APPENDIX H:

Botanical Resources

POTENTIAL SENSITIVE PLANT HABITATS

The Regional Forester designates a list of species for which they and their habitat is managed by the Region's Sensitive Species Program in order to prevent a need for federal listing at a future date. Sensitive species are those that are vulnerable due to low population levels or have significant threats to their habitat (USFS, R-6 FSM). Known population locations are on the Oakridge GIS system and population information is contained in an associated advanced revelation (ADREV) database. Sensitive plant surveys which are done in the watershed are generally associated with proposed management activities (timber sales and other projects).

Two plants on the sensitive list have documented populations within the watershed. These two sensitive plants are found in non-forested meadow and meadow edge habitats.

Mesic to dry meadow openings in mid-elevation Abies dominated forests are prime habitat for the Umpqua swertia (Frasera umpquaensis). This sensitive species is federally listed by the USFWS as a Candidate 2 species for which further information is necessary to be able to propose the plant as Threatened or Endangered. It is an ODA protected Candidate List 1 Endangered species, for which any native plant is determined to be in danger of extinction throughout all or any significant portion of its range or those listed as Endangered on the federal list. It is also a Natural Oregon Heritage Database (ONHDB) List 1 species, Threatened or Endangered throughout its range (ONHP, 1993).

The northern most populations of this species are found on Sourgrass Mountain (OA/LO), Elk Camp Meadows (managed by the Oakridge District), and Nevergo Creek (LO) which border the Lowell and Oakridge Ranger Districts. These populations were designated for monitoring (beginning spring of 1991) in the monitoring plan for the Conservation Strategy. These populations were placed in categories designated as "selected" or "non-selected" for placement of monitoring plots to determine population trends over time. The Nevergo and Elk Camp populations are designated as selected (thought to be critical to maintain viable, genetically stable populations over time throughout the species range). No human-caused impacts such as logging, trail-building, etc., will occur within these sites. The Sourgrass population (managed by the Lowell District) is designated as non-selected (deemed not to be critical for species viability). Non-selected sites are chosen where current impacts are occurring or where future ground disturbing management activities may take place.

Thompson's mistmaiden (Romazoffia thompsonii) is found in full sun in seepy rock outcrop habitats on south-facing open meadow slopes. Soil development is minimal; the substrate consists of gravel/rock, usually associated with small soil pockets and moss (Bryum miniatum) mats. This plant is dependent upon the hydraulic regime and blooms during the seasonal flow (May-June). Thompson's mistmaiden is a Central Oregon Cascades endemic, with populations documented on all 7 WNF Ranger Districts. Two main populations are located within the watershed. Thompson's mistmaiden is a USFWS Candidate 3 species (no longer being considered for listing as Threatened or Endangered), and a ONHBDB List 1 species (ONHP, 1993). Habitat where this species is found in the watershed is not generally threatened by ground disturbing activities as it is non-forested. However, one population which consists of three subpopulation sites, has two sites that are located in meadow openings directly below an active timber sale (Tiny Creek) road. These sites had not been surveyed for sensitive plants before the road was built in. These populations are currently being monitored (every two years) to document population trends over time which may potentially have been influenced by hydrological changes resulting from road construction. Additional habitat for Thompson's mistmaiden exists in the watershed that has not yet been surveyed.

Many plant species are known to be "fire-followers" as evidenced by documentation of occurrence after fire events, however, much is not yet known about the maintenance of plant/animal/fire evolutional relationships. A current sensitive plant species, the Woodland milkvetch (Astragalus Umbraticus), and a former sensitive species, branching montia (Montia diffusa), are fire followers as well as being responsive to other disturbances which create openings, such as logging. The woodland milkvetch has recently been documented in the Warner Creek Fire area in the Salt Creek Drainage (Dimling/McMahan, 1993), and is the northernmost documented range for this species. It prefers open canopies, and was noted to follow moderate intensity burn patches for the Warner populations (Dimling/McMahan, 1993). Branching montia was discovered growing very profusely after the Shady Beach fire on the Rigdon District in 1988 in plant succession ecology plots. Branching montia was also found in the Baby Rock fire area on the Oakridge District (McCabe, 1993). This pattern of occurrence influenced the downlisting of the species from sensitive to a forest Watch List species. It is likely the woodland milkvetch could follow suite and eventually be dropped off the forest sensitive list in view of recently documented occurrences. The woodland milkvetch and the branching montia could potentially occur in the watershed.

Sensitive Plants In The North Fork Middle Fork Watershed:

Species	Sitename	Subpops	Impacts
Frasera umpquaensis	Elk Camp	2	None
Romanzoffia thompsonii	Tiny Creek	4	Hydrological changes from road construction above subpopulation
Romanzoffia thompsonii	Alpine Trail	1	Trampling from trail use

The following table lists habitat in the watershed where sensitive plants may potentially be found.

Potential Habitat In The Watershed For Sensitive Plants:

Habitat	Species
Mesic meadows	Calamagrostis breweri Frasera umpquaensis Gentiana newberryi Sisyrinchium sarmentosum
Wet meadows/Bogs	Carex livida Lycopodiella inudata Ophioglossum pusillum Scheuchzeria palustris
Ponds	Utricularia minor Wolffia columbiana
Riparian	Calamagrostis breweri Huperzia occidentalis Cimicifuga elata Sisyrichium sarmentosum
Moist woods	Botrychium minganense Botrychium monatum Cimicifuga elata Huperzia occidentalis

Dry meadows/Open woods	Agoseris elata Astragalus umbraticus Frasera umpquaensis Hiercacium bolanderi
Rocky outcrops/Cliff crevices	Asplenium septentrionale Pellaea andromedaefolia Polystichum californica
Rocky slopes/Scree	Arnica viscosa Aster gormanii Romanzoffia thompsonii

(Note: under the currently proposed NFMA rule, 25 of the 28 sensitive species, including Thompson's mistmaiden would be dropped from the Willamette NF Sensitive Species list.)

RARE AND UNIQUE PLANTS

Sensitive and other rare plants, including survey and manage species, whether they are occurring at the edge of their range, disjunct, regional endemics and/or those found only in unique habitats are important contributors to the overall diversity of landscapes; some may be genetically diverse (adapted to marginal conditions), and therefore necessary genotypes to maintain the species in the advent of environmental change. It is crucial to prevent the need to list these species by accounting for them in appropriate management actions.

Additional rare plant species of concern occur in the watershed, of which some, like most sensitive plants, are found within non-forested special habitats. Others occur in forested habitats. Six species that are listed on the WNF Watch and Concern Lists are located within the watershed. These species are usually located and tracked along with sensitive plant inventories and other botanical inventories conducted in Wilderness, Special Interest Areas, and other non-timber allocation areas.

Rare And Unique Plants In The NFMF Watershed:

Watch List Species:	**Occurrence**
Erigeron cascadensis	Huckleberry Mountain (ONHP list 4)
Sidalcea cusickii	Box Canyon (ONHP list 4, OA/BR border) Major Prairie
Species Of Special Concern:	
Orobanche pinorum	coniferous woods,
Isoates sp.	Torrey Mire, Skookum Lake, Waldo Lake
Pleuricospora fimbriolata	coniferous woods, numerous sightings
Woodwardia fimbriata	road 1912

The Cascade daisy (Erigeron cascadensis) inhabits rock outcrops in high subalpine mountain peaks and is confined to bedrock and scree microsites. Cusick's checker-mallow (Sidalcea cusickii) is a bright pink checkermallow which inhabits moist meadows. The distribution of this species is patchy across the forest. The pine broomrape (O. pinorum) is found in forested habitat. This species is mycotrophic and lacks chlorophyll, receiving nutrients from the host species, most often ocean spray. The plant is found in dry coniferous woods. Plants haven't been found in clear cuts areas, where the host has been destroyed (MF WA, 1995). Populations are sprinkled as far north as the Gifford Pinchot NF in southern Washington. Quillworts (Isoates

spp.) are aquatic to terrestrial spore-bearing plants, found on wet ground to wholly submerged in deep water. Fringed-pinesap (Pleuricospora fimbriolata) is another non-green species found in the duff of old-growth forests. The giant chainfern (Woodwardia fimbriata) is found along stream banks and wet places from lowlands to midmontane elevations in the understory of coniferous woods. The southern end of the Willamette NF seems to be the northernmost part of this species range.

