FINAL REPORT:
UNDERSTORY VEGETATION BASELINE MONITORING IN THE CITY OF CORVALLIS ROCK CREEK WATERSHED

submitted to

Trout Mountain Forestry
721 NW 9th Avenue, Suite 228
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Submitted by:

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Introduction

Carex Working Group collaborated with Trout Mountain Forestry to sample forest understory vegetation in the City of Corvallis Forest in the Rock Creek Watershed. The purpose of the project was to provide baseline data on understory vegetation in forested habitats within the Corvallis Forest so that effects of forest management actions on plant diversity, understory structure, and exotic species can be monitored in the future. Information derived from such monitoring will provide the ability to adjust management actions to better attain desired conditions and respond quickly to invasion by exotic species. In addition, upland forest plant association groups and riparian plant communities were mapped to give managers additional guidance on appropriate management actions. The study was designed to gather vegetation data efficiently over a relatively large area to minimize expense and time and allow for rapid assessment in the future.

Vegetation of the Watershed

Douglas fir forest covers a large majority of the land area within the Rock Creek Watershed. A small portion is non-forested: meadows, residences and small areas of remnant native upland prairie. This study was focused entirely on forested habitats.

The watershed is located at the interface between the Willamette Valley and the Coast Range and the plant communities exhibit influences of each of these areas. Willamette Valley plant communities are generally drier than those of the Coast Range, and developed with relatively frequent burning by fires that were intentionally set by Native Americans. The fires that burned in the valley undoubtedly spread into the surrounding foothills including the watershed. As a result, the vegetation of the watershed was probably much more open at the time of Euro-American settlement in the mid-1800s, with more open conifer forests on the moister, northerly and easterly aspects and Oregon white oak woodlands, savannas and prairies on the southerly and westerly aspects.

With settlement, burning by Native Americans ceased and tree species such as Douglas fir and Grand fir were able to survive and spread to drier habitats. Eventually, most of the watershed became forested by conifers, mainly Douglas fir, which overtopped and suppressed oaks and invaded prairies and savannas. A legacy of this history is that there are few large conifer snags and logs in the watershed forest, even in stands classified as old growth. There is also minimal development of vertical structure and canopy layering in old growth and middle aged stands.

Old growth stands in the watershed typically have trees of two age classes – large, widely scattered “superdominants” that predate settlement, and middle aged trees that established

after settlement. The older trees are recognizable not only because they are usually taller than the middle aged trees, but because they retain large branches nearly to the ground, evidence that they established and grew in a much more open stand. Most of these trees also have fire scars and charred bark from the fires that burned through from time to time.

Middle-aged stands are dominated by trees that established since settlement, either following pasture abandonment or early logging. Because they establish somewhat erratically due to varying climate and soil conditions these stands are often not even-aged. In addition to the Old growth and middle-aged stands there are young plantations of Douglas fir in areas that were logged during the last 20 to 55 years.

Riparian areas are forested by a mix of hardwoods such as red alder, bigleaf maple, and Oregon ash, and conifers such as Douglas fir and grand fir. These areas experience more disturbance than upland habitats both from natural stream dynamics (flooding, erosion, deposition) and from human activities associated with watershed management. As a result the overstory is often more patchy and understory vegetation is denser with more exotic species.

Methods

Understory vegetation was measured on 100 temporary plots scattered throughout the watershed. The plots were randomly selected from approximately 400 cruise plot locations from the 2009 forest resources inventory. An effort was made to adequately represent all the forest types that have been mapped in the watershed by Trout Mountain Forestry. The sample plots were laid out on a grid in which each plot is equidistant from each of its neighboring plots. The cruisers flagged their routes between plots and with few exceptions the flagging was still visible in 2010 for locating the plots for vegetation sampling. In the few cases in which the selected plot could not be located either an adjacent plot was used or a plot was established in a location that was assumed to be close to the selected plot location. The vegetation plots were not permanently marked. A map showing the location of the cruise plots is on file with Trout Mountain Forestry. The plots that were selected for sampling of understory vegetation are listed in a separate computer file that is being submitted with this report.

