to enhance these patches through plantings. The Oregon grape grew together in that particular spot for a particular reason, the salal in another spot for another reason, etc. This does not mean that we should not try to re-introduce species into areas, but rather than when we plant species already found in the area that we do so with the thought that like should be planted near like.

The second rule of successful establishment: there is strength in numbers. Trying to create a patch of less than five forbes or scrubs of a particular species is really just a waste. There is notice magical about the number five, and in fact in some cause the area or the plant species might require a planting with a larger number. In fact, more is generally better when trying to add to an established patch or when trying to re-introduce a new species to an area. In the past, practical and funding considerations has limited in the number of plants we have put into the ground. Hopefully we can find new ways to get more plants and put much larger number in specific areas.

The third rule: plant them small but not too small. Plants that are planted when they are young will eventually out-produce plants that are planted when they are older and larger. This is largely do to the fact that smaller plants have greater capacity to establish associations within bacteria in the soil. But we do not want to plant plants that are too small, because as one horticulturist put it, “They will just get eaten by the landscape” (S. Blue, Seattle Horticulturist 1999.) So the trick is to find a happy medium and to use a planting scheme that will lead to

success. This means that when trying to re-establish a fore, for example, we might one to start will larger plants and then later place smaller plants nearby. The large plants will have a chance to hold their own and establish a patch. The smaller plants would then "beef" this patch and eventually out product these larger plants.

The fourth rule: plant in the Fall. Plant is the Pacific Northwest must develop roots before the dry summer sets in. We need to plant them in fall to give them a chance to grow.

The fifth rule: know your tree's needs. Different trees have different tolerances. Alder can grow in the sun, but needs wetter soil. Douglas fir and shore pine need open areas and cannot grow under shade. Hemlock and western red cedars need wet and closed canopies when they are young. Big leaf maple can grow in a closed canopy, and does well, when water for the first year, in open area. In short, different trees have different needs. This not only tells us what trees to plant in what area, but also where to place a particular tree in an area. For example, in a open area where we wish to have a mixed forest we want to plant Douglas fir and shore pine in open drier, more open spots, and plant dog wood and big leaf maple in wetter areas *or* in open areas where already established trees will provide shade for a portion of the day.

The sixth rule: diversity is good. We want to plant in a way that increases diversity. Yew, cherry, dog wood, madrona grand fir, and hemlock are all trees we could plant more. Likewise there are a variety of scrubs we could plant more too: mock orange, serviceberry, huckleberry, and ninebark, to name just a few. Additionally, where tree concerned planting trees over an extended period of time, or planting trees of various ages will help create a diversity of age with the stand.

The seventh rule: build from the top down and inside out. When trying to create a forest in what was once a field of invasive plants, start by planting trees that will create a canopy and work your way down the layers of the canopy. This will take years, but is likely the only way to really control broom and blackberry. See the Bergman Technique in the previous section.

Additionally, the use of already existing adult vegetation can greatly help us as we try to extend forests or patches of vegetation. The Bradley Technique above describes a method to do just this. To repeat what is state here: begin by working from areas of already existing native flora and few invasives, and work outward towards the invasive. See above: strength in numbers.

The eighth rule: think about wildlife. Our goal is not only to increase native plant diversity, but also to increase the ability of our park to act as habitat for wildlife. Wildlife need places to hide, places to rest, food, and water. Our plantings can increase the four components with in the forest. Certain scrub species create wonderful thickets in the forest (i.e. salmon berry, Indian plum, and snowberry) that are used by wildlife. Other can grow as a solitary, small refuge in the middle of the meadow (i.e. serviceberry, ocean spray, and cascara). Berry plants are valuable sources of food as well as shelter. Importing logs is also important. Large woody debris proves perching sites, dens site, and food source for insects, and also helps regulate water cycles.

Learning more about the wildlife in the park and their needs is an essentially part of becoming a good steward. We work to restore the park; we are not only trying to learn what works to vegetation, but also what works for wildlife. So in short, we have to be aware of the plant/ animal associations.