SURVEY AND MANAGE SPECIES: FUNGI, BRYOPHYTES, LICHENS, & VASCULAR PLANTS

The ROD for the Management of Habitat for Late-Successional and Old-growth Forest Related Species within the Range of the Northern Spotted Owl (USDA and USDI, 1994) contains management direction and standards and guideline provisions for survey and manage plant and animal species generally associated with late-successional and/or riparian forests (Table C-3 list in the ROD). Ecological goals of the S&G's is to maintain late-successional and old-growth habitat and ecosystems on federal lands and to maintain biological diversity associated with native species and ecosystems in accordance with laws and regulations. Late succesional species habitat in the watershed has declined due to extensive harvest of old-growth stands and associated road building. The remaining old-growth in the watershed is concentrated at higher elevations and, in some areas, is highly fragmented. Many survey and manage species have limited dispersal capabilities, thus in fragmented habitat areas geneflow may be restricted between populations. Single species planting after harvest in riparian forests along with adjacent upland stands has contributed to a simplification of species richness in plant communities.

Survey and manage species have not yet been systematically been inventoried in Region 6. The Regional Ecosystem Office (REO) is due to release C-3 species location information in June 1995 and survey protocols in 1996. Existing biological and ecological information is minimal for most of these species. However, it is reasonable to assume that if systematic surveys were conducted for old-growth dependent species a much larger number would be found in the watershed.

Survey and Manage measures from the ROD (1994) which apply forestwide, regardless of allocation, are as follows:

Survey strategy 1: manage known sites

- Provisions must be made for these sites for activities implemented in 1995 and later. Survey strategies 1 and 2 are the responsibility of the National Forests.

Survey strategy 2: survey prior to activities and manage sites

- For these species, activities implemented in 1999 or later must have completed surveys.

Survey strategy 3: conduct extensive surveys to find high priority sites for species management

Survey strategy 4: conduct general regional surveys

- Survey strategies 3 and 4 are more general and must be underway by 1996. These strategies are to be conducted at the regional level. Each species was rated during the analysis for the EIS and is designated certain survey strategy(ies) to follow, depending on the rarity of the species, potential threats, and numerous other factors.

Survey And Manage Species Occurring In The Watershed:

Species	Survey Strategy	Status
Vascular plants:		
Allotropa virgata	1,2	Numerous sites
Arceuthobium tsugense	1,2	
Nitrogen fixing lichens:		
Lobaria oregana	4	Districtwide
Lobaria pulmonaria	4	Districtwide
Rare nitrogen fixing lichen:		
Lobaria halli	1,3	1 site on the North Fork
Aquatic lichen:		
Hydrothyria venosa	1,2	2 sites
Semi-aquatic liverwort:		
Marsupella emarginata var. aquatica	1,2	1 documented site Waldo Lake outlet
False Truffles:		
Rhizopogon abietis	3	Waldo Wilderness
R. truncatus	3	
Rare false truffle:		
Rhizopogon evadens var. subalpinus	1,3	Waldo Wilderness
Mushrooms:		
Cantharellus cibarius	3,4	second growth stands
C.subalbidus	3,4	upper elevation areas

Discussion of groups: The following biological and ecological information regarding survey and manage species is taken from the ROD, 1994; FSEIS, USDA, USDI, 1994; FEMAT, 1993.

Fungi-

Fungi have critical roles in forested systems, contributing to nutrient cycling and changes in structural and species diversity, which in turn provides habitat for other plant and animal organisms. Mycorrhizal fungi play an important role in transferring nutrients to vascular plants. Fungal fruiting bodies, mushrooms, conks and truffles, are an important food source to small mammals; some are important for their food or medicinal value in the special forest products industry. The rare false truffle, Rhizopogon evadens var. subalpinus, is found in the Waldo Lake Wilderness in mid-upper elevations near the timberline, and is ectomycorrhizal with mountain hemlock, fir and pine species. It is disjunct from Mt. Rainier to N. California. The two False truffles, R. abietis and R. truncatus, both are found in mixed conifer stands, in relatively high elevations, in moderately dry sites, associated with Doug fir, pine, true fir, and mountain hemlock. R. abietis ranges from Oregon to California in the Cascades. R. truncatus ranges from Oregon to Washington in the Cascades. The Waldo Wilderness and Torrey-Charlton RNA areas are good examples of the fungal diversity and richness in the watershed. Chantrelles (C. cibarius and C. subalbidus are both sought after as choice edibles. Golden chantrelles are not uncommon in second growth Douglas-fir stands. A mushroom study is currently underway in the FlatWalk Young Stand Study Project on Christy Flats for C. cibarius.

Bryophytes, Hornworts, Liverworts & Mosses-

Bryophytes, the hornworts, liverworts and mosses are small, non-green, non-vascular spore-bearing plants of highly diverse habitats from deserts to coastal shores. Like many late-successional dependent species, most bryophytes do not become established until at least 100 years, becoming well developed in much older stands (400 years) and in riparian areas on hardwoods. Like lichens, they are important to nutrient cycling, accumulate air pollutants, contribute to soil structure and stability, and are food and habitat for vertebrates and invertebrates. The traditional harvest of mosses and liverworts for floral arrangement material is a serious concern for long-term sustainability of bryophyte species and their connection to ecological processes.

The rare semi-aquatic leafy liverwort, Marsupella emarginata var. aquatica, grows on rocks in the splash zone of the Waldo Lake outlet. This is the only documented occurrence in Western North America.

Lichens-

Lichens occur on many kinds of specific substrates and habitats, either growing on trees as draping or matting epiphytes, imbedded into rocks, on exposed soil in a leaf-like form, in stream splash zones, or on decaying wood. Many lichens are critical for nitrogen-fixation, some are used for air-quality biomonitors. Many lichens are important forage, nesting material and camouflage for birds and mammals, and habitat and food for invertabrates. Forest development causes a succession of lichen species, which can grow slowly over time compared to other organisms. Late-successional lichens become established with increasing successional stabilization, which may take over 200 years, some old-growth dependent species do not become established until 500 years or so, when the ecological continuity of mature tress enable them to persist. As most lichens use vegetative propagules rather than spores as a means of dispersal, their dispersal range is relatively short. They have long been harvested as SFPs for medicinal, floral, and dye-making uses.

Lobaria pulmonaria and L.. oregana are found forest-wide in old-growth stands. L. halli, a rare nitrogen-fixing lichen is documented to occur at one site along the North Fork corridor. This species is found in riparian areas and wetlands, growing most abundantly on large diameter hard woods. It ranges from north Alaska to central coastal California. Hydrothyria venosa is an aquatic lichen found on rocks in streams, where it provides habitat for aquatic invertabrates. This species does not survive desiccation and is very sensitive to water siltation and flow fluctuation; appearing more sensitive than salmon to stream sedimentation and is therefore a valuable indicator of water quality. Two sites in the North Fork corridor are listed in the database.

Vascular Plants

Two plants, Candystick (Allotropa virgata) and Hemlock dwarf mistletoe (Arceuthobium tsugense occur in the North Fork watershed. Candystick grows in deep humus, in association with coarse woody debris, in dry, well-drained soils, primarily in old-growth Douglas-fir forests in the North Fork, though this species is also found in pole and mature stands. It is a non-green mycotrophic plant that may not flower or emerge from the soil every year, instead lying dormant underground. Fire suppression, fragmentation of habitat, and reduction of large decaying logs are contributing factors to declining occurrences of this species. Candystick is slow to establish and its minute seeds have a short survival span. It does not tolerate competition well and is never abundant. Repeated thinning and shorter rotations are considered detrimental, resulting in increased competition, reduced coarse woody debris, and mechanical disturbance to the ground.

Hemlock dwarf mistletoe is parasitic on Western and Mountain hemlock. It is not uncommon in the watershed. A recommendation to the REO has been made to drop this species from the survey and manage status or change its survey strategy from 1 and 2 to 4. A decision has not yet been made as to the status of this species.

