2003
Vegetation
Monitoring Manual

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Salal
Gaultheria shallon
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Snohomish County Surface Water Management

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VegMon Program

Introduction

Welcome to the Snohomish County Surface Water Management Vegetation Monitoring Program. This protocol has been designed specifically to engage trained citizen volunteers into restoration project monitoring and analysis. Snohomish County is dedicated to the recovery of critical habitats which support a diverse array of wildlife. Much time, money, and effort is spent each year in the acquisition, conservation, planning, rehabilitation, and monitoring of county lands. Partnerships have been developed with private landowners who have granted the County access to natural resource commons. You have indicated an interest in assisting county staff in assessing the success of restoration projects in regard to vegetation.

VegMon was initiated in 2000 as a vegetation monitoring component of a larger countywide natural resource monitoring effort. Primarily our interest is in documenting change in plant community composition over time at stream, wetland, and forest rehabilitation and restoration projects across the county. Monitoring is critical to determining the relative success or failure of a project and is key to adopting an informed adaptive management approach to natural resource management.

The goals of VegMon are:

- To provide consistent, high-quality data to be used by managers and scientists to measure conditions of our regions plant communities, in both reference sites and restoration sites,
- To contribute to the creation of a regional database of revegetation projects,
- To educate and inform Snohomish County citizens about the ecology and importance of Puget Sound ecosystems and the native plants found in them,
- To provide opportunity for Snohomish County citizens to become involved in the stewardship of the county's ecosystems.

As a Snohomish County VegMon Volunteer, you will participate directly in the collection of valid scientific data and immerse yourself in the diverse natural resources of Snohomish County.

What to Expect

Participation in the Snohomish County VegMon program begins with an introduction to the monitoring protocol manual through one of several training modules offered throughout the year. Reading through the protocols and procedures prior to training will enhance your ability to comprehend the field procedures. After training, you will be assembled into monitoring teams and assigned monitoring sites from our project roster. Optimal team size is three, although two seasoned field crew can be efficient. For each monitoring site, you and your team members will be given a project file, all the proper monitoring tools, and an introduction to the site by the SWM native plant steward and or project manager. Monitoring is conducted during the peak growing season of June through August.

Getting Started

Site Selection

Snohomish County VegMon sites are prioritized for visitation at the beginning of each field season dependent upon site age, accessibility, time line for particular the site, response to seasonal site assessment, and availability of staff and volunteers. Assignments are given based on the complexity of the project monitoring and the experience of the volunteer monitors. You will be given a project folder with all pertinent information about the project site.

Equipment

All necessary monitoring equipment is provided by SWM and assigned to each monitoring team lead. Be sure all the equipment you need is in the container. Consult the equipment check list for the correct array of gear you will need for a particular set of monitoring protocols.

Please take good care of the equipment and return it when you are done with your assignments. Leave SWM Monitoring ID Placard in car windshield.

Personal gear: Dress appropriately for field conditions. It is up to you to decide the level of protection necessary for the field condition. Recommended: hat, sunglasses, sun screen, protective clothing (long pants, long sleeves), foot wear (sturdy shoes, rubber boots), rain gear, field vest.

Make sure all your equipment is in good working condition prior to going into the field.

Compass: Always check compasses to make sure they are working properly before going out into the field. Make sure you understand declination, and note whether your compass, either assigned or personal, allows declination offset. Reset declination to 0 if necessary. **Record magnetic bearings only!!**

Calipers: Calipers are comprised of a fixed arm, scale and moveable arm. The fixed arm is placed along one side of the tree or shrub at the desired height. The moveable arm is then placed flush against the other side of the tree and the scale is read directly. The calipers must be located perpendicular to the stem axis. Make sure you understand how to measure with the calipers. Pay special attention to the calibrations on the calipers to insure you record the correct measurement. Read from the lower scales in millimeters. The correct reading for the illustration on the right, reading at the 0 mark, not the edge of the plastic, is 15.0 mm.

Diameter Tape: A diameter tape is used to measure the diameter of a tree. Since trees are swelled at the base, measurements are

made 4.5 feet above the ground in order to give an average diameter estimate. The diameter tape is wrapped around a tree and is specially designed to convert the tree circumference to tree diameter. Note: use the correct side of the tape when measuring diameter, one side of the tape will measure actual circumference, and the other side converts the circumference to diameter.

Clinometer: The clinometer is a height measuring instrument of small size and light weight. It is robust and inexpensive. The clinometer has a eye piece at the rear but none at the front. A weighted wheel within the clinometer rotates in relation to level. When looking through the eyepiece, a circular field of view of the scales and a horizontal line is seen. Scale readings are taken from the indicator line.
When used correctly, the Suunto Clinometer has an accuracy of about +/- 0.5 m for a 20 m tall tree (i.e. about 2.5%). Make sure you are reading from the scale marked in **degrees.** See appendix for directions on use.

Sampling Frame: The sampling frame or quadrat is an elegantly simple tool for documenting repeated small subsets of the typical herbaceous vegetation in a plant community. We most commonly use a frame that is one quarter of a square meter in area, otherwise written as .25 m^2 quadrat. The frame is placed on the ground adjacent to the line intercept, at a previously determined increment. The frame is used to estimate the amount of cover contributed by each plant species within. Cover is the "silhouette" of the plants canopy projected vertically onto the ground. Cover for all species combined can be greater than 100%. The frame is marked in black and white one-decimeter increments to aid estimation. Practice practice practice. Record only species rooted within the quadrat. It is helpful to search through the quadrat once it has been placed and identify and record all species present, then go back and estimate cover. Herbaceous cover data is recorded on the separate Herbaceous Data Form. Record cover according to Daubenmire cover classes.

Spherical Densiometer: The spherical densiometer is used in measuring forest overstory density or relative canopy closure. We utilize this old forester's tool for getting canopy closure estimates from the center or edges of the stream where each line-intercept crosses.

Follow directions on the inside cover of the densiometer. Make four readings at each stream crossing- one facing in each compass direction, or upstream, downstream, left bank, right bank.

Record your four raw scores in the four columns of the 2M Belt Transect section on the same line you have recorded the stream edge intercept.

Remember you are recording canopy openings, so you are counting the imaginary dots that blue sky superimposed on them. There are 96 possible dots.

Safety

The following is a brief overview of how to stay safe and comfortable when monitoring. Additional safety information is provided at monitoring training. Remember, your safety is far more important than the data you collect.

General Precautions: Always wear long sleeves and tuck in your shirt. Wear sturdy shoes and protect yourself from the elements. Be careful of steep or variable terrain, or various objects which may be dangerous, such as fallen trees, holes, or human artifacts (old fences, broken glass, etc.). If you do not feel comfortable with a site, please inform Snohomish County SWM and they will make arrangements to locate a different site for you. Most importantly, never work alone and always carry or have access to a first aid kit. Let someone know where you are going to be and when you will be back. Place the Dashboard ID Card in plain site on dash before starting your survey.

Data Management

It is important that the data you collect be accessible and useable to others. Quality assurance starts with record keeping. The data sheets must be complete and in a standardized form. It is best to use the actual forms provided by SWM as these have been printed on all-weather paper, paper that will not disintegrate if wetted. All field entries should be made using #2 hardness pencils. Ink washes off when wet, and does not work well on all-weather paper. In case of entry error, draw one line through the error, then write the correct answer next to it. Do not try to remove the error by erasing or marking heavily in the area. The original answer must be known for verification purposes.

After monitoring, one person designated as a team leader must check all data sheets to ensure correctness and completeness, then initial and date the top line in the verification box on each data sheet.

Fill out all information on your data sheets. All entries should be legible and easy to read by someone beside yourself. Most likely someone else will be entering your data and you won't be around to interpret what you meant. Keep good track of sheets. When you return from the field, make photocopies of sheets and related field notes and store the copies in a project folder/binder. Original forms and notes are delivered to SWM for processing. If you elect to enter the data yourself onto the accompanying spreadsheet, complete this as soon after your fieldwork as you can. Send the file by email or disk to SWM, and deliver all originals and related field notes by mail or in person.