The vegetation plots were 1/50 acre in area (16.7 ft diameter). For each plot we recorded slope and aspect. Vegetation sampled included all species of trees in the intermediate layer and below, and all species of shrubs and herbs. Overstory trees (dominants and codominants) were excluded. For each species we recorded percent cover, form (tree, shrub, herb), and whether the species was native or introduced. Because there can be overlapping layers total percent cover can exceed 100%. Cover amounts of less than 1%

were recorded as “trace”. For the purposes of data entry and analysis a trace of cover was assumed to be 0.1%.

On upland plots, plant association was assigned using the Field Guide to Forested Plant Associations of the Northern Oregon Coast Range (McCain and Diaz 2002). On riparian plots plant community was assigned using the Field Guide to Riparian Plant Communities in Northwestern Oregon.

Plot data were entered into a computer spreadsheet and data summaries were generated for upland vs. riparian plots and for old growth, middle aged, and plantation plots. A list of all vascular plant species encountered on the plots was compiled (Attachment A). An example data sheet is contained in Attachment B. The plot data are being submitted in a separate computer file.

Plant association/community for each plot was mapped onto an aerial photo of the watershed and formed the basis for mapping plant associations for the entire watershed. The plant association/community mapping was ground truthed and the mapping refined accordingly. Detailed mapping was beyond the scope of this project. As a result, large areas of a given plant association/community are likely to contain small areas of other plant associations/communities. Riparian communities were lumped into a single combined mapping unit due to the complex arrangement and small size of the communities. More detailed mapping of plant associations/communities would require a more intensive field inventory.

Results

Species richness and cover data are summarized in Table 1.

Table 1. Average understory plant species richness and percent cover (note: Upland averages include data from Old growth, Middle age and Plantations combined).

Stand Type	Average No. of Species	Average Percent Cover		
		Tree	Shrub	Herb
All plots	19	14.6	35.8	21.4
Riparian	22	30.0	42.4	39.9
Upland	18	11.0	34.3	17.1
Old growth	20	16.5	42.9	19.0
Middle age	21	9.7	26.5	25.3
Plantations	12	7.0	34.2	5.3

Riparian plots average somewhat higher numbers of understory species than upland forest plots. This is likely due to both the higher levels of moisture which allows more species to establish and thrive, and the more active disturbance regime which results in more patchiness and opportunities for early successional species. Understory species richness is relatively constant among the stand types except in plantations where it averages lower than in old growth and middle aged stands. Plantations have dense overstories and relatively depauperate understories due to the lack of light reaching the forest floor, resulting in sparse understory vegetation and low numbers of species.

Riparian plots have higher average cover by trees, shrubs and herbs than upland forest plots, again reflecting the higher moisture and the disturbance regime in the streamside habitats. Old growth stands have higher average cover by trees and shrubs, indicating that these stands are further along the trajectory of developing the more complex structure we would expect to see in an older forest. Middle age stands and plantations both have low cover by understory trees and plantations have very low herb cover due to the dense overstory. Plantations have relatively high cover by shrubs, probably a legacy of the first decade following harvest when shrub species tend to dominate before they are overtopped by the young Douglas fir trees.

In general, forest understories in the watershed are relatively unimpacted by exotic species. Of the 100 plots sampled, 19 plots had exotic plant species. The average cover by exotics on these 19 plots was 1.3%. Table 2 shows a breakdown of the proportion of plots that have exotics by stand type.

Table 2. Proportions of plots with exotic plant species by stand type.

Stand Type	Proportion of plots with exotics
All	19.0%
Riparian	42.1%
Upland	13.6%
Old growth	4.0%
Middle aged	22.6%
Plantation	23.1%

A disproportionately high number of riparian plots have exotic plant species. The natural disturbance regime of the riparian zone combined with the human disturbance related to management of the watershed accounts for the higher occurrence of exotics on these plots. The riparian zone serves as both a habitat for weeds and a transport corridor for weeds to move up and down the watershed. Relatively few upland plots have exotic species.