The historic representation of the pattern of the watershed landscape fire history (Chapter I, Figure 2) suggests that the western half developed into larger old-growth tracts of forest with patchy fire occurrences prior to extensive logging and fire suppression, during which time longer intervals occurred between large scale fire events. Species diversity and richness in old-growth dependent and riparian-dependent communities would have had more time to develop before increases in early seral stages were brought about by extensive timber harvesting. The eastern half of the watershed displayed a higher frequency of stand replacing fires, leaving residual patches of old-growth in a more isolated pattern, thereby leaving old-growth associated species relegated to riparian areas and refugia such as basins, valley bottoms and ridgeline breaks where a higher level of downed woody debris and snag development remained.

Marsupella emarginata var. aquatica is restricted to a wet environment in the stream channel of the Waldo Lake outlet. The current channel is not the original location of the outlet, which was modified prior to the 1930's. It is not recorded exactly where Marsupella existed prior to the stream course construction and to what extent populations reached downstream. No surveys have as yet been conducted in the watershed for this species or for other survey and manage species.

NOXIOUS WEEDS AND OTHER NON-NATIVE INVASIVE PLANT SPECIES

Non-native plant species play a significant role in influencing changes to native plant communities. Many noxious weed species and other non-native invasive plants are found in the watershed. Many of these species are firmly established and have been for some time now, and some are currently increasing in their rate of spread largely due to logging and road building practices over the long term assisting in the establishment of dispersal pathways and mechanisms.

Those non-native plant species legally designated as noxious, mean "any weed designated by the Oregon State Weed Board that is injurious to public health, agriculture, recreation, wildlife, or any public or private property" (ODA Noxious Weed Policy and Classification System, 1995). Several detrimental effects are included as the basis for criteria for rating and classifying weeds as noxious, one being "a plant species that is or has the potential of endangering native flora and fauna by its encroachment in forest and conservation areas" (ODA, 1995). Most northwest weeds are originally native to Europe or Asia and were introduced intentionally or by accident. Noxious weeds and other invasive non-natives have the potential to alter native plant communities as they are able to displace and outcompete native species. They are opportunists with broad ecological tolerances, can grow under a wide range of climatic and soil conditions, and have excellent reproductive capabilities (Taylor, 1990).

The Willamette NF initiated an Integrated Weed Management Plan Program (WNF IWMP) in 1993. The standards and guidelines in the forest plan directs us to identify and analyze noxious weed sites for the most effective control methods based on site-specific analysis of populations (USDA, 1993). The highest priority species for treatment are new invader species that are in the early stages of invasion and have not naturalized to the point that resource damage is occurring. New invaders are of biological concern in the watershed because of their potential to move from road systems in established sites into natural non-forested openings where they could outcompete natives. Control of new invaders may include hand-pulling, mechanical mowing or chemical application depending upon the characteristics of the site, closeness of water and/or human uses. Established infestations are weed species populations that have spread to the point that eradication is impossible and resource damage is unacceptable. Due to the sheer degree of infestations, control methods are generally limited to biocontrol agents, which involve the use of insects that naturally feed upon that plant and its seeds, affecting the vigor and reproduction abilities of the targeted weed.

Noxious weeds are classified on the Willamette NF as potential invader, new invader, or established species in the WNF IWMP. The following table lists the documented noxious weeds, potential noxious invaders, and several noted invasive non-natives:

Noxious Weeds, Potential Noxious Invaders and Invasive Non-natives in the NFMF Watershed:

Common Name	Scientific Name	Classification
rough pigweed	Amaranthus retroflexus	none
cheatgrass	Bromus tectorum	none
spotted knapweed	Centaurea maculosa	new, established
meadow knapweed	Centaurea pratense	new, established
ox-eye daisy	Chrysanthemum leucanthemum	none
Canada thistle	Cirsium arvense	established
bull thistle	Cirsium vulgare	established
hedgehog dogtail	Cynosurus echinatus	none
teasal	Dipsacus sylvestris	none
St. John's-wort	Hypericum perforatum	established
spotted cat's-ear	Hypochaeris radicata	none
wall lettuce	Lactuca muralis	none
nipplewort	Lapsana communis	none
everlasting peavine	Lathyrus latifolius	none
rose campion	Lychnis coronaria	none
purple loosestrife	Lythrum salicaria	potential
coast tarweed	Madia sativa	none
plantian	Plantango lanceolata	none
Giant knotweed	Polygonum sachalinense	potential
heal-all	Prunella vulgaris	none
red sorrel	Rumex acetosella	none
curly dock	Rumex crispus	none
Himalaya blackberry	Rubus discolor	none
evergreen blackberry	Rubus lacinatus	none
tansy ragwort	Scenecio jacobaea	established
spiny sowthistle	Sonchus asper	none
dandelion	Taraxacum officianle	none

Invasion and Establishment of non-native plants in the watershed are a serious threat to native plant diversity. The WNF Integrated Weed and Management Environmental Analysis lists 7 site types where potential occurs to harbor noxious weeds already established on the forest and potential invader weeds. All of these site types are found within the watershed. Site types range from bare, rocky, gravely ground such as road beds, quarries, etc., to floristically diverse areas such as meadows, sensitive plant sites, wetlands, etc., (see the EA for full descriptions).

Roadside inventories on the Oakridge Ranger District of noxious weeds were conducted by the ODA in 1988 and again in 1993. The results of these inventories have shown that some noxious weed species have increased in an alarming rate of spread. For instance, scotch broom was calculated to have infested an additional 35% sections and increased the number of roads infested to 51% (Glen Miller, personal communication).

Major forest roads and other corridors, such as right-of-way clearances serve as noxious weed dispersal pathways and establishment sites. Aufderheide Drive (FS Road 19) is a well-used travel-way by which vehicular, mechanical, and wind-born weed seed transport and spread has occurred. Timber sale units, associated roads and landing sites, trails, and other disturbed openings have seral conditions which typically support weed populations. Other spread mechanisms in the watershed include bird and mammal seed dispersal and weed seed contamination of forage and erosion control seeding mixes.

Scotch broom (Cytisus scoparius) is abundant in the lower elevation reaches of the watershed, particularly on river banks, gravel bars, roadsides, and other areas where past ground disturbance has resulted in openings. It competes with young conifers in plantations. This species is eventually outcompeted, due to lack of sunlight. A biocontrol agent, the seed feeding weevil (Apion fuscirostre), has been used on scotch broom since the 1980's and releases will be continued. Isolated targets will be emphasized in future releases. Scotch broom is a designated target or "T" weed, a selected weed that is included in an annual list of species the ODA develops to prioritize those species considered to be an economic threat to the State of Oregon and receive more intensive control treatments.

Spotted knapweed (C. maculosa) has three significant documented sites within the watershed. These are small roadside populations, targeted for proposed herbicide control in 1995. This species has also been given priority status as a target weed for established population control work and slowing population spread on the forest. It has been moving eastwards over the Cascade Crest through major travel routes and is considered a major threat to native biodiversity (USDA, 1993). Several types of biocontrol agents are being considered for use in the spotted knapweed control program.

Meadow knapweed (C. pratensis) is a hybrid between brown knapweed (C. jacea) and black knapweed (C. nigra) and is projected to become a dominant weed species in the future. It is commonly found in the Willamette Valley and is moving up in elevation (USDA, 1993). It is a garden weed and has been noted to have been dumped along with other yard debris near Hill's Creek Reservoir at the water's edge (MF WA, 1995). One significant roadside population located during the 1993 weed survey exists in the watershed.

Bull and Canada thistle (C. vulgare and C. arvense) are commonly found in timber sale clear cuts, landings, roadside sites and other areas with prior ground disturbance and open canopies in the watershed. These weeds are also found in meadow communities. These are early seral species and eventually become shaded out with canopy closure, therefore are of low risk to forested interiors. Galls formed by the fly larvae of Urophora stylata are presently being used on bull thistle to reduce flower head formation to prevent seed dispersal.