The ninth rule: use the canopy that's already there. There are many areas of the Park filled with "old growth broom. It forms an 8-10 foot canopy under which little else but grass grows. The Bergman technique takes advantage of this canopy to introduce native plants under the protection of these old broom. The large area east of the south parking lot and south of the "500 area" is filled with this old growth broom. Planting this with an "understory" of new Doug Firs, Cedars, Shore Pines and Hemlock would be a very wise use of limited resources. As these begin to overtake the broom in height, they will easily crowd out the invasives.

Tools, Tasks and Roles

The size of the park, legal considerations, and the magnitude of the task we face, requires us to define the role of parks department employees and the role of volunteers. Volunteers can use certain tools, and we have found that some of these tools are better to some tasks and not so great for others. Other tools, however, can only be used by staff. The same is true of tasks. Volunteers and staff can work together on certain tasks while others will belong solely to each group. composting, plant maintenance, moving piles, and maintaining wood chip piles.

Mowing

Only the grounds crew can use mowers. Because of the negative effects of mowing on insects and plant life we want to be very careful using this tool. The park, however, is so large and invasive plants are so persistent that is it unlikely that a volunteer effort alone will be able to control invasives in open areas. Indeed getting volunteers into these open spaces to pull, cut and remove invasives in an open area might be just as harmful, if not more, than mowing at a selected schedule.

When mowing to control invasive there are various options: mowing twice a year, mowing once a year, mowing when needed, or mowing on a rotation. Mowing should occur as close to the first frost as possible, and if done twice a year, as early in the spring as can be done given the wetness of an area's soil. In some areas, mowing will only have to occur in select spots—i.e. the blackberry patch in the meadow near the large alder (Tim's Alder). In other areas, a rotation that controls invasives over several years might be used—i.e. the north bluff and the area near the Utah wetlands. A hammer blade and tractor might be desirable for large areas, while selected areas might require only a hand held weed eater (Links 1999.)

Mowing broom should especially view with caution, as once broom has been cut it is nearly impossible to pull. Mowing blackberry is a reasonable way to get a large patch under control so volunteers can dig up large roots, and use burlap to maintain the area. After volunteers have

reduced the number of blackberry plants in the area, herbicide can be applied by cutting a dubbing (if the park's department is using herbicides.)

If it is determined an area needs to no longer be mowed, we should not be fooled into thinking that we can simply leave it and it will naturally turn into the wild meadow we desire. All meadows in the park are going to have to be intensively managed if we wish to control broom. New growth will make its way into the fields and this will have to be removed. But moreover, by moving we have selected for a species of plants that can survive in areas that mowed. Thus we might want to increase native diversity by helping to establish those plants that we would like to see in the area but that are miss (i.e. camas.)

Herbicides

The use of herbcides also must be complete by staff members. Park's staff must have a public certification card in order to apply chemical to control vegetation. ***(Special Note: Integrated Weed Management is a system of management that uses a variety of techniques to control invasive plants. Chemical controls are not completely ruled out, every attempt is made to limit the amount of chemical use. If we are to use chemicals, we should adopt this philosophy.)***

Certain large-scale actions have been taken in the park

A number of large-scale restoration projects have taken place. Source for this information can be found in the Discovery Park Library and by talking with various members of the Discovery Park staff as well as Mark Van Horn and Kevin Stoops. These actions included the removal of large building when the fort was closed, the creation of ponds and wetlands, and the use of bio-soils in the meadow in an attempt to reduce the amount of broom. The Shoreline Improvement Report (SPIF) will be extremely helpful towards this end.

Invasive Task Force or Council: These actions need coordination, planning and above all , the input and enthusiasm of many people. A monthly or quarterly meeting could begin to help focus attention on this process. Getting volunteers, Park grounds crew and other employees and Seattle City naturalists together in a regular forum would promote exchange of ideas and potentiate the "brain-storm" effect. Hopefully, thi s task force could evolve into the primary body in developing a well coordinated plan and help obtain funding to pursue it.

LAST THOUGHTS

It is easy to get discouraged during a restoration project. Invasive plants are persistent. It is important to take joy in small accomplishment: a year's growth on a Douglas fir tree, a new patch of established thimbleberry, the flowers on a current bush. It is also important to remember that we are not just about pulling things out. True we have to yank invasive plants out by the roots, but what we really want to think about the things we plant and the habitat we wish to create. This is really the difference between deciding what we do want as opposed to deciding what we do not want. This is a very powerful distinction. Any fool can remove a forest, how many can grow one?