Only 4% of old growth plots had exotic species – the lowest of any stand type. Middle aged stands and plantations had about the same proportion of plots with exotic species, but the majority of middle aged occurrences (6 of 8 plots with exotics) were in stands that had been used for agriculture before becoming forested, and this disturbance history could account for the higher incidence of exotic species. Plantations were harvested well after settlement and would have been subject to weed invasion for two reasons. First, the disturbance of logging and road building provides habitat and seed sources for exotics. Second, these activities occurred well after the arrival in Oregon of many weedy species including some of our worst invaders such as False Brome (*Brachypodium sylvaticum*) and Armenian blackberry (*Rubus armeniacus*).

Twelve exotic plant species were found on the understory vegetation plots (Table 3).

Table 3. Exotic plant species found on understory vegetation plots (* = particularly invasive in forest understories and/or riparian zones).

Latin Name	Common Name	No. of Plots	Average Cover
Brachypodium sylvaticum*	False brome*	4	0.8%
Cirsium arvense	Canada thistle	2	0.1%
Cirsium vulgare	Bull thistle	3	0.1%
Digitalis purpurea	Foxglove	2	0.6%
Ilex aquifolium	English holly	1	1%
Leucanthemum vulgare	Ox-eye daisy	1	0.1%
Mycelis muralis	Wall lettuce	4	0.3%
Phalaris arundinacea*	Reed canarygrass*	1	0.1%
Poa trivialis ssp. trivialis	Rough bluegrass	3	0.1%
Prunus avium*	Sweet cherry*	2	3%
Rubus armeniacus*	Armenian blackberry*	4	3%
Senecio jacobaea	Tansy ragwort	1	0.1%

Four of these species are particularly aggressive weeds of forest understories and riparian zones: False brome, Reed canarygrass, Sweet cherry, and Armenian blackberry all have the ability to dominate plant communities and exclude native species.

Eleven upland plant associations were mapped in the project area (Table 4; Attachment C). Plant associations in the Grand Fir series cover the majority of upland forest areas. In addition plant associations in the Western Hemlock and Douglas Fir series were mapped. Plant associations express a moisture/temperature gradient with Douglas Fir and Oregon

White Oak associations occurring on the driest sites at low elevations and Western Hemlock associations occurring on moist sites on northerly aspects and at the highest elevations in the watershed. Grand Fir associations occur on mesic sites throughout the watershed. Along the entrance road in the eastern part of the watershed, the presence of Oregon White Oak places this area into an Oak plant association that has not been defined by the Forest Service. Grand Fir associations interfinger into this area and it was mapped as a combined association without attempting to separate the two types.

Table 4. Upland plant associations.

Plant Association	Map Code	Location/notes
PSME/MANE2 Douglas Fir-Cascade Oregon Grape	PM	Hot, dry, southerly aspect in the isolated parcel on upper Griffith Creek.
PSME/MANE2-GASH Douglas Fir-Cascade Oregon Grape-Salal	PMG	Hot, dry, southerly aspect in the isolated parcel on upper Griffith Creek.
ABGR/HODI/POMU - OAK Grand Fir/Oceanspray/Sword Fern	AHP/OAK	Lowest elevations along the entry road. Oak is an undefined plant association occurring on low elevation sites in and at the edges of the Willamette Valley. This mapping unit is a combination of the two plant associations.
ABGR/HODI/POMU Grand Fir/Oceanspray/Sword Fern	AHP	Mostly on dry, warm, southerly aspects in the northern portion of the watershed
ABGR/COCO6/VAHE Grand Fir/California Hazel/Inside-out Flower	ACV	On dry, warm, southerly aspects in the northern portion of the watershed and at the far eastern end near Highway 34.
ABGR/MANE2-GASH Grand Fir/Cascade Oregon Grape-Salal	AMG	Widespread on dry to mesic sites throughout the watershed.
ABGR/ACCI/POMU Grand Fir/Vine Maple/Sword Fern	AAP	Mesic to moist sites adjacent to riparian areas and scattered elsewhere. More common in the southern half of the watershed.
TSHE/ACCI-GASH/POMU Western Hemlock/Vine Maple-Salal/Sword Fern	TAGP	Dry-mesic sites at higher elevations in isolated parcel on upper Griffith Creek.
TSHE/MANE2-GASH Western Hemlock/Cascade Oregon Grape-Salal	TMG	Mesic sites on northerly aspects in upper Rock Creek area.