Tansy ragwort (Senecio jacobea) is widely established west of the Cascades in Oregon and is moving east over the crest of the Cascades (USDA, 1993). Tansy ragwort is well established in the watershed. Twenty-one significant roadside tansy populations were identified during the 1993 weed survey. Biocontrol agents have been in use on the district since late 1970s to control tansy densities and are still currently being released. The root-eating flea beetle (Longitarsus jacobaea), was last released on rosettes on several tansy populations within the watershed in winter 1995. Several sites, notably on FS Road 1912, contained already established flea beetle populations on plant rosettes. The Cinnabar moth (Tyria jacobaeae) was first released in Western Oregon in the 1960's to combat tansy ragwort. The moth was not tested thoroughly enough to determine plant host specificity (this testing and release of bio-control agents is accomplished by the APHIS, a section of the Federal Dept. of Agriculture) (MF WA, 1995). The Cinnabar moth was released on tansy ragwort populations to cause defoliation. Cinnabar moth defoliation damage to related native sencecio species such as arrow-leaf groundsel (S. Triangularis) has recently been of concern on the Rigdon District, where moderate impacts on the plant has been identified (MF WA, 1995). However, the cinnabar moth does not fare well during cold, wet spells, and eventually will disappear from the system (Glen Miller, pers. comm.). Informal tracking of such damage is now emphasized during shab surveys. Tansy ragwort has been included on the latest 1995 "T" list for future priority control work.

St. John's-wort (Hypericum perforatum) is an aggressive pioneer species which poses a threat to plant communities in dry and mesic meadow openings by displacing native forb and grass species via underground spread and seed set (USDA, 1993). These areas often contain natural soil disturbers such as groundhogs and mountain beavers, who provide conditions where this

pioneer weed thrives. It has become a common roadside noxious weed in the watershed and is also documented to occur in Thompson's mistmaiden habitat; it is now found in most natural meadows on the district.

Weed competition is openly occurring with desirable native plant species in reforestation project areas, wildlife use areas (including small wetlands and river floodplains) and it has also been noted that some weeds are extending into natural dry/moist meadow openings and rock garden communities. In many areas, non-desirable weed species are excluding other desirable plants to the point of forming dense weed patches and thickets. The non-native invasive Himalaya and evergreen blackberries (Rubus discolor and R. lacinatus) flourish in floodplain sites and form monocultures which often extend underneath the canopy. Blackberries are currently and have long been a formidable presence in lower elevation river flats on the district and their potential rate of spread in the watershed is of concern. They are of particular concern because there are currently no biological controls available to use on blackberries and they have the potential to directly compete with the sensitive plant, tall bugbane, by occupying the same habitat (S. Santiam WA, 1995). They have not been systematically surveyed on the forest, but are now a priority for informal tracking of new infestations and rate of spread. Blackberries have also been found at higher elevations (up to 4,000 feet) at several locations in the watershed, in moist ground along roadsides and in openings. Their vigor is noticeably less higher up due to harsher site conditions. Ox-eye daisy (C. leucanthemum), another weed of concern for informal tracking, has become a common site along roads, in disturbed forest openings and meadows. It forms dense colonies and could move up into higher elevation reaches, invading meadows and reducing native plant diversity in them. This could be of special concern in wilderness and other special areas of botanical and wildlife interest. Sweet pea (Lathyrus latifolius), another potential species of concern, has been noted to occur along lower elevation roadsides on the Lowell Ranger District and the Oakridge District. It could potentially spread farther into the watershed. A noxious weed currently on the Forest's potential invader list meriting concern to watershed plant and wildlife values is purple loosestrife (Lythrum salicaria). Purple loosestrife is found in extremely wet habitats. It is currently invading the state of Oregon and is becoming established in the Willamette Valley. Wetland biodiversity in the watershed could potentially be seriously disrupted and wildlife habitat decreased by this very aggressive species. Prolific spread of purple loosestrife is accomplished by seed set (up to 3 million per plant annually) lasting several years, waterborn seed transport, and sprouting by fragmentation of plant parts and roots (ODA, 1995). No occurrence of this weed has yet been documented in the Willamette, however it is expected to eventually make its way into the forest (Glen Miller, pers. comm.). Giant knotweed (Polygonum sachalinense) is another potential invader of concern. Two populations have recently been noted on the Rigdon District (E. Everett, pers. comm.) and is found elsewhere in the Cascades. This species was introduced into the Coast Range to stabilize stream banks and is now widespread there in riparian areas (MF WA, 1995). Canary reedgrass (Phalaris arundinacea) is suspected to be present in the High Prairie area on private agricultural land. This grass is a very effective and widespread invader and has the potential to spread into upper elevations and wilderness areas. It is currently in use; propagated and dispersed for revegetation purposes (E. Everett, personal comm).

Non-native plant species have been introduced into Oregon since European settlers began bringing them into the state for uses such as ornamentals and herbal medicines. Many noxious weeds species were garden escapees or contaminants brought in inadvertently from shipping goods from overseas or overland. Scotch broom was introduced as an ornamental shrub and erosion control agent in the 1920s. The advent of logging forest land and building roads produced an abundant increase in noxious weeds and invasive non-natives since the 1930s, when many noxious weeds would have been considered newly invading species. Livestock grazing on forest land utilized on-site forage and initially did not contribute as much towards non-native invasion as did logging practices, but sheep grazing in non-forested openings likely brought in St. John's-wort and other non-native grass and forb species.

APPENDIX I:

Percent Riparian Reserve Impacted By Stand Replacement Harvest
(by planning subdrainage)

Number	Name	% Impacted by Stand Replacement Harvest	Number	Name	% Impacted by Stand Replacement Harvest
171	Coffee	64	17U	Captain	34
172	Tenth	11	17V	Major Parker	47
173	Eight	43	17W	Roosevelt	43
174	Huckleberry	42	17X	Devils Canyon	11
175	Fifth	20	17Y	Hemlock	12
176	Third	23	17Z	Whiterock Shale	43
177	First	21	24A	Glade	23
178	High Prairie	16	24B	Augusta	8
179	Mossy - Grassy	55	24C	Tiny	2
17A	Short - Hemlock	24	24D	Box Canyon	1
17B	Dartmouth	27	24E	Outer Bend	3
17C	Leapfrog	21	24F	Skookum	0
17D	High	28	24G	Otter	0
17E	Hammer	46	24H	Erma Bell	0
17F	McKinley	38	24I	Pothole	0
17G	Chalk	34	24J	Harvey	0
17H	Evangeline	46	24K	Torrey	0
17I	Billy	48	24L	Waldo	0
17J	Nehi	51	24M	Eddeeleo	0
17K	Sardine	56	24N	Moolack Lake	1
17L	Christy Head	28	24Q		0
17M	Lowell	49	24R		0
17N	Lowell Head	37	24S		19
17P	Christy South	49	24T		12
17Q	Flats	4	24U		45
17R	Buffalo	17	24V		26
17S	Major Prairie	63	24W		12
17T	Brock	33			

APPENDIX J:

Culvert Hydraulic Analysis

Walk Thin Timber Sale Culvert Assessment

Road No.	MP	Stream Name	Diam	Culvert Length	Slp%	Flow Capacity Pipe	Fill	Q100	Pipe %Q100	Fill %Q100	Inlet Plug%	Dent%	Outlet Plug%	Dent%	Drop	Q 100/10 D	V
1926	1.99		5	46	12						10	5	0	0	8		
1926-636	0.41		2	34.5	5						5	0	0	0	0		