Field Notebook

In addition to all the assorted monitoring gear included in your kit, you will be issued a water-resistant field notebook. The notebook is used for documenting information pertinent to each monitoring site you visit. You will want to record the name of the site, date of the visit, amount of time you spent at the site, general impressions. Make notes about conditions of the site, especially status of monitoring baselines, monuments, permanent plot markers, etc. If you are setting up a site, take copious notes on how you sited your baseline, what your reference points are, locations of the of the transects, and quadrat sample location. Drawings and diagrams are encouraged. Anything that will help the site manager or future monitoring volunteers to interpret the site and how the monitoring was set-up. Other observations are welcome including descriptions of vegetation, sightings or signs of wildlife, and stream condition observations.

Make sure you put your name, phone number, address on the front cover of the notebook along with SWM information in case it is lost. Make sure you make copies of all your notes on a regular basis and place the copies in a safe place, like the project folder.

Four-Letter Species Codes

Its not @#$!, even though expletives may be warranted in trying to identify a particularly difficult grass or sedge.

To avoid rewriting each plants genus and species name on data sheets each time it is encountered, botanists have established a short hand convention that aids rapid data entry both in field forms and the electronic data base. We will use the Four-Letter Species Code for all our data entry. When we have multiple species with similar names we may use six letters. The four-letter code gives a unique name to most species we are likely to encounter. The four letters are the first two letters of each the plant genus and plant species (GEnus SPecies) and recorded as GESP. Recorded in all capital letters. For example Rubus spectabilis is recorded as RUSP. Picea sitchensis is recorded as PISI. Check our handy species code reference for more examples. If you can identify a plant to genus, but don't know the species record it with XX in the species slot. You know its a willow, Salix, but can't figure out what species—so record as SAXX. If you have multiple unknowns of the same genus, and can tell them apart, try adding a number on the end for each one, such as SAXX2. Or just call it Goober1, WartyGreenthing, Scrappygrass or any fun and creative name as long as you're consistent. Be sure to collect a sample, label it with your unique name that you've used on the data sheet and have a reputable botanist complete the identification for you. Sometimes conflicts arise when two species have the exact same four letter code. Say you've got beaked hazel (Corylus cornuta) and brass buttons (Cotula cornopifolia) --- both are COCO. Go to six letters—CORCOR and COTCOR.

Site Establishment

Site Information

Your site folder contains information necessary to successfully assess your site, including general location map and address, written directions to the site and the project, and landowner information. An aerial photo of site with critical features highlighted may be included. A map, description, and GPS coordinates will be provided to help you locate project features such as baseline endpoints, transects, bioengineered

structures, and hard reference points. At a minimum you should have the as built plant list/schedule and list of additional volunteer plants identified on site since establishment. The as built schedule tells how many plants by species were planted onsite. A planting plan will tell you where each plant, by species, was planted on the site.

Monitoring Protocol

Overview: Monitor Components

Snohomish County VegMon protocol is a robust monitoring tool designed to assess a wide variety of vegetation and the plant communities in which they reside. Monitoring projects will include linear riparian communities, patches of floodplain or wetland, and natural or restoration sites. Monitoring elements range from brief walk through assessments to complex multiple canopy cover analysis. Each procedure is designed to act independently but more often is linked to a hierarchy of increasing detail.

The protocol has been designed to minimize subjectiveness of an individual observation. Most of the methods are quantitative – a particular trait or characteristic is directly measured with a scaleable device and that number is recorded, summed, and analyzed to derive a score or biometric for that character. The overall sum of these measured observations gives us information about the relative success about the project, and allows us to better predict its long term trajectory. These include plant measures such as stem diameter, plant height, shoot number, and line intercept increments.

There are a few elements of the monitoring protocol that remain qualitative. You must use your best professional judgment, educated interpretation, or gut level instinct. Qualitative measures include vigor assessments, photo documentation, and herbaceous cover (quadrats). Training, practice, and on the job cumulative experience using a consistent procedure will make your observations comparable with your teammates and other monitoring teams.

For your Information: We are currently trying several methods for protection where beaver activity is suspected to be high. Please become familiar with these methods so you are not surprised when monitoring. Paint with sand: recycled latex paint to which course sand is added (30% by weight), painted on the entire above ground portion of the post. Chickenwire: posts are wrapped with 1" mesh , 3-4 feet widths, staked to the ground with wood stakes or wire staples. Deterent powders and sprays.

Procedures:
Site Assessment
Vigor and Mortality Assessment
Morphometric Vigor and Growth
Vegetation Cover
Live Post Vigor

Monitoring Site
Establishment & Preparation

Objective

Establish monitoring site baselines and transects to facilitate long term evaluation of the project site. Provide set up for Vigor and Mortality Assessment, Morphometric Vigor and Growth, and Vegetation Cover. (Instructions for establishing monitoring sites using methodologies other than baselines and transects will be provided on a site-by-site basis.) The monitoring site should be established and site map completed before any monitoring begins. All measures should be to the nearest tenth of a meter.

Existing Sites

You may be visiting a site that has baseline and endpoints established. The greatest challenge will be relocating all the monitoring reference points. Each visit to the site should also be used as an opportunity to dress up, repair, and make each point easily found for next time. Rely on notes and maps from previous years. Check with Lead Steward if you have difficulty relocating any or all points.

Establishing a New Site

You are so lucky. This is an important task to the overall, long-term success of the monitoring program. A well set up baseline and transects will make your job easier, and for monitors who follow in later years (it could be you, but may not), so document it well! This is often the most time consuming portion of the monitoring protocol. In all cases we will establish a monumented baseline the length of the project site that will serve as a starting reference for all future monitoring episodes, whether those are temporary or permanent procedures.

Baselines are installed similarly in most sites. Baselines extend the length of riparian projects parallel to the stream course at the outmost periphery of the project area. This can be a road or trail edge, a fence-line, top of bank, etc. Transects are laid perpendicular to the baseline and extend across the project site, crossing the stream or aquatic area, and ending at the project limit at the other side. Transect ends are generally marked permanently with T-posts and given a unique identification number. Transect identification numbers begin at the upstream end of the project and are numbered sequentially in the downstream direction.

Equipment Needed

- 50-meter tape
- T-posts
- Post driver
- Hand sledge
- Aluminum nails
- Compass
- Tags
- Rebar and rebar caps
- Measuring rod
- Graph paper
- Site information sheet
- Field notebook
- Pencils
- Colored flags
- Data forms
- Notecards

Methodology

Baseline

This method establishes a baseline approximately parallel to a stream channel and permanent or temporary transects perpendicular to the baseline. The baseline may coincide with the outside edge of the project, a fence line or some other designated monument.

The baseline ends should be marked permanently with t-posts or other permanent markers. Measure length of baseline to the nearest tenth meter and read the compass direction of the baseline facing down stream. Record the length and compass direction in your field notebook and site information sheet. Draw a site map with baseline and prominent features.

2 Meter Belt Transects

Vigor and Plant Morphometry assessments are made using 2 meter belt transects. Shrub cover (line intercept) assessments are made along the mid-line of the 2 meter belt transect. 2 meter belt transects can be temporary or permanent. They are located at predetermined random points that should be provided with site instructions.

1. On the measuring tape extended along the baseline, locate each of the assigned 2 meter belt transect intercepts.

2. For permanent 2 meter belt transects, mark location with t-posts or rebar posts and a numbered tag for each 2 meter belt transect at the baseline. For temporary 2 meter belt transects, mark each location with a colored flag.

3. Fasten the end of a 50 meter measuring tape to the transect post and run it out to the stream edge or to the opposite project boundary, 90° to the baseline.

4. If transect length is greater than 10 meters, install additional t-posts along length to prevent line from “bending”, aiding in the exact relocation of the tape in future revisits.

5. Record the length of the transect and compass direction facing the stream in the field notebook and site information sheet. All measures should be to the nearest tenth of a meter.

6. Repeat process for all transects, recording the lengths and compass directions in the field notebook and site information sheet.

7. Draw the 2 meter belt transects at their assigned locations on the site map and number each of the transects in consecutive order.

8. Photo-document each transect line while measuring tape is in place. Place camera at the origin of the transect at the baseline and point the camera in the direction of the endpoint of the transect. A transect identification card, hand held at a distance of about 10 meters, should be included in photograph. The site name, date, and transect should be clearly printed in bold black lettering on the number card. Record the date, transect number, frame number, camera type, aperture, and lens speed in the field notebook.