TSHE/MANE2/POMU Western Hemlock/Cascade Oregon Grape/Sword Fern	TMP	Dry-mesic sites at higher elevations in isolated parcel on upper Griffith Creek.
TSHE/ACCI/POMU Western Hemlock/ Vine Maple /Sword Fern	TAP	Mesic sites on northerly aspects at higher elevations in isolated parcel on upper Griffith Creek.

Riparian plant communities occur in narrow corridors along the major streams in the watershed (Attachment C). The area in which true riparian vegetation occurs is narrower than the mapped riparian stand type. Both natural and human-caused disturbances have fragmented and interfingered the different riparian communities with each other and with upland plant associations. Due to this complexity it was not feasible to map each community individually. Instead, riparian communities were lumped together into a single riparian vegetation map type. Four riparian plant communities were identified in the watershed (Table 5). In addition, the ABGR/ACCI/POMU (Grand Fir/Vine Maple/Sword Fern) upland plant association occurs commonly in riparian corridors.

Table 5. Riparian plant communities.

Plant Association	Map Code	Notes
COCO6-ACCI/OXALI California Hazel-Vine Maple/Sorrel	CAO	Occurs in drier parts of the riparian zone. Overstory mostly Bigleaf Maple, mixed with Red Alder and Douglas Fir.
RUSP-ACCI Salmonberry-Vine Maple	RA	Occurs in riparian-upland transition zone mixed with Salmonberry/Sword Fern community and Grand Fir/Vine Maple/Sword Fern plant association.
RUSP/POMU Salmonberry/Sword Fern	RP	Occurs in riparian-upland transition zone mixed with Salmonberry-Vine Maple community and Grand Fir/Vine Maple/Sword Fern plant association.
RUSP/TOME-OXALI group Salmonberry/Piggyback Plant-Sorrel group	RTO	On active flood plains, streambanks and low terraces, usually with an overstory of Red Alder.

Conclusion

The results of this study indicate that the forest understory vegetation in the Rock Creek Watershed is in excellent condition with minimal occurrence of exotic species on the sampled plots in upland forest areas. Riparian plots have a higher incidence of exotic species but cover by these species is still quite low.

These data provide a baseline snapshot of current understory conditions to which future conditions can be compared. This will allow assessment of the success of efforts to accelerate development of late successional conditions and enhance biodiversity. This, in turn, will provide guidance on adjusting management regimes to achieve desired conditions and to respond to ongoing threats from invasive species. For consistency, future forest resource inventories should include sampling of understory plants using methods similar to those of this survey.

Literature Cited

McCain, C. and N. Diaz. 2002. Field guide to the forested plant associations of the northern Oregon Coast Range. USDA-Forest Service, Pacific Northwest Region, Technical Paper R6-NR-ECOL-TP-03-02.

McCain, C. and J.A. Christy. 2005. Field guide to riparian plant communities in northwestern Oregon. USDA-Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-01-05.

Attachments:

A. Vascular plant species list
B. Data sheet
C. Plant association map

ATTACHMENT A

Vascular Plant List for Rock Creek Watershed

Plant Species Occurring on Understory Vegetation Plots
Sampled in 2010

Total number of species: 139
Native species: 127 (91%)
Exotic Species: 12 (9%)