North Fork Timber Sales Culvert Assessment

Road No.	MP	Stream Name	Diam	Culvert Length	Slp%	Flow Capacity Pipe	Fill	Q100	Pipe %Q100	Fill %Q100	Inlet Plug%	Dent%	Outlet Plug%	Dent%	Drop	Q 100/10 D	V
19	3.45		2	49	7	14	28	39	36	72	25	2	0	0	6	0.5	7.1
19	4.95	First	8x5.5	30	2	322	406	460	70	88	0	0	0	0	2	0.7	8.1
19	6		3	48	5	33	66	41	80	161.0	5	0	50	0	1.5	0.4	6.3
19	6.15		4	57	8	68	108	104	65	104	0	0	0	0	1	0.6	9.4
19	6.4	Huckleberry	7	71	10	294	919	1318	56	70	0	0	0	0	6	1.62	18
			8.5	71	6	447					5	0	0	0	7	1.8	15.3
19	7.82		2.5	61	8	21	47	41	51	115	25	20	0	0	3	0.4	7.5
19	7.9	Eighth	3	46	9	35	92	354	10	26	15	10	0	0	2.5	1.2	13.4
19	10.1		3	60	2	31	70	57	54	123	40	0	10	0	0	0.7	4.8
19	12.4	Tumble	8.5	47	6	414	563	318	130	177.0	0	0	0	0	1		
19	13.64	Coffee	5	57	6	125	246	125	100	197	0	0	0	0	5	0.6	8.8
19	13.92	Sidewalk	5	81	2	119	308	149	80	207	0	0	0	0	2	0.9	6
19	14.4	Whiterock	5	87	9	122	219	153	80	143	0	0	0	1	2	0.6	10.7
19	14.55	Plateau/Shale	4	87	4	68	178	170	40	105	0	0	0	1	6	0.9	8.3
19	16.9	Cedar	6	74	6	180	461	326	55	141	0	0	0	1	4	0.9	11.3
19	17.3	Devils Canyon	10	113	4	720	1093	522	138	209	10	0	0	0	5	1.1	10.5
19	18.2	Roosevelt	6.5	60	2	215	722	341	63	212	5	0	10	0	0	1.3	7.4
19	18.81	Steer	4	53	7	70	80	67	104	119	2	0	0	0	6	0.5	7.9
19	19.1	Silver	4	54	14	75	129	136	55	95	5	0	20	0	0	0.6	12.5
19	19.3	Major	4	57.5	2	74	104	147	50	71	0	0	0	0	0.5	0.9	6.6
19	19.85	Parker	9.8x7.5	125	6	470	732	410	115	179	0	0	0	0	10		
19	20.7		5	70	2	130	190	134	97	142	0	0	0	0	1.5	0.8	6
19	21.01		4	73	12	72	152	144	50	106	0	0	0	0	1.5	0.6	11.9

Riparian and Special Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
American coot	LKRVA	Cascade torrent salamander	LKRVARML
American widgeon	LKRVA	Pacific giant salamander	LKRVARML
California gull	LKRVA	Pacific water shrew	LKRVARML
Caspian tern	LKRVA	belted kingfisher	LKRVARML
Glaucous-winged gull	LKRVA	bufflehead	LKRVARML
Greater scaup	LKRVA	common goldeneye	LKRVARML
Greater white-fronted goose	LKRVA	common merganser	LKRVARML
Pacific loon (Arctic)	LKRVA	harlequin duck	LKRVARML
blue-winged teal	LKRVA	hooded merganser	LKRVARML
bonaparte's gull	LKRVA	tailed frog	LKRVARML
canvasback	LKRVA	water shrew	LKRVARML
cinnamon teal	LKRVA	wood duck	LKRVARML
common loon	LKRVA	Anna's hummingbird	LKRVRE
dunlin	LKRVA	common yellowthroat	LKRVRE
eared grebe	LKRVA	marsh wren	LKRVRE
Eurasian widgeon	LKRVA	purple martin	LKRVRE
gadwall	LKRVA	yellow-breasted chat	LKRVRE
green-winged teal	LKRVA	American redstart	LKRVRG
horned grebe	LKRVA	bank swallow	LKRVRG
leach's storm petrel	LKRVA	northern rough-winged swallow	LKRVRG
lesser scaup	LKRVA	warbling vireo	LKRVRG
northern pintail	LKRVA	downy woodpecker	LKRVRML
northern shoveler	LKRVA	red-eyed vireo	LKRVRML
oldsqaw	LKRVA	white-footed vole	LKRVRML
red phalarope	LKRVA	American bittern	SPCL
red-throated loon	LKRVA	Long-billed dowitcher	SPCL
redhead	LKRVA	Solitary sandpiper	SPCL
ring-billed gull	LKRVA	Sora	SPCL
ruddy duck	LKRVA	Townsend's big-eared bat	SPCL
snow goose	LKRVA	Virginia rail	SPCL
surf scoter	LKRVA	acorn woodpecker	SPCL
trumpeter swan	LKRVA	barn owl	SPCL
tundra (whistling) swan	LKRVA	barn swallow	SPCL
western grebe	LKRVA	black swift	SPCL
white-winged scoter	LKRVA	bushy-tailed woodrat	SPCL
Canada goose	LKRVARE	cliff swallow	SPCL
killdeer	LKRVARE	common snipe	SPCL
mallard	LKRVARE	greater yellowlegs	SPCL
water vole	LKRVARE	house mouse	SPCL
western pond turtle	LKRVARE	least sandpiper	SPCL
Dunn's Salamander	LKRVARG	lesser yellowlegs	SPCL
bald eagle	LKRVARG	northern harrier	SPCL
beaver	LKRVARG	northern waterthrush	SPCL
bullfrog	LKRVARG	pectoral sandpiper	SPCL
common egret	LKRVARG	peregrine falcon	SPCL
double-crested cormorant	LKRVARG	pika	SPCL
great blue heron	LKRVARG	prairie falcon	SPCL
green-backed heron	LKRVARG	red-winged blackbird	SPCL
mink	LKRVARG	rock dove	SPCL
muskrat	LKRVARG	rock wren	SPCL
nutria	LKRVARG	sandhill crane	SPCL
osprey	LKRVARG	semipalmated plover	SPCL
pied-billed grebe	LKRVARG	short-horned lizard	SPCL
ring-necked duck	LKRVARG	spotted frog	SPCL
river otter	LKRVARG	spotted sandpiper	SPCL
white-faced ibis	LKRVARG	white-headed woodpecker	SPCL
American dipper	LKRVARML	yellow-bellied marmot	SPCL
Barrow 's goldeneye	LKRVARML		

Generalist Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
American crow	TLGG	clouded salamander	TLGG
black bear	TLGG	coast mole	TLGG
bobcat	TLGG	common garter snake	TLGG
common raven	TLGG	dark-eyed junco	TLGG
coyote	TLGG	deer mouse	TLGG
gray fox	TLGG	dusky shrew	TLGG
gray wolf	TLGG	ermine	TLGG
lynx	TLGG	evening grosbeak	TLGG
mountain lion	TLGG	golden-crowned kinglet	TLGG
wolverine	TLGG	golden-mantled ground squirrel	TLGG
Bohemian waxwing	TLGG	hairy woodpecker	TLGG
Cooper's hawk	TLGG	hermit thrush	TLGG
Virginia opossum	TLGG	house finch	TLGG
Yuma myotis	TLGG	house sparrow	TLGG
common nighthawk	TLGG	long-toed salamander	TLGG
gray flycatcher	TLGG	mountain beaver	TLGG
gray jay	TLGG	mountain chickadee	TLGG
hoary bat	TLGG	mourning dove	TLGG
long eared owl	TLGG	northern alligator lizard	TLGG
long-eared myotis	TLGG	northern oriole	TLGG
long-legged myotis	TLGG	northern pygmy-owl	TLGG
long-tailed weasel	TLGG	northwestern salamander	TLGG
mule deer and black-tailed deer	TLGG	Oregon meadow vole	TLGG
northern flicker	TLGG	pacific jumping mouse	TLGG
northern saw-whet owl	TLGG	pine grosbeak	TLGG
porcupine	TLGG	pine siskin	TLGG
sharp-shinned hawk	TLGG	purple finch	TLGG
silver-haired bat	TLGG	raccoon	TLGG
spotted skunk	TLGG	red crossbill	TLGG
striped skunk	TLGG	red-breasted sapsucker	TLGG
western rattlesnake	TLGG	red-legged frog	TLGG
western small-footed myotis	TLGG	red-napped sapsucker	TLGG
wild turkey	TLGG	ring-tailed cat	TLGG
American robin	TLGG	ringneck snake	TLGG
Cascade frog	TLGG	roughskin newt	TLGG
Douglas' squirrel	TLGG	rubber boa	TLGG
Ensatina	TLGG	ruby-crowned kinglet	TLGG
Hammond's flycatcher	TLGG	ruffed grouse	TLGG
Hutton's vireo	TLGG	rufous hummingbird	TLGG
Norway rat	TLGG	rufous-sided towhee	TLGG
Pacific tree frog	TLGG	sharptail snake	TLGG
Steller's jay	TLGG	snowshoe hare	TLGG
Swainson's thrush	TLGG	solitary vireo	TLGG
Townsend's chipmunk	TLGG	song sparrow	TLGG
Townsend's solitaire	TLGG	southern alligator lizard	TLGG
Vaux's swift	TLGG	tree swallow	TLGG
Wilson's warbler	TLGG	vagrant shrew	TLGG
band-tailed pigeon	TLGG	violet-green swallow	TLGG
black-capped chickadee	TLGG	western gray squirrel	TLGG
black-chinned hummingbird	TLGG	western redback salamander western	TLGG
black-headed grosbeak	TLGG	screech-owl	TLGG
black-throated gray warbler	TLGG	western tanager	TLGG
blue grouse	TLGG	western toad	TLGG
brush rabbit	TLGG	western wood-pewee	TLGG
cedar waxwing	TLGG	winter wren	TLGG
chestnut-backed chickadee	TLGG	yellow warbler	TLGG
chipping sparrow	TLGG	yellow-pine chipmunk	TLGG
Clark's nutcracker	TLGG	yellow-rumped warbler	TLGG