Site Assessment

Objective

This is the most basic level of site monitoring. It is a qualitative assessment performed once a year for all ongoing projects, especially in their first three years of establishment. This is an opportunity to conduct a casual walk through the site in order to become familiar with the location, features, assess overall planting condition, identify particular groups of plants that may not be performing well, and potential problems with the site. This observation period and report will help determine and plan seasonal maintenance needs for the site.

Methodology

Fill in the Site Assessment procedure sheet answering all questions. The following is a list of questions to keep in mind while assessing your site.

Does it look like the planting plan? Can you identify all the species on the species list? Are there signs of natural recruitment (desirable plants present that were not planted)? Any sign of vandalism? Is fencing intact and gates secure? Are there any problem or noxious weeds present and if so what is their relative threat to the planted species? Are there obvious signs of animal damage? Do the plants need water, mulch, staking, or browse protection? Are there persistent problems that were identified the previous year? If monitoring has been established on this site can you find baselines, transect endpoints, and monuments?

Equipment Needed

- Camera and film
- Plastic bags and permanent marker
- Notecards and pen
- Compass
- Colored flagging tape

See also "Supplies and Equipment List" in the Appendix.

Red Elderberry
Sambucus racemosa

Vigor and Mortality Assessment

Objective

Establish estimate of plant vigor and mortality within a 2 meter wide belt transect.

Equipment Needed

- Camera and film
- Notecards and pen
- Plastic bags and permanent marker
- Colored flagging tape
- 2 - 50 meter tapes
- Compass
- 2 meter measuring rod
- Bamboo stakes

See also "Supplies and Equipment List" *in the Appendix.*

Methodology

1. Using the site map and planting schedule as a guide, locate the baseline and the origin of the first 2 meter belt transect.

2. Fasten meter tape to the origin of the transect and extend tape to opposite endpoint of the transect. Stretch tightly and make sure tape is in contact with additional t-posts. Record transect length.

3. Return to origin. Extend a measuring rod or 2 meter rule and center over the measuring tape so that the rod extends a meter to each side of the tape.

4. Walk along the tape and record the following information about each plant that falls within 1 meter of each side of the 2 meter belt transect:

   - Species of each plant in the **Species Code** section, using the appropriate 4-letter code.

   - In the **Vigor Assessment** section, record in the **Class** column, whether the plant is thriving, alive, stressed, or dead using the following codes:

1= thrive Evidence of vigorous growth includes: new green leaders, flowers, developing fruits, sign of last years fruits, etc.
2= alive No evidence of above, but plant is green and has no apparent signs of damage or stress.
3= stressed Plant color poor, withering leaves, desiccated leaders.
4= dead No sign of life. Scratch bark to check for green cambium layer.

   - If the stem is from a live stake, mark Y=yes in the **Live Stake** column of the **Vigor Assessment** section. Look for a central stem that has been cut off at the top and lateral branches that arise from the stem.

   - If the site instructions require a damage assessment, carefully examine the entire length of the plant and record the appropriate code for damage. Stems girdled by rodents is a commonly observed animal damage; record the best estimate of the percent girdled next to the code for animal damage (e.g., ad/25%) in **Damage** column of the **Vigor Assessment** section.

Repeat for all transects.

Morphometric Vigor and Growth

Objective

Determine growth trajectory by annual measurement of height, diameter, and number of stems.

Equipment needed

- Camera and film
- Notecards and pen
- Plastic bags and permanent marker
- Colored flagging tape
- 2 - 50 meter tapes
- Compass
- 2 meter measuring rod
- Bamboo stakes
- Caliper
- Diameter tape

See also "Supplies and Equipment List" *in the Appendix.*

Methodology

1. Using the site map and planting schedule as a guide, locate the baseline and the origin of the first 2 meter belt transect.

2. Fasten meter tape to the origin of the transect and extend tape to opposite endpoint of the transect. Stretch tightly and make sure tape is in contact with additional t-posts. Record transect length.

3. Return to origin. Extend a measuring rod or 2 meter rule and center over the measuring tape so that the rod extends a meter to each side of the tape.

4. Walk along the tape and record the following information about each plant that falls within 1 meter of each side of the 2 meter belt transect:

Species
Record the plant species, using the 4-letter code, in the **Species** column**.** In the **Line Intercept** column, record the location along the transect that the plant occurs, using the approximate center of the plant.

Stem Count
Record in the **Stem Count** column. Count the total number of stems emerging out of the ground of a plant that has multiple stems.

Height
Hold your measuring rod or carpenter's rule vertically adjacent to the plant and sight across the top to get an estimate of height. Refrain from straightening up the shrub, unless it has been knocked down by other vegetation. For plants greater than 2 meters use a clinometer. Height calculations should not be made in the field. Use the **Live Stake** columns in the Vigor Assessment to record:

1. Distance from the tree to the observer to the nearest tenth meter.
2. Clinometer angle reading in degrees (°).
3. Eye height of observer to the nearest tenth meter. (e.g., 109.4 m/ 47°/ 1.7m).

See attached instructions for specific directions in using the Suunto clinometer.

Diameter
Record in the **Diameter** column to the nearest tenth of a centimeter (cm). For plants less than 2 meters tall measure the diameter

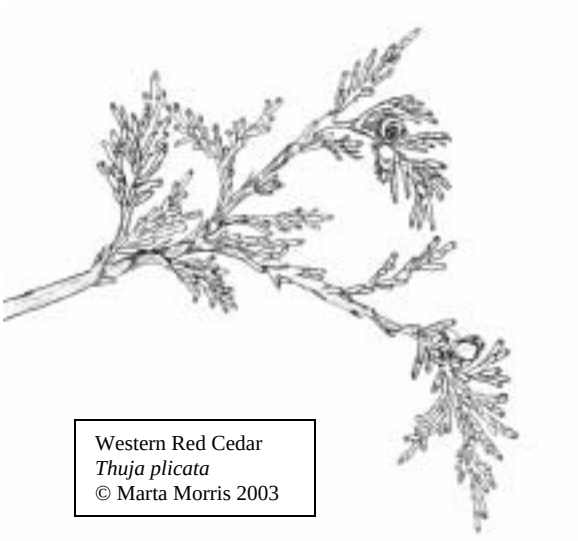
10 centimeters above the ground of the thickest stem (if multiple stemmed) using a caliper. For plants greater than 2 meters tall measure the “diameter at breast height” or dbh. Breast height is considered to be 4.5 feet above ground. Use a diameter tape if the plant is too large for a caliper. See attached instructions.

Live Stakes

If you can see that your plant is a live stake, enter the number of leaders greater than 10 cm long and the length of the longest one in the **live stake** column. If site instructions require leader counts (LC) and leader lengths (LL), count the number of leaders emerging from the stake and measure the longest 5 leaders to the nearest tenth of a centimeter.

If surveying a site predominately planted with live stakes and posts use the special live post vigor form and attached instructions.

Repeat for all transects.



Western Red Cedar
Thuja plicata

Vegetation Cover

Line Intercept: Shrub and Tree Cover

Objective

Determine and characterize vegetative cover for trees, shrubs, and problem herbaceous species.

Equipment Needed

- Camera and film
- Notecards and pen
- Plastic bags and permanent marker
- Colored flagging tape
- 2 - 50 meter tapes
- Compass
- 2 meter measuring rod
- Bamboo stakes
- Clinometer
- Caliper
- Diameter tape

See also "Supplies and Equipment List" *in the Appendix.*

Methodology

1. Using the site map and planting schedule as a guide, locate the baseline and the origin of the first 2 meter belt transect.

2. Fasten meter tape to the origin of the transect and extend tape to opposite endpoint of the transect. Stretch tightly and make sure tape is in contact with additional t-posts. Record transect length.