Key: T = Tree, S = Shrub, H = Herb; N = Native; E = Exotic

Form	N/I	Latin name	Common name
T	N	Abies grandis	Grand fir
T	N	Abies procera	Noble fir
S	N	Acer circinatum	Vine maple
T	N	Acer macrophyllum	Bigleaf maple
H	N	Achlys triphylla	Vanilla leaf
H	N	Actaea rubra	Western red baneberry
H	N	Adenocaulon bicolor	Trailplant
H	N	Adiantum aleuticum	Western maidenhair fern
T	N	Alnus rubra	Red alder
S	N	Amelanchier alnifolia ssp. semiintegrifolia	Pacific serviceberry
H	N	Anaphalis margaritacea	Pearly everlasting
H	N	Anemone deltoidea	Threeleaf anemone
H	N	Anisocarpus madioides	Woodland tarweed
H	N	Aquilegia formosa	Red columbine
T	N	Arbutus menziesii	Pacific madrone
H	N	Asarum caudatum	Western wild ginger
H	N	Athyrium filix-femina var. cyclosorum	Northwestern lady fern
H	N	Blechnum spicant	Deer fern
H	E	Brachypodium sylvaticum	False brome
H	N	Bromus vulgaris	Columbia brome
T	N	Calocedrus decurrens	Incense cedar
H	N	Calypso bulbosa var. occidentalis	Fairy slipper orchid
H	N	Camassia quamash ssp. maxima	Great camas
H	N	Campanula scouleri	Scouler's campanula
H	N	Cardamine angulata	Angled bittercress
H	N	Cardamine nuttallii var. nuttallii	Spring beauty
H	N	Carex hendersonii	Henderson's sedge
H	N	Carex leptopoda	Slender-foot sedge
S	N	Ceanothus sanguineus	Redstem ceanothus
H	N	Chimaphila menziesii	Little prince's pine
T	N	Chrysolepis chrysophylla var. chrysophylla	Golden chinquapin
H	N	Circaea alpina ssp. pacifica	Enchanter's nightshade

H	E	Cirsium arvense	Canada thistle
H	E	Cirsium vulgare	Bull thistle
H	N	Claytonia siberica	Candyflower
H	N	Collomia heterophylla	Varied leaf collomia
H	N	Corallorhiza maculata	Spotted coralroot
T	N	Cornus nuttallii	Pacific dogwood
S	N	Corylus cornuta ssp. californica	California hazel
H	N	Cynoglossum grande	Pacific hound's tongue
H	N	Delphinium trolliifolium	Poison larkspur
H	N	Dicentra formosa ssp. formosa	Bleedingheart
H	E	Digitalis purpurea	Foxglove
H	N	Elymus glaucus ssp. glaucus	Blue wildrye
H	N	Equisetum arvense	Common horsetail
H	N	Equisetum telmateia var. braunii	Giant horsetail
H	N	Erythronium oregonum	Oregon fawnlily
H	N	Eurybia radulina	Rough-leaved aster
H	N	Festuca occidentalis	Western fescue
H	N	Festuca subulata	Bearded fescue
H	N	Festuca subuliflora	Crinkle-awn fescue
H	N	Fragaria vesca ssp. bracteata	Woodland strawberry
T	N	Fraxinus latifolia	Oregon ash
H	N	Galium aparine	Cleavers
H	N	Galium triflorum	Fragrant bedstraw
S	N	Gaultheria shallon	Salal
H	N	Glyceria sp.	Mannagrass
H	N	Goodyera oblongifolia	Western rattlesnake plantain
H	N	Heracleum lanatum	Cow parsnip
H	N	Hieracium albiflorum	White flowered hawkweed
S	N	Holodiscus discolor var. discolor	Ocean spray
H	N	Hydrophyllum tenuipes	Pacific waterleaf
T	E	Ilex aquifolium	English holly
H	N	Iris tenax var. tenax	Oregon iris
H	E	Leucanthemum vulgare	Ox-eye daisy
H	N	Ligusticum apiifolium	Celery leaved lovage
H	N	Lilium columbianum	Columbia lily
H	N	Linnaea borealis var. longiflora	Western twinflower
H	N	Listera cordata	Heartleaf twayblade
S	N	Lonicera ciliosa	Orange honeysuckle
S	N	Lonicera hispidula var. hispidula	Hairy honeysuckle
H	N	Lotus sp.	Deervetch
H	N	Luzula comosa var. laxa	Wood rush
S	N	Mahonia aquifolium	Tall Oregon grape
S	N	Mahonia nervosa	Cascade Oregon grape
H	N	Maianthemum dilatatum	Beadruby
H	N	Maianthemum racemosum ssp.	Large false solomon's