Contrast Habitat Species Guilds -- preliminary guilding

Common Name	Guild	Common Name	Guild
boreal owl	TLC	little brown myotis	TMC
elk	TLC	Cassin's finch	TSC
golden eagle	TLC	Lewis' woodpecker	TSC
great gray owl	TLC	Nashville warbler	TSC
great horned owl	TLC	ash-throated flycatcher	TSC
red-tailed hawk	TLC	brown-headed cowbird	TSC
turkey vulture	TLC	dusky flycatcher	TSC
American kestrel	TMC	flammulated owl	TSC
California myotis	TMC	heather vole	TSC
European starling	TMC	olive-sided flycatcher	TSC
big brown bat	TMC		

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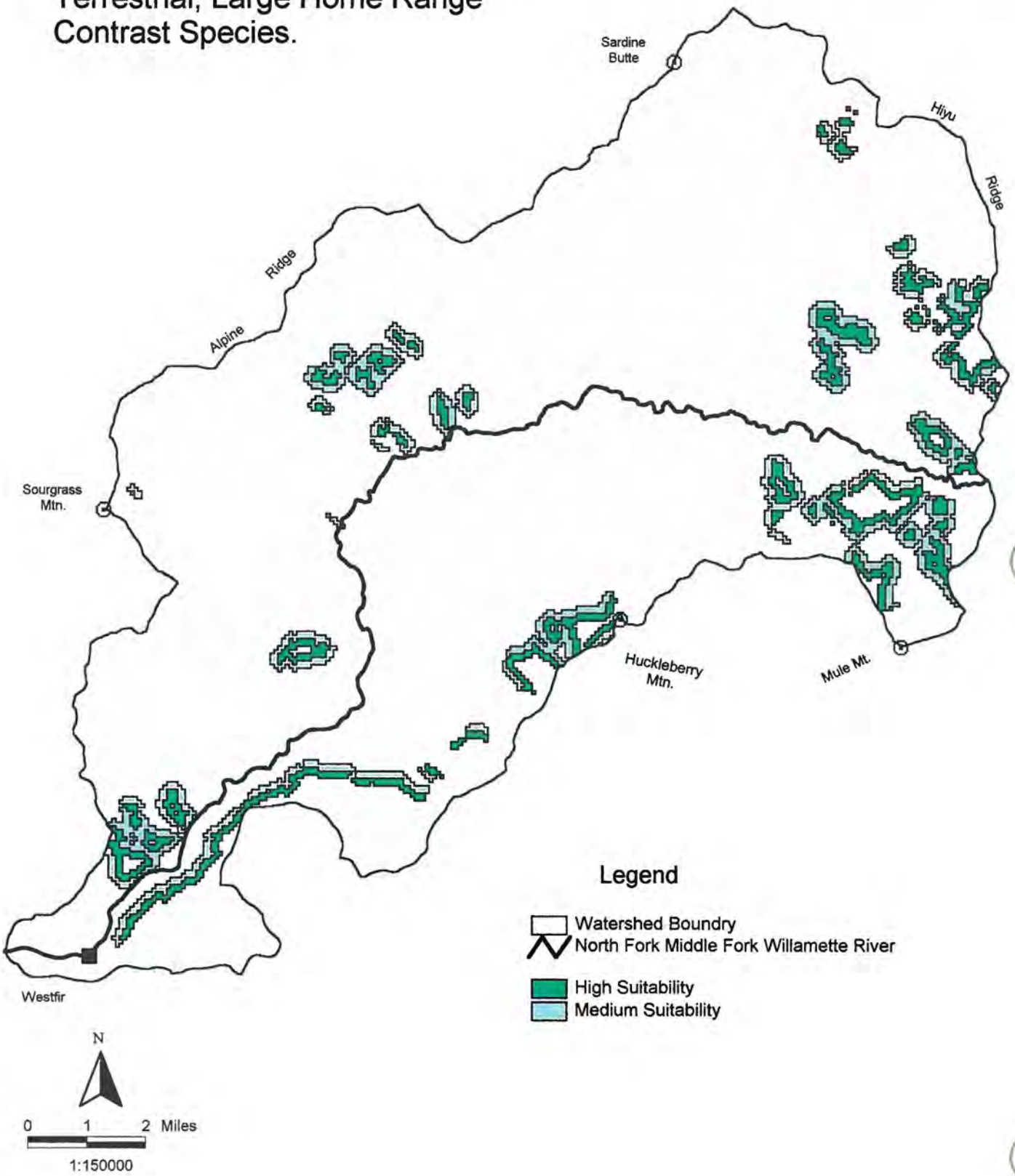
KEY TO WILDLIFE GUILDS OF THE WILLAMETTE NATIONAL FOREST

LKRVA = Lake or river, using the aquatic portion only.
LKRVARE = Lake or river, using the aquatic portion and terrestrial riparian vegetation in the early seral stage.
LKRVARG = Lake or river, using the aquatic portion and terrestrial riparian vegetation regardless of seral stage (generalist).
LKRVARML = Lake or river, using the aquatic portion and terrestrial riparian vegetation in the mid and late seral stages.
KRVRE = Lake or river, using the terrestrial vegetation only in an early seral condition.
LKRVRG = Lake or river, using the terrestrial vegetation only regardless of seral stage (generalists).
LKRVRML = Lake or river, using the terrestrial vegetation only in mid and late seral stages.
SPCL = Associated with a special habitat, as listed.
TLC = Terrestrial, large home range, contrast species.
TLGG = Terrestrial, large home range, generalist species.
TLME = Terrestrial, large home range, mosaic, early seral stage users.
TLML = Terrestrial, large home range, mosaic, late seral stage users.
TMC = Terrestrial, medium home range, contrast species.
TMGG = Terrestrial, medium home range, generalist species.
TMME = Terrestrial, medium home range, mosaic early seral stage users.
TMML = Terrestrial, medium home range, mosaic late serral stage users.
TMPE = Terrestrial, medium home range, patch species, early seral.
TSC = Terrestrial, small home range, contrast species.
TSGE = Terrestrial, small home range, generalist early seral.
TSGEM = Terrestrial, small home range, generalist early/mid seral.
TSGG = Terrestrial, small home range, generalist.
TSGML = Terrestrial, small home range, generalist mid/late seral.
TSME = Terrestrial, small home range, mosaic early.
TSPE = Terrestrial, small home range, patch species, early seral.
TSPL = Terrestrial, small home range, patch species, late seral.

Figure: 1a

Historic
Terrestrial, Large Home Range
Contrast Species.