3. Return to the start of the transect and perform the following:

Shrubs and tree canopy
Starting at the origin of the transect (0.0 meters), walk along the tape, record only the plant species that fall directly under or above the tape. Record the 4-letter species code in the **Species** column and the intercept length to the nearest centimeter of each species from the point it is first encountered and the point it ends along the tape in the **Line Intercept** column. For visualization, pretend this tape represents a parallel, vertical plane passing through the tape extending to the ground and sky above. Any plant parts that this plane passes through are in the intercept. This is mostly for planted shrub and tree sapling cover. However, note distances and intercepts for the stream edges (Ordinary high water mark "OHWM"), dominant volunteer vegetation, reed canary grass, Himalayan blackberry, Japanese knotweed, and other noxious weeds.

4. Return to the start of the transect, using the 2 meter belt transect perform the following to assess tree basal area:

    - Extend a measuring rod or 2 meter rule and center over the measuring tape so that the rod extends a meter to each side of the tape.

Species
Record the plant species, using the 4-letter code, in the **Species** column of plants that fall within 1 meter of each side of the measuring tape**.** In the **Line Intercept** column, record the location along the transect that the plant occurs, using the approximate center of the plant.

If there are larger trees onsite, lying outside the boundary of the 2 meter belt transect that

contribute canopy to the intercept, record species, the height and diameter of the tree, the distance from the base of the tree to the intercept tape, and the line intercept point. At this approximate intercept, use a spherical densiometer, for canopy cover estimate. See Equipment tutorial.

Height
Hold your measuring rod or carpenter's rule vertically adjacent to the plant and sight across the top to get an estimate of height. Refrain from straightening up the shrub, unless it has been knocked down by other vegetation. For plants greater than 2 meters use a clinometer. Height calculations should not be made in the field. Use the **Live Stake** columns in the Vigor Assessment to record:

1. Distance from the tree to the observer to the nearest tenth meter.
2. Clinometer angle reading in degrees (°).
3. Eye height of observer to the nearest tenth meter. (e.g., 109.4 m/ 47°/ 1.7m).

See attached instructions for specific directions in using the Suunto clinometer.

Diameter
Record in the **Diameter** column to the nearest tenth of a centimeter (cm). For plants less than 2 meters tall measure the diameter 10 centimeters above the ground of the thickest stem (if multiple stemmed) using a caliper. For plants greater than 2 meters tall measure the "diameter at breast height" or dbh. Breast height is considered to be 4.5 feet above ground. Use a diameter tape if the plant is too large for a caliper. See attached instructions.

Sampling Frame: Herbaceous Cover

Objective

Determine and characterize vegetative cover of the ground level, herbaceous component.

Equipment Needed

- Camera and film
- Notecards and pen
- Plastic bags and permanent marker
- Colored flagging tape
- 2 - 50 meter tapes
- Compass
- Bamboo stakes
- Quadrat sampling frame

See also "Supplies and Equipment List" *in the Appendix.*

Methodology

1. Using the site map and planting schedule as a guide, locate the baseline and the origin of the first 2 meter belt transect.

2. Fasten meter tape to the origin of the transect and extend tape to opposite endpoint of the transect. Stretch tightly and make sure tape is in contact with additional t-posts. Record transect length.

3. Return to the start of the transect and perform the following:

Establishment
Six to eight quadrats per transect are adequate and maximum for our purposes and available time. Stay away from immediate vicinity of baseline and project edges. Use a random number generator to select locations along transect. Locate your

first plot, and place sampling frame on downstream side of transect, immediately adjacent to the tape, with one frame corner at the selected number, and the other corner towards the higher numbers on tape.

Record the meter location along the tape for each quadrat in the **Plot Number** box at the top of the **Plots** columns.

Record species of all herbs, grasses, and grass-like plants **rooted** within the quadrat using appropriate 4-letter code. Create a table or legend with 4-letter code and plant name using common, Latin binomial, or alias “herb1”, “Ralph”, etc.
Record estimated percent cover or Daubenmire cover class for each plant species present within the quadrat in the corresponding plot number column. Total cover may equal greater than 100%. Include bare ground.

In some cases, you may be asked to do frequency instead of cover. In this case, simply record the names of the species present (rooted in) in each quadrat.

Make this quadrat location permanent by pounding rebar into ground on inside, opposite corners of quadrat frame, with one rebar at the transect length recorded. Place yellow cap on top of rebar for easier relocation. The capped rebar should be the only part sticking up out of the ground.

Daubenmire Cover Class

Coverage Class	Range of Coverage	Midpoint of Range
1	0-5%	2.5%
2	5-25%	15
3	25-50%	37.5
4	50-75%	62.5
5	75-95%	85
6	95-100%	97.5

Live Post Vigor

Objective

Assess survivorship, vigor, and growth phenology of live stakes and posts.

Equipment Needed

- Sequentially numbered permanent tags or aluminum tags and pencil
- Aluminum nails
- Hammer
- 2 meter measuring rod
- Diameter tape
- Caliper
- Data sheet
- Clipboard
- Pencil

Methodology

1. Nail a numbered tag or wire tag to the live post near the top. Record number in **Post** column on data sheet.

2. Record 4-letter species code in **Species** column.

3. Measure and record diameter in **Diameter** column using diameter tape or a caliper.

4. Record height in meters using a meter stick or tape in the **Height** column. If you know the original length of the post/stake you might want to add a column with that info.

5. In the **Condition** column, indicate whether the post is Alive or Dead. A good questions to ask yourself: is the cambium still green?

6. If girdling is present, record the percent of the circumference that has been girdled in the **Girdle Percent** column. An example of deep girdling is beavers. An example of surface girdling is voles.

7. Record number of leaders over 10 centimeters in length (LC) and record lengths of the 10 longest leaders (LL) in centimeters using the **Live Stake** section.

8. Record condition of all leaders for which you recorded a length in the **Condition** column.

9. Use the **Damage Comments** section to note any additional observations, i.e. protection method (Paint with Sand, chickenwire), damage, environmental observations.

Oregon Grape
Mahonia nervosa

Appendix

General Vegetation Monitoring Hierarchy

Type	Frequency	Purpose	Method
Site Assessment	annual	assess overall condition & maintenance needs	casual walk through entire site observation of species with particular problems. determine maintenance needs photodocumentation
Vigor and mortality	year 1,2,5	determine survival rate	establish baseline& transects photodocumentation from photopoints vegetation mapping tally alive/dead plants by species in belt transects
Morphometric vigor	year 1,2,5	determine growth trajectory	plotless or within 2-Meter belt transects growth measurement: height, dia. at base, or dbh
Plant Cover Analysis	year 1,2,5,10	determine &characterize vegetative cover	establish baseline and transects line intercept: cover belt transect: basal area in stream canopy cover by spherical densiometer
Herbaceous Plant Cover	baseline year 2, 5, 7	determine & characterize herbaceous vegetative cover	establish baseline, permanent transects and plots Daubenmire cover class

4-Letter Species Codes

CODE	Common Name	Scientific Name
ACMA	big-leaf maple	*Acer macrophyllum*
PREM	bitter cherry	*Prunus emarginata*
RHPU	Cascara	*Rhamnus purshiana*
POBA	cottonwood	*Populus balsamifera*
MAFU	crabapple	*Malus fusca*
PSME	Douglas fir	*Pseudotsuga menziesii*
ABGR	Grand fir	*Abies grandis*
COCO	hazel	*Corylus cornuta*
BEPA	paper birch	*Betula papyrifera*
POTR	quaking aspen	*Populus tremuloides*
ALRU	red alder	*Alnus rubra*
PICO	shore pine	*Pinus contorta*
PISI	Sitka spruce	*Picea sitchensis*
TSHE	western hemlock	*Tsuga heterophylla*
THPL	western redcedar	*Thuja plicata*
PIMO	white pine	*Pinus monticola*
CRDO	black hawthorne	*Crataegus douglasii*
HODI	oceanspray	*Holodiscus discolor*
MAAQ	Oregon grape (tall)	*Mahonia aquifolia*
MANE	Oregon grape (dull)	*Mahonia nervosa*
OECE	Indian plum	*Oemleria cerasiformis*
PHCA	Pacific ninebark	*Physocarpus capitatus*
RISA	red-flowering currant	*Ribes sanguineum*
ROGY	bald-hip rose	*Rosa gymnocarpum*
RONU	Nootka rose	*Rosa nutkana*
SAHO	Hooker willow	*Salix hookeriana*
SALU	Pacific willow	*Salix lucida var lasiandra*
SARA	red elderberry	*Sambucus racemosa*
SPDO	Douglas' spirea	*Spirea douglasii*
COST	red-osier dogwood	*Cornus stolonifera*
GASH	salal	*Gaultheria shallon*
RUSP	salmonberry	*Rubus spectabilis*
SASC	Scouler' willow	*Salix scouleri*
AMAL	serviceberry	*Amelanchier alnifolia*
SASI	Sitka willow	*Salix sitchensis*
SYAL	snowberry	*Symphoricarpos albus*
RIBR	stink current	*Ribes bracteosum*
RILA	swamp gooseberry	*Ribes lacustre*
RUPA	thimbleberry	*Rubus parviflorus*
RUUR	trailing blackberry	*Rubus ursinus*
LOIN	twinberry honeysuckle	*Lonicera involucrata*
ACCI	vine maple	*Acer circinatum*

CODE	HERBS/FERNS/GRASSES	Scientific Name
DREX	coast shield fern	*Dryopteris expansa*
BLSP	deer fern	*Blechnum spicant*
ATFI	lady fern	*Athyrium filix-femina*
POMU	sword fern	*Polystichum munitum*
LYAM	skunk cabbage	*Lysichiton americanum*
OESA	water parsley	*Oenanthes sarmentosa*
CAOB	slough sedge	*Carex obnupta*
SCMI	small-fruited bulrush	*Scirpus microcarpus*
CAST	sawbeak sedge	*Carex stipata*
	EXOTICS/INVASIVES	
RUDI	Hymalayan Blackberry	*Rubus dicolor*
RUUR	Evergreen Blackberry	*Rubus ursinus*
POSP	Japanese Knotweed	*Polygonum spp.*
PHAR	Reed Canary Grass	*Phalaris arundinacea*
LYSA	Purple Loosestrife	*Lythrum salicaria*

Damage Codes

ad	animal damage
bb	broken stem
bc	bud collar damage
bl	broken leader
br	browse
cl	crooked leader
di	diseased/sick
dl	dead leader
dt	dead top
gr	girdling (est. %)
ml	multiple leaders
ms	multiple stems
ot	other (specify)
re	repressed
ro	rot
ww	weed whack
sw	sweep

Protection Codes

nn	none
ib	intact budcap
db	damaged orpartiallyremoved budcap
ts	intact tubular screen
ds	damaged orpartiallyremoved screen
cw	chicken wire
ps	paint with sand
tp	top paint

Supplies and Equipment List

The following is a complete list of equipment that is used in the SWM VegMon program. Shaded equipment items are needed when first establishing transects at your monitoring site. Different levels or scopes of monitoring are designed to look at different aspects of the restoration project and require different measurement tools. In a later section on monitoring procedures, specific equipment needed for each level of assessment is listed. Most equipment is available on loan from SWM.

Vegetative Monitoring Supplies and Equipment List

(✓ = required item; * = may be required)

Item	Site Ass.	Vigor/Mort.	Mor. Vig.	Line Int.	Samp. Fr.
Site access permission form	*	*	*	*	*
Site & location map	✓	✓	✓	✓	✓
Site specific plant materials list	✓	✓	✓	✓	✓
Monitoring manual	✓	✓	✓	✓	✓
Plant identification book(s)	✓	✓	✓	✓	✓
Monitoring form(s) and pencil	✓	✓	✓	✓	✓
Site information sheet	✓	✓	✓	✓	✓
Site condition & maintenance sheet	✓	✓	✓	✓	✓
Species and damage code sheet	✓	✓	✓	✓	✓
Vegetation monitoring sheet(s)		✓	✓	✓	
Herbaceous stratum data sheet(s)					✓
Weatherproof field notebook	✓	✓	✓	✓	✓
Field first aid kit	✓	✓	✓	✓	✓
Dashboard ID, SWM Monitoring Volunteer	✓	✓	✓	✓	✓
Camera & film	✓	✓	✓	✓	✓
Photo sign board w/marking pens	✓	✓	✓	✓	✓
Plastic bags & permanent marker	✓	✓	✓	✓	✓
Colored flagging tape	✓	✓	✓	✓	✓
2-50 meter tapes		✓	✓	✓	✓
Compass	✓	✓	✓	✓	✓
2-meter measuring rod		✓	✓	✓	
Bamboo stakes		✓	✓	✓	✓
T-posts and driver		*	*	*	*
Rebar & yellow caps		*	*	*	*
Aluminum wire tags		*	*	*	*
Numbered aluminum disc tags & nails		*	*	*	*
Hand Sledge or Hammer		*	*	*	*
Calipers			✓	✓	
Diameter tape (D-tape) (2m)			✓	✓	
Clinometer				✓	
Quadrate sampling frame					✓

Equipment Notes

Make sure all your equipment is in good working condition prior to going into the field.

Plant Etiquette

Salmonberry
Rubus spectabilis
© Marta Morris 2003

Minimum Impact Monitoring

The focus of riparian restoration projects is to restore the damaged system back to a natural and working habitat. In order for these fragile habitats to evolve into a natural system the human impact needs to be minimized, and ideally eliminated. However, we need to monitor these sites to identify maintenance needs and acquire growth measurements. This requires people to walk through restoration sites, causing some disturbance.

As a vegetation monitor, you will walk through the restoration sites to record measurements and set up transects. The following is a list of minimum impact rules you can use to prevent your site from becoming damaged:

Keep group sizes small. Less people keeps the trampling impact at a minimum.

Clean boots before entering a site. Invasive species are successful because their mode of reproduction is extraordinary, don't let any of their seeds travel in the soles of your boots and be deposited in a restoration site.

Carry your garbage out with you. Garbage can pollute and harm the wildlife.

Plant Collection

You might be asked to collect plant specimens that you are unable to identify in the field. Use the following guidelines when choosing whether to collect a plant:

Become familiar with the rare plants in the area. Washington has many plants listed as endangered, threatened, etc. These plants are on the list due to various disturbances, such as human collecting, that the plant wasn't able to compete successfully with. This includes human collecting. If the plant appears on any rare plant list, do not take any part of the plant. A description will work as a substitute for the plant specimen.

Use the 1-in-20 rule. Do not collect a specimen until you find at least 20 plants in the area. This also applies to shrubs and mat-forming plants. Never collect more than five percent of the shrub or plant. Choose specimens that are representative of the general plant size and are in flower and fruiting.

How to collect. Use a trowel or other digging tool to loosen the plant from the soil, being careful to keep the roots attached to the plant as you pull it from the soil. Knock as much soil from the roots as possible. Place the plant in a plastic bag, with collecting number, and put in an ice chest or refrigerator until it can be identified.

Record the following information in your notebook:

- Your name and collection number (also write on collecting bag)
- Date collected
- Location including township, range, section, county, and state with general driving and walking directions
- Habitat information including slope, aspect, elevation, shade, and moisture regime
- Associated species
- Notes on plant size and flower color
- Site information: landowner and restoration project name

Invasive Plant Species

Japanese Knotweed
Polygonum cuspidatum

- Small whitish flowers in drooping clusters from leaf axils; mid or late summer, through the fall
- Leaves are 4”-6” long
- Stems are smooth and hollow, resembling bamboo-like canes; they are jointed and swollen at the nodes
- Herbaceous perennial, strongly rhizomatous, reaching over 12 feet tall; stems die back at first frost
- Once established, forms large rhizomatous mats, making control very difficult; spreads mainly by fragmentation; dominates and out competes riparian vegetation
- Tolerates a variety of adverse conditions including full shade, high temperatures, high salinity, and drought
- Found near water sources, such as along streams and rivers, in low-lying areas, waste places, utility rights-of-way, and around old home sites
- Introduced to the U.S. in the late 1800's as an ornamental and has also been used for erosion control and for landscape screening

Scotch Broom
Cytisus scoparius

- 5-angled stems; yellow pea like flowers in leaf axils; perennial, deciduous shrub; flowers mid-spring
- Black, flattened seed pods that eventually dry and pop open, throwing the seeds; results in an excellent form of reproduction and seed dispersal
- Common along road ways and in disturbed sites
- Introduced in 1850 to Vancouver Island

Himalayan Blackberry
Rubus discolor

- Prefers sunny to partly shady areas with wet to moist soil
- A few inches to several feet high; stems are thick, sprawling canes with piercing thorns
- Leaves are dark green with notched edges
- Flowers are small, white blooms
- New growth spreads rapidly in the spring with sweet-tasting berries ripening late in the summer
- An Asian species introduced from India via England; widely spread in disturbed sites

Reed Canary Grass
Phalaris arundinacea

- Reproduces by long rhizomes
- Identified as a Class C weed on the Washington State Noxious Weed list
- The state Weed Control Board describes it as forming ‘dense, highly productive single species stands that pose a major threat to many wetland ecosystems’
- Grows so vigorously that it is able to inhibit and eliminate competing species.
- Completely overgrows stream channels, resulting in loss of habitat and extreme streambed siltation.

Clinometer

The clinometer is a height measuring instrument of small size and light weight. It is robust and inexpensive. The clinometer has a peep-hole at the rear but none at the front. A weighted wheel within the Sclinometer rotates. When looking through the peephole, a circular field of view of the scales and a horizontal line is seen. Scale readings are taken from the line.

When used correctly, the Suunto Clinometer has an accuracy of about +/- 0.5 m for a 20 m tall tree (ie about 2.5%).

1. Measure the horizontal distance from the base of a vertical tree (or the position directly beneath the tree tip of a leaning tree) to a location where the required point on the tree (e.g. tree tip) can be seen.

2. Sight at the required point on the tree:

    i. Using one eye: Close one eye and simultaneously look through the Suunto at the scale and 'beside' the Suunto at the tree. Judge where the horizontal line on the Suunto scale would cross the tree.

    ii. Both eyes: With one eye looking at the Suunto scale and the other looking at the tree, allow the images to appear to be superimposed on each other and read where the horizontal line on the Suunto scale crosses the tree. Note: If you suffer from astigmatism (a common situation where the eyes are not exactly parallel), use the one eye approach.

3. Read from the percent scale and multiply this percentage by the horizontal distance measured in step 1.

4. Site to the base of the tree and repeat steps 2 – 3

5. Combine the heights from steps 3 and 4 to determine total tree height:

    i. Add the 2 heights together if you looked up to the required point in step 2 and down to the base of the tree in step 6.

    ii. Subtract the height to the base of the tree from the height to the required point if you are on sloping ground and had to look up to **both** the required point and the base of the tree.

6. Check all readings and calculations.

How to Calculate Tree Height

Method 1:
Shoot two angle measurements

1) shoot tree top
2) shoot tree trunk at dbh tape location (4.5’ from ground surface)

Calculation:

[top angle]-[dbh angle] + 4.5’ (for breast height) = tree height

*be sure to note if the shot angle is *negative* or *positive* when calculating.

(pers com. Daniel Jones 2000)

Method 2:
Shoot tree top (tree angle from clinometer)
Measure distance from tree
Measure eye height
Convert eye height (feet/inches) to feet (e.g. 5’2” = 5.16’)
Divide the number of inches by 12 (e.g. 2/12 = 0.16)

Calculation:

$$\frac{\text{Tree angle from clinometer}}{100} * \text{distance measured from tree} = S$$

then

S + eye height feet = Tree height in feet

Example:

$\frac{48°}{100} * 80’ = 38.4’$ and 5’2” = 5.16’ (eye)

then

38.4’ + 5.16’ = 43.56’

(SSC 2000, Suunto precision Instruments)

Ten Thousand Random Digits **(cont.)**

	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90-94	95-99
00	53330	26487	85005	06384	13822	83736	95876	71355	31226	56063
01	96990	62825	97110	73006	32661	63408	03893	10333	41902	69175
02	30385	16588	63609	09132	53081	14478	50813	22887	03746	10289
03	75252	66905	60536	13408	25158	35825	10447	47375	89249	91238
04	52615	66504	78496	90445	84414	31981	88768	49629	15174	99795
05	39992	51082	74547	31022	71980	40900	84729	34286	96944	49502
06	51788	87155	13272	92461	06466	25392	22330	17336	42528	78628
07	88569	35645	50602	94043	35316	66344	78064	89651	89025	12722
08	14513	34794	44976	71244	60548	03041	05300	46389	25340	25804
09	50257	53477	24546	01377	20292	85097	00660	39561	62367	61424
10	35170	69025	46214	27085	83416	48597	19494	49380	28469	77549
11	22225	83437	43912	30337	75784	77689	60425	85588	93438	61343
12	90103	12542	97828	85859	85859	64101	00924	89012	17889	01154
13	68240	89649	85705	18937	30114	89827	89460	01998	81745	31281
14	01589	18335	24024	59498	82052	07868	49486	25155	61730	08946
15	36375	61694	90654	16475	92703	59561	45517	90922	93357	00207
16	11237	60921	51162	74153	94774	84150	39274	10089	45020	09624
17	48867	68353	40567	79819	48551	26789	07281	14669	00576	17435
18	99286	42806	02956	73762	04419	21676	67533	50553	21115	26742
19	44651	48349	13003	39656	99757	74964	00141	21387	66777	68535
20	83251	70164	05732	66842	77717	25305	36218	85600	23736	06629
21	41551	54630	88759	10085	48806	08724	50685	95638	20829	37264
22	68990	51280	51568	73661	21764	71552	69654	17776	51935	53169
23	63393	76820	33106	25322	16783	35630	50938	90047	97577	27693
24	93317	87564	32371	04190	27608	40658	11517	19646	82335	60088
25	48546	41090	69890	58014	04093	39286	12253	55859	83853	15023
26	31435	57566	99741	77250	43165	31150	20735	57406	85891	04806
27	56405	29392	76998	66849	29175	11641	85284	89978	73169	62140
28	70102	50882	85960	85955	03828	69417	55854	63173	60485	00327
29	92746	32004	52242	94763	32955	39848	09724	30029	45196	67606
30	67737	34389	57920	47081	60714	04935	48278	90687	99290	18554
31	35606	76646	14813	51114	52492	46778	08156	22372	59999	43938
32	64836	28649	45759	45788	43183	25275	25300	21548	33941	66314
33	86319	92367	37873	48993	71443	22768	69124	65611	79167	49709
34	90032	32514	24446	60301	31376	13575	99663	81929	39343	17648
35	83752	51966	43895	03129	37539	72989	52393	45542	70344	96712
36	56755	21142	86355	53569	63096	66780	97559	75150	25718	33724
37	14100	28857	60648	86304	97397	97210	74842	87483	51558	52883
38	69227	24872	48057	29318	74385	02097	63266	26950	75175	55025
39	77718	56967	36560	87155	26021	70903	32086	11722	32053	63723
40	09550	38799	88929	80877	87779	99905	17122	25985	16866	76005
41	12404	42453	88609	89148	85892	96045	10310	45021	62023	70061
42	07985	27418	92734	80000	58959	99011	73815	49705	68076	69605
43	58124	55830	08705	20916	46048	30342	86530	72608	93074	80937
44	46173	77223	75661	57691	24055	27568	41227	58542	73196	44886
45	13476	72301	85793	80516	59479	66985	24801	84009	71317	87321
46	82472	98647	17053	94591	36790	42275	51154	77765	01115	09311
47	55370	53433	80653	30739	68821	46854	41939	38962	20703	69424
48	89274	74795	82231	69384	53605	67860	01509	27273	76316	54253
49	55242	74511	62992	17981	17323	79325	35238	21393	13114	70084

Equipment Checklist

The following is a list of equipment needed to perform vegetation monitoring. Snohomish County will provide each item listed below in the monitoring tool kit. Use this list as a check out of equipment received. This form will be used as a check in at the end of the monitoring season.

Check Out:

_____ Monitoring manual
_____ Windshield identification
_____ Plastic bags
_____ Permanent marker
_____ Plant ID book
_____ Flagging tape
_____ First aid kit
_____ Waterproof field notebook
_____ Camera
_____ 50 (2) meter tape
_____ Compass
_____ T-posts
_____ Aluminum tags & nails
_____ Post driver
_____ Hand sledge
_____ Rebar & caps
_____ 2 meter measuring rod
_____ Calipers
_____ Dbh tape
_____ Clinometer
_____ 100 meter tape
_____ Sampling frame: 0.25 m^2
_____ Photo sign board
_____ Bamboo stakes

Site Specific:

_____ Location map
_____ Access permission form
_____ Site planting schedule

Date: _____
Volunteer signature: _____
Coordinator signature: _____

Check In:

_____ Monitoring manual
_____ Windshield identification
_____ Plastic bags
_____ Permanent marker
_____ Plant ID book
_____ Flagging tape
_____ First aid kit
_____ Waterproof field notebook
_____ Camera
_____ 50 (2) meter tape
_____ Compass
_____ T-posts
_____ Aluminum tags & nails
_____ Post driver
_____ Hand sledge
_____ Rebar & caps
_____ 2 meter measuring rod
_____ Calipers
_____ Dbh tape
_____ Clinometer
_____ 100 meter tape
_____ Sampling frame: 0.25 m^2
_____ Photo sign board
_____ Bamboo stakes

Site Specific:

_____ Location map
_____ Access permission form
_____ Site planting schedule

Date: _____
Volunteer signature: _____
Coordinator signature: _____

Glossary

acre: a unit of area equal to 43,560 sq. feet or 0.405 hectares, approximately equal to a square measuring 209 feet on a side

basal area: the cross sectional area of a tree's trunk at breast height; is used as an index of coverage

bearing: direction of travel identified using a compass

biological community: any assemblage of interacting plants and animals which inhabit a given area

biological diversity (biodiversity): the variety of life that occurs at all levels of biological organization – genetic, species, community, and ecosystem

canopy: the uppermost layer of tree leaves in a forest

circumference: the distance around the outer edge of a circle such as a tree trunk

coverage: the proportion of ground covered by a plant species, as viewed from above

density: the number of individual plants per unit area

diameter: the distance across the exact middle of a circle such as a tree trunk

disturbance: a natural or human-induced event that alters an ecosystem and results in the mortality of organisms; examples of natural disturbances include fire caused by lightening, wind, natural flooding, and drought; examples of human-induced disturbances include land clearing, timber harvesting and the introduction of exotic species

ecosystem: the organisms in a biological community and the nonliving environment in which they exist, which function together as a system

foliage: the collective term for the leaves on a plant or group of plants

frequency: the number of times an event occurs in time or space; for example, when analyzing tree monitoring data, frequency would be measured by the percentage of plots in which a species occurs

herbaceous: plants in which the aerial portion is relatively short-lived and the tissues are relatively soft, i.e. non-woody

indicator species: species whose presence in an ecosystem tells us something important about the quality of the habitat

invasive species: species that are currently expanding their range, often as a result of human-induced changes in the environment; invasive species include many on-native and some native species; an aggressive non-native species is particularly harmful to an ecosystem because it displaces significant numbers of native species

monitoring: measuring some aspect of a system in order to detect changes over time

native species: in North America, native species are often considered to be those species which were present in an area before European settlement

non-native (or exotic) species: in North America, non-native species are considered to be those species which were not present in an area before European settlement; non-native species occur in an area as a result of human influence
perimeter: the edge surrounding a given area

plot: an area in which terrestrial monitoring is conducted

quadrat: a square plot

recruitment: the gradual replacement of old trees with new ones

sapling: a young tree; trees > 1 meter tall and less than 10 cm dbh

seedling: small trees < 1 meter tall

shrub: a woody plant that is multiple stemmed at or near the base; seldom attain height greater than 10 feet (~ 3 m)

snag: a dead standing tree

stable: a system that is not likely to change over time as a result of disturbance

succession: a slow, orderly sequence of change in the structure and complexity of an ecosystem, resulting in progressive change in species composition over time

taxon: any unit of classification of a life-form such as family, genus, or species

topographic map: a type of map that shows the physical characteristics of land, particularly the variations in elevation

transect: a straight line through a forest, usually marked with rope so that some measurement may be taken along it

tree: a woody plant which has a single stem or trunk coming out of the ground; grow to a height of at least 12 feet (~3.5 m); branch well above the ground

understory: the plants growing on the forest floor beneath the canopy

vine: a woody plant that wraps around trees or trails along the ground

woody: plants whose stems and roots increase in diameter from year-to-year

Level A Vegetative Monitoring
Site Condition and Maintenance Assessment

Site Name: Hamley Farm **Date of visit:** 7/10/03

Monitoring Team: Tanya W. & Sacha J. **Time Onsite:** 9-1

Part I. Site Condition

Native plant community health.

List the approximate # and/or % of plants by species that are stressed, damaged or dying.

Individual Species	Stressed #	Stressed %	Damaged #	Damaged %	Dead #	Dead %	Suspected Cause
ALRU	3	25	2	20	1	10	ad
RISP					4	50	ww
RUPA	1	10	3	50			br

(Suspected causes: flooding, browsing, beaver or rodent damage, trampling, "weed-whacking", vandalism, etc.)

Plant vigor. Indicate the proportion of plants observed that appear:

Thrive 50 **Alive** 30 **Stressed** 5 **Dead** 15

(Thrive = vigorous growth, new leaders, flowers, developing fruits; Alive = no new growth but plant is green with no apparent signs of damage or stress; Stressed = plant color poor, withering leaves, no flowers/fruits or damage; Dead = no sign of life (scratch bark to check for green cambium layer.)

List plant species that are exhibiting growth by producing new leaders, stems or flowers. POBA, SAXX, LOIN, RISP

Noxious/invasive plants. List any noxious weeds or invasive plant species such as reed canary grass, blackberries, knotweed, etc. and estimate the dimensions of the space covered by the plants. RCG, JKW : 10 x 10 ft for RCG, 20 x 10 ft for JKW

Natural disturbances. Note the location of any significant natural disturbances such as standing water, erosion, plant disease, etc. erosion on left bank at far south end of planting

Human disturbance. Note the location and amount of trampling, trash, vandalism and other forms of human disturbance. none

Overall site evaluation. Summarize the overall plant health and site condition based on the assessment above: Most plants are doing well, ones on the outer edge seem to be getting smoured/ weed wacked by land owner. Plants are getting plenty of water.

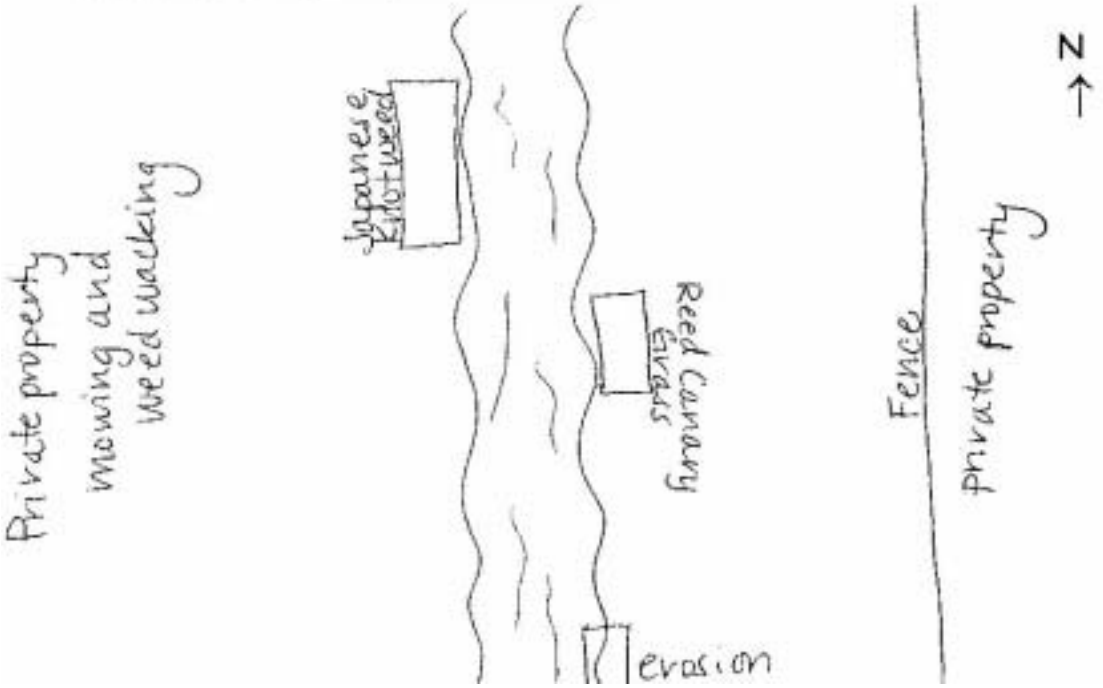
Part II. Maintenance Assessment

Site maintenance priority. Write the code for the specific type of maintenance needed indicating whether the maintenance priority is high, medium, or low. Use the comments section to note any specific details about the needed maintenance.