		amplexicaule	seal
H	N	Maianthemum stellatum	Starry false solomon's seal
H	N	Melica subulata	Alaska onion grass
H	N	Mertensia platyphylla	Western bluebells
H	N	Mimulus guttatus	Common monkeyflower
H	N	Mitella caulescens	Leafy mitrewort
H	N	Moehringia macrophylla	Bigleaf sandwort
H	N	Montia parvifolia	Littleleaf miner's lettuce
H	E	Mycelis muralis	Wall lettuce
H	N	Nemophila parviflora var. parviflora	Small flowered nemophila
S	N	Oemleria cerasiformis	Osoberry
H	N	Oenanthe sarmentosa	Pacific water parsley
H	N	Osmorhiza berteroi	Mountain sweet cicely
H	N	Oxalis oregana	Oregon wood sorrel
H	N	Petasites frigidus var. palmatus	Western coltsfoot
H	E	Phalaris arundinacea	Reed canarygrass
H	E	Poa trivialis ssp. trivialis	Rough bluegrass
H	N	Polypodium glycyrrhiza	Licorice fern
H	N	Polystichum munitum	Western sword fern
H	N	Prosartes smithii	Fairy lanterns
T	E	Prunus avium	Sweet cherry
T	N	Pseudotsuga menziesii var. menziesii	Douglas-fir
H	N	Pteridium aquilinum var. pubescens	Bracken fern
H	N	Pyrola picta	White vein pyrola
T	N	Quercus garryana var. garryana	Oregon white oak
H	N	Ranunculus occidentalis	Western buttercup
H	N	Ranunculus uncinatus	Little buttercup
S	N	Rhamnus purshiana	Cascara
S	N	Ribes divaricatum var. divaricatum	Straggly gooseberry
S	N	Rosa gymnocarpa	Baldhip rose
S	E	Rubus armeniacus	Armenian blackberry
S	N	Rubus parviflorus	Thimbleberry
S	N	Rubus spectabilis	Salmonberry
H	N	Rubus ursinus	Pacific dewberry
T	N	Salix scouleriana	Scouler's willow
H	N	Sanicula crassicaulis	Pacific snakeroot
H	N	Satureja douglasii	Yerba buena
H	N	Scirpus microcarpus	Small fruited bulrush
H	N	Scoliopus hallii	Fetid adder's tongue
H	E	Senecio jacobaea	Tansy ragwort
H	N	Stachys cooleyae	Cooley's hedgenettle
H	N	Stachys sp.	Hedgenettle
H	N	Stellaria crispa	Crisped starwort
H	N	Streptopus amplexifolius	Twistedstalk
S	N	Symphoricarpos albus var. laevigatus	Common snowberry

H	N	Synthyris reniformis	Snow queen
T	N	Taxus brevifolia	Pacific yew
H	N	Tellima grandiflora	Fringecup
H	N	Thalictrum occidentale	Western meadowrue
T	N	Thuja plicata	Western red cedar
H	N	Tolmiea menziesii	Piggyback plant
S	N	Toxicodendron diversilobum	Poison oak
H	N	Trientalis latifolia	Western starflower
H	N	Trillium albidum	Sessile trillium
H	N	Trillium ovatum ssp. ovatum	Western trillium
H	N	Trisetum cernuum	Nodding trisetum
T	N	Tsuga heterophylla	Western hemlock
S	N	Vaccinium parvifolium	Red huckleberry
H	N	Vancouveria hexandra	Inside-out flower
H	N	Vicia americana var. americana	American vetch
H	N	Viola glabella	Stream violet
H	N	Viola sempervirens	Evergreen violet
H	N	Xerophyllum tenax	Beargrass