Lower North Fork Middle Fork
Willamette River Watershed



Road No.	MP	Stream Name	Diam	Culvert Length	Slp%	Flow Capacity Pipe	Fill	Q100	Pipe %Q100	Fill %Q100	Inlet Plug%	Dent%	Outlet Plug%	Dent%	Drop	Q 100/10 D	V
19	21.32		4	42	2	62	67	56	111	120	10	1	0	0	0	0.6	4.8
19	22.23	Brock	11	87	3	875	1197	372	235	322	2	0	5	0	0	1.1	7.5
19	22.52		6	59	3	185	301	137	135	220	0	2	5	0	0	0.7	6.9
19	23.39	Glade	7	72	9	290	313	261	111	120	0	0	5	0	0	0.7	13.1
19	24.5	Little	8	76	3	380	466	89	427	524	15	0	0	0	0	0.4	4.6
19	24.79		6	70	4	198	316	330	60	96	5	0	0	0	0.3	1.1	9.6
19	27.68	Minute	8	62	6	300	363	137	219	265	5	0	10	0	0	0.8	10.4
19	28.75		2.5	51	2	27	48	108	25	44	0	0	0	1	0	1	5.8
19	28.9	Box Canyon	6.5	66	1	209	294	348	60	84	0	0	1	0	0	1.5	6

APPENDIX K:

Riparian Thinning Analysis

On December 14, 1994 Al Johnson (hydrologist), Eric Ornberg (planner/silviculturist), Dede Steele (wildlife biologist), Kim MacMahan (botanist), and Tim Bailey (planner/silviculturist) met to develop prescriptions for the young managed stand thinning, typically that proposed in stands 35 to 45 years old created by past harvest.

We were especially interested in proposed thinning as most young managed stands contain riparian reserves as prescribed by the Northwest Forest Plan. We wanted to come to a common understanding as to whether it was appropriate and desirable to thin within riparian reserves, and if so, whether thinning prescriptions should be different between riparian zones and adjacent matrix land.

Based upon typical age, densities, and general condition of these young stands; our desire to minimize the number of harvest entries to minimize the amount of soil and residual tree disturbance, and the common goal of all these thinnings to increase within-stand structural diversity, we determined that most thinning prescriptions within matrix lands should harvest roughly 50 percent of the existing stems. We also agreed that there should be no thinning within 50 feet of channel edges to provide for a constant, high level of fine organic material input, to maintain existing rooting strength, and to avoid the possibility of channel edge disturbance. We also recognized that often times the conifers immediately adjacent to the stream channels are not particularly dense due to the greater diversity of tree and shrub species in riparian environments, so there is a lesser need to thin to promote diversity or to generate larger conifer stems.

Our discussion centered upon whether and how the riparian reserves between 50 and 200 feet from the stream (the site potential tree heights for most of these proposed units are about 200 feet) should be thinned. Recognizing that we want to assure (for both aquatic and terrestrial habitat long-term objectives) these stand will in the future contain large-diameter dominant trees, we believe thinning at some level is necessary within the riparian reserves. To avoid creating an overly-large change in microclimate however, we initially suggested that riparian reserve thinning between 50 and 200 feet from stream channels be less intensive than what would be prescribed for adjacent matrix lands. We identified the following advantages to thinning the riparian reserves (again between 50 and 200 feet from the stream channels) to a density about one third less than current conditions, a spacing between dominant conifers of approximately 17 feet, depending upon the stand in question:

- It would better buffer microclimate changes (temperature of air, soil, water; humidity; solar radiation; etc.) in the unthinned area immediately adjacent to the channels

- The amount of crown damage from a heavy thinning could add to the above microclimate changes, provide a more open environment, and result in longer periods of crown closure recovery

- There would be less potential for damage to understory layers near stream channels

- It might provide better currently available dispersal habitat and more immediately effective dispersal corridors

- It would provide for greater overall within-stand structural and species diversity

- A 30 percent harvest prescription would leave more options for wildlife tree/large woody debris management, i.e. more trees would be available for falling or girdling without additional microclimate impacts or without causing the stands to become understocked;

- It would provide a buffer for potential losses from windthrow and snow breakage

- It would mean less trees to mark (easier implementation)

We identified the following disadvantages of thinning the riparian reserves (again between 50 and 200 feet from the stream channels) to a lesser spacing than adjacent Matrix Lands:

- There would be a reduced rate of diameter growth in the riparian reserve as compared to adjacent Matrix lands. This could result in a stand within the riparian reserve which has noticeably smaller dominant tree diameters as compared to adjacent Matrix areas in the future (50 to 100 years);

- It would be a more complex prescription to be implement because there would have to be more measuring and tree marking personnel would have to keep in mind two separate prescriptions

Recommendations-

The above stated advantages of thinning riparian reserves to a lesser spacing are certainly more numerous than the disadvantages but it should be noted that the disadvantage of creating riparian stands with diameters smaller than the stands as a whole as the result of a different thinning prescription is of some concern. It should also be noted that many of the advantages are only short-term advantages and the disadvantage of slower relative diameter growth is long-term. Potential micro-climate changes resulting from a heavier thinning might not last much longer than a decade, possibly less. That not withstanding, we have still opted to take a conservative approach in the short-term effects and have recommended in the following discussion that perennial stream riparian reserves be thinned to leave a somewhat greater leave tree density to avoid potential excessive changes in micro-climate and general stand disturbance.

It should be kept in mind that growth rates for stands thinned as we suggest should be monitored and modeled, including a projection of diameter growth for the thinning prescriptions proposed. If we begin to see a trend indicating that riparian stands in decades hence may be of considerably smaller diameter than adjacent upland stands such that we may not be able to produce stems of sufficient size to fully meet aquatic conservation strategy objectives, we should then reconsider this conservative approach to thinning within riparian reserves.

With these qualifications, our recommendations for thinning in riparian reserves for the Heart and Finberry planning areas are as follows:

- No thinning should occur within 50 feet of any class of stream channel

- The portion of the riparian reserve from 50 to 200 feet from the channel edge should be thinned to a lesser degree than adjacent matrix lands (in these sale areas, a harvest of about 30 percent of the stand) in class II and III riparian reserves and adjacent to special wildlife habitats and wetlands greater than one acre

- The portion of class IV riparian reserves from 50 to 200 feet from the channel should be thinned with the same prescription used on adjacent Matrix lands, in these cases about half of the stems in the stands. Where site specific conditions indicate a need for greater protection of riparian resources, a wider no cut area or a 30 percent harvest should be implemented

- The no harvest areas immediately adjacent to channels could be narrower than 50 feet if site specific conditions indicate a need (i.e. very dense, stagnated stands), to be no narrower than 20 feet. This situation is not expected to occur very often

- Precommercial thinning could occur even closer to stream channels than above if the stand is dense. Serious consideration should be given to a fairly wide precommercial spacing in riparian zones to establish fast diameter growth early on in the hope of avoiding the need to commercially thin later when a change in microclimate and damage to understory vegetation could be of concern

- Wetlands and special habitat less than one acre should be protected with a 50 foot wide no-harvest buffer and thinning the same as prescribed for adjacent matrix lands in the remainder of the riparian reserve. In special situations where there is a need identified, this no-harvest buffer could be greater or a two-level thinning prescription could be implemented. In any case, such areas should be protected to the extent provided for in the Forest Plan.

How Thinning In Riparian Reserves Relates To The Northwest Forest Plan Aquatic Conservation Strategy Objectives (April 4, 1995)

This discussion focuses on proposed thinning of young managed stands (from 25 to 50 years of age) created by past clearcut harvest. This past harvest did not treat riparian zones differently than upslope areas and the stands are more or less homogenous across the slope. As of this writing most of the stands in this age range contain moderate to large amounts of large woody debris in and near stream channels as well as in upland areas but they contain essentially no large residual trees or snags. Most of these young stands were planted almost exclusively with Douglas-fir, though other species have naturally established to a greater or lesser extent. These stands were densely planted and those proposed for thinning are quite dense, often to the extent that tree mortality is currently occurring or soon will and understory ground vegetation is sparse to non-existent. Thinning is proposed in the riparian portion of these managed stands generally to create a more diverse stand and to assure that riparian stands have the same stem size distribution and understory composition as adjacent thinned upland stands. How thinning specifically affects the nine Aquatic Conservation Strategy Objectives presented on page B-11 of the Northwest Forest Plan follows below:

1. Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to assure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Thinning will help to better achieve this objective. Thinning is proposed in these young stands to provide for a more diverse riparian and terrestrial stand by opening up the canopy somewhat such that shade tolerant conifers and ground vegetation can become established or to provide for the more vigorous growth of that which already exists. Thinning will also provide for greater long-term structural diversity by generating larger stem diameters, overall greater variation in stem sizes, a structurally more complex dominant tree crown (deeper, with thicker branches) and future sources of appropriately large snags and down woody material. If these dense, young stands are not thinned there will be, to a large extent, a detrimental impact on aquatic and terrestrial populations and communities in the long-run as these stands may take a very long time to generate large stem calipers and late-successional habitat conditions in general if they remain at their current densities.

2. Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian dependent species.

Thinning will not affect the connectivity these recovering riparian stands now provide. While there may be some short-term negative effects in terms of micro-climate changes by reducing the current crown coverage, or in terms of branches and trees tops creating barriers to animal movement, there is an overall benefit in creating more structurally complex habitat for animals to travel through in the future.

3. Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.
Yarding systems and harvest prescriptions would be designed to maintain channel stability in all cases including intermittent stream channels. Riparian areas within 10 to 50 feet of stream channels would generally not be thinned. Trees to be removed will not be transported across stream channels unless an analysis shows that additional road construction needed to avoid yarding across streams would be more harmful than a narrow skyline corridor through the riparian area. Skyline yarding corridors across stream channels would minimized, however where analysis determined that yarding across a stream channel could be accomplished while protecting streambanks and channels, stream crossing corridors would be allowed. Logs would be fully suspended above intermittent and perennial stream channels unless analysis determined yarding could be accomplished while maintaining objectives for protection streambanks and channels.

4. Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.
Thinning would have a neutral effect on water quality in the short run. In the long run it may have a slightly beneficial effect as thinning will speed up the creation of large stems, some of which will eventually fall into the channels to provide for more stable channels. Retention of all trees within 50 feet of stream channels will provide for shade to maintain cool stream temperatures.

5. Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate and character of sediment input, storage and transport.
See the above discussion; thinning will have neutral effect on sediment regimes as long as road construction effects are balanced with the desire to minimize yarding across stream channels. Thinning would enhance development of LWD which when incorporated into stream channels has beneficial effects on storage and routing of sediment. No harvest areas adjacent to stream channels should mitigate the potential for stream bank erosion.

6. Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.
Thinning will have a neutral effect on in-stream flows. Though thinning would reduce the amount of evapotranspiration in riparian zones and adjacent uplands, this effect would be very temporary; there would not be long-term change in the amount of leaf area supported by these sites. To a large extent thinning can be thought of as an activity that re-structures, rather than reduces, the vegetation occurring on a site. Thinning would also have a long-term positive effect on sediment, nutrient, and wood routing as discussed in objectives 4. and 5. above.

7. Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.

Thinning will have a neutral effect on the timing and variability of floodplain inundation and wetland water table levels, similar to the effects on in-stream flows as discussed above.

8. Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration to supply amount and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
Thinning is proposed in riparian stands primarily to better accomplish this strategic objective. Thinning will modify the species composition of these stands to more closely approximate the composition of stands occurring in these riparian areas prior to the regeneration harvest. Reducing the density of these stands will provide for growth of large tree boles which will ultimately have a number of positive effects on channel stability and complexity, as well as general stand structural diversity. Thinning will provide for the establishment and growth of understory vegetation which will provide for greater structural a diversity and for better thermal regulation and nutrient filtering. Thinning will have a neutral effect on surface and bank erosion. Thinning, through the eventual generation of larger in-channel woody debris, could influence future channel migration but the introduction of larger woody debris could also enhance channel stability.

9. Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian species.
The young, previously managed stands proposed for thinning do not currently comprise late-successional habitat. One of the primary objectives of this proposed thinning is to make these dense, young stands more diverse from a structural and species composition perspective. Thinning will ultimately produce a more structurally diverse stand.

APPENDIX L:

Literature Cited

Agee, J. K., 1981. Fire Effects on Pacific Northwest Forests: Flora, Fuels, and Fauna. from: Conference proceedings, Northwest Forest Fire Council 1981, Portland Oregon, November 23-24, 1981; pp. 54-66.

Agee, J.K., and R. Flewelling. 1983. "A fire cycle model based on climate for the Olympic Mountains". Washington. Fire For. Meteorol. Conf. 7:32-37.

Aquatic Analysts, 1990. Waldo Lake Water Quality Report. Prepared for the Oregon Department of Environmental Quality, Portland, Oregon. March, 1990.

Behnke, R. J., 1992. Native Trout of Western North America. American Fisheries Society, Bethesda, Maryland. 275 pp.

Brown, James K., 1974 - "Handbook for Inventorying Downed Woody Material". USDA For. Serv. Gen. Tech. Rep. INT-16, 24 p., illus Int. For. and Range Exp. Stn., Ogden, UT.

Carter, G.H., 1966. A Limnological Study of Waldo Lake in Oregon. Prepared for the Oregon Sate Sanitary Authority and the US Forest Service. July, 1966.

Fahnestock, G.R., and J.K. Agee. 1983. "Biomass consumption and smoke production by prehistoric and modern forest fires in western Washington". J. For. 81:653-657.

Franklin, J. F., and C.T. Dyrness, 1988. Natural Vegetation of Oregon and Washington. Oregon State University Press, 1988.

Goldman and Horne, 1983. Limnology ; McGraw-Hill, New York.

Hemstrom, M. A., S. E. Logan, and W. Pavlat, 1987. Plant Association and Management Guide, Willamette National Forest. USDA Forest Service, Pacific Northwest Region. R6-Ecol-257-B-86, May, 1987.

Huff, M.H., and J.K. Agee. 1980. "Characteristics of large lightning fires in the Olympic Mountains, Washington". Fire For. Meteorol. Conf. 6:117-123.

Hutchinson, J. M., K. E. Thompson, and J. D. Fortune, Jr., 1966. Basin Investigations - Upper Willamette Basin. Oregon State Game Commission, Portland Oregon. 40pp.

Jensen, Chris. 1995. Personal communication. Recreation Assistant, USDA Forest Service, Oakridge Ranger District, Willamette National Forest, Westfir, Oregon.

Johnson, Daniel M., Richard R. Peterson, D. Richard Lycan, James W. Sweet, Mark E. Neuhaus, Andrew L. Schaedel, 1985. Atlas of Oregon Lakes. Portland State University in cooperation with Andrew L. Schaedel, Oregon Department of Environmental Quality. Oregon State University Press. Corvallis, OR.

Larson, D. W., and J. R. Donaldson. 1970. Waldo Lake, Oregon: A Special Study. Water Resource Research Institute, Oregon State University, Corvallis, Oregon. WRRI-2. May, 1970.

Larson, D.W., 1972. Comparative Limnology and Phytoplankton Ecology of Four "Oligotrophic" Lakes in Oregon, U.S.A., with Emphasis on Lake Typology. Northwest Science, Vol. 46, No. 2, 1972.

Larson. D.W., J.W. Sweet, and R.A. Jones, 1991. Clean-Lakes Challenge Grant, Waldo Lake, Oregon; A Report to the Oregon Department of Environmental Quality, June, 1991.

Larson, D. W., 1995. Personal communication, Douglas W. Larson, Limnologist, Portland Oregon. August 23, 1995.

Legard, H. A. and L. C. Meyer, 1973. Soil Resource Inventory, Willamette National Forest. USDA Forest Service, Pacific Northwest Region.

Lider, E.L., J.J. Cooper, S.R. Robertson. 1980. Limnological Investigations of Waldo Lake, Oregon. Prepared for: Willamette National Forest, Eugene, Oregon. Desert Research Institute University of Nevada System. Publication No. 50014.

Liss, W. J., 1991. cologcal Effects of Sticked Fish ON Naturally Fishless High Mountain Lakes of the North Cascades National Park. Final Report of The U. S. National Park Service, Oregon State University, Corvallis, Oregon.

Maleug, K.W., J.R. Tilstra, D.W. Schultz, C.F. Powers, 1972. Limnological Observations on an Ultra-Oligiotrophic Lake in Oregon, USA. Verh. Internat. Verein