Maintenance Type	Priority Code	Comments
Mowing	High	for RCG
Mulching	Med	
Invasive weed control	High	RCG, JKW
Watering	Low	
Plant replacement	Low	
Other (specify)		

(High=immediate need, project at risk; Medium=no immediate need, but sometime during current year; Low=some need, but could pass over current season.)

Site Sketch. Use this space to sketch the general location of any unusual plants, plant damage, any concentrations of invasive plants and disturbances. Include any structures, water sources, and any other prominent features.



Level A Vegetative Monitoring
Site Condition and Maintenance Assessment

Site Name: _____ Date of visit: _____

Monitoring Team: _____ Time Onsite: _____

Part I. Site Condition

Native plant community health.

List the approximate # and/or % of plants by species that are stressed, damaged or dying.

Individual Species	Stressed		Damaged		Dead		Suspected Cause
	#	%	#	%	#	%	

(Suspected causes: flooding, browsing, beaver or rodent damage, trampling, "weed-whacking", vandalism, etc.)

Plant vigor. Indicate the proportion of plants observed that appear:

Thrive _____ Alive _____ Stressed _____ Dead _____

(Thrive = vigorous growth, new leaders, flowers, developing fruits; Alive = no new growth but plant is green with no apparent signs of damage or stress; Stressed = plant color poor, withering leaves, no flowers/fruits or damage; Dead = no sign of life (scratch bark to check for green cambium layer.)

List plant species that are exhibiting growth by producing new leaders, stems or flowers. _____

_____

Noxious/invasive plants. List any noxious weeds or invasive plant species such as reed canary grass, blackberries, knotweed, etc. and estimate the dimensions of the space covered by the plants. _____

_____

Natural disturbances. Note the location of any significant natural disturbances such as standing water, erosion, plant disease, etc. _____

_____

Human disturbance. Note the location and amount of trampling, trash, vandalism and other forms of human disturbance. _____

_____

Overall site evaluation. Summarize the overall plant health and site condition based on the assessment above: _____
_____
_____
_____
_____
_____
_____

Part II. Maintenance Assessment

Site maintenance priority. Write the code for the specific type of maintenance needed indicating whether the maintenance priority is high, medium, or low. Use the comments section to note any specific details about the needed maintenance.

Maintenance Type	Priority Code	Comments
Mowing		
Mulching		
Invasive weed control		
Watering		
Plant replacement		
Other (specify)		

(High=immediate need, project at risk; Medium=no immediate need, but sometime during current year; Low=some need, but could pass over current season.)

Site Sketch. Use this space to sketch the general location of any unusual plants, plant damage, any concentrations of invasive plants and disturbances. Include any structures, water sources, and any other prominent features.

Site: **Observer(s):**

Transect ID: **Transect Length:** **Transect Heading:** m / t

		Line Intercept		2M Belt Transect				Vigor Assessment				
								1=thrive, 2=alive, 3=stressed, 4=dead				
	Species	Start	End	Intercept	Diameter	Height	Stem	Class	Dist Livestake	Angl Livestake	Eye Livestake	Damage
	4-letter code	(m)	(m)	(m)	(cm)	(m)	Count	1 thru 4	Y/N	LC	LL	See Code
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												

Site: Hamley Farm Observer(s): Tanya W. & Sacha J.

Transect ID: 1 Transect Length: 25 meters Transect Heading: m / 1

		Line Intercept		2M Belt Transect				Vigor Assessment				
								1=alive, 2=alive, 3=stressed, 4=dead				
	Species	Start	End	Intercept	Diameter	Height	Stem	Class	Livestake Dist	Livestake Angle	Livestake Left	Damage
	4-letter code	(m)	(m)	(m)	(cm)	(m)	Count	1 thru 4	Y/N	LC	LL	See Code
1	ACMA							2				bb
2	ABGR							3				dt
3	TSHE							1				
4	RISA							4				gr(occ.)
5	SPDO							2	Y			
6	RUSP							1				
7												
8	ALRU	5.12			1.8	2.12	1		Y	48	1.8	
9	RISA	6.24			2.1	.85	1					
10	RUPA	8.95			.8	1.44	1					
11	RILA	10.38			1.9	.75	1					
12	OHWA	13.54			—	—	—					
13	COST	15.47			.7	.93	2		Y	35	8	
14	PHCA	17.92			1.5	.79	3					
15												
16	RILA	5.15	6.23									
17	COST	7.54	9.02									
18	PSME	9.54	10.15									
19	RUSA	11.65	12.47									
20	RISA	12.81	13.23									
21	PHCA	16.92	17.33									
22	LOIN	17.94	18.15									
23	OHWM	18.92	20.34									
24	COST	22.51	22.98									
25	PHCA	3.49			.8	.76						
26	RILA	4.32			.9	.42						
27	COST	5.40			.8	.89						
28	ALRU	7.92			1.3	1.21						
29	TSHE	10.45			1.1	.73						
30	ACMA	11.32			.7	1.07						

Mortality Assessment

Vigor and Growth

Vegetation Cover #1

Vegetation Cover #2

Vegetation Monitoring

Herbaceous plant cover

Site:	Date:	Observer(s):
Transect:		

	Plots												
	Species	1	2	3	4	5	6	7	8	9	10	cover1	cover2
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

1=0-5% **2**=5-25% **3**=25-50% **4**=50-75% **5**=75-95% **6**=95-100%

Vegetation Monitoring **Herbaceous plant cover**

Site: Hamley Farm Date: 7/10/03

Observer(s): Tanya W. & Sacha J.

Transect: 3

	Species	5.62 1	10.5 2	15.65 3	20.43 4	5	6	7	8	9	10	cover1	cover2
		Plots											
1	RARE	3											
2	OESA	2											
3	CAOB	1											
4	CAST		2										
5	RARE		2										
6	OESA		1										
7	SCMI			1									
8	OESA			1									
9	RARE			3									
10	RARE				5								
11	CAST				2								
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

1=0-5% 2=5-25% 3=25-50% 4=50-75% 5=75-95% 6=95-100%

LIVEPOST VIGOR
Level III

Location: | **Stock source:** | **Inventory date:**

Planting Date:

Number Planted: | **Stock type:**

Post	Species	Diameter	Height	Condition		Girdle Percent		Leaders		Condition			
		(cm)	(m)	Alive	Dead	Deep	Surface	Number	Length (cm)	Alive	Dead	Damage Comments	

LIVEPOST VIGOR
Level III

Location:	Hamby Farm			Stock source:				Inventory date:	7/10/03				
Planting Date:	1/15/01												
Number Planted:	150			Stock type:	POBA								
Post	Species	Diameter (cm)	Height (m)	Condition Alive	Condition Dead	Girdle Percent Deep	Girdle Percent Surface	Leaders Number	Length (cm)	Condition Alive	Condition Dead	Damage Comments	
10	POBA	18.4	2.09	✓			50	10	15.2	✓			
									20.3	✓			
									17.5	✓			
									25.9	✓			
									10.2		✓		
									26.3	✓			
									25.9	✓			
									12.2	✓			
									28.7	✓			
									27.8	✓			
20	POBA	22.7	2.56	✓		70		18	16.4	✓			
									29.7	✓	✓		
									18.5				
									13.2	✓			
									25.3		✓	beaver damage!!	
									34.6	✓			
									29.7	✓			
									40.8		✓		
									21.7	✓			
									27.2	✓			

Snohomish County Surface Water Management
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