ATTACHMENT B

Corvallis Watershed 2010 Understory Vegetation Project
Field Data Sheet

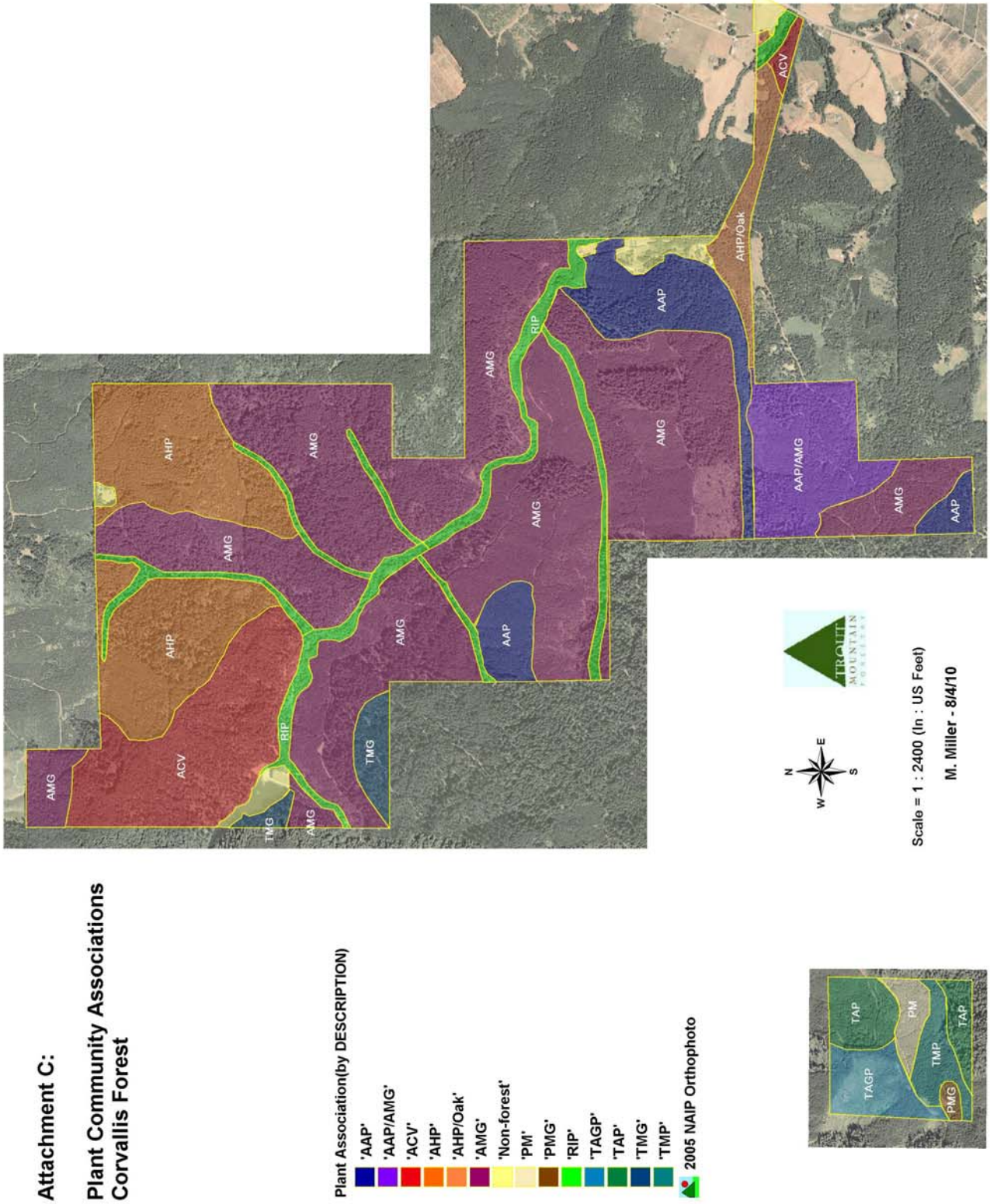
Personnel_____ Date_____

Stand_____ Plot_____ Slope_____ Aspect_____

Plant Association/Plant Community_____

Vegetation Cover

Species	Form	% Cover	Species	Form	% Cover


Attachment C:
Plant Community Associations
Corvallis Forest
Plant Association(by DESCRIPTION)
'AAP'
'AAP/AMG'
'ACV'
'AHP'
'AHP/Oak'
'AMG'
'Non-forest'
'PM'
'PMG'
'RIP'
'TAGP'
'TAP'
'TMG'
'TMP'
2005 NAIP Orthophoto
AMG
ACV
AHP
RIP
TMG
AAP
AHP/Oak
AAP/AMG
N
W
E
S
TROUT MOUNTAIN
Scale = 1 : 2400 (In : US Feet)
M. Miller - 8/4/10
TAP
TAGP
PM
TMP
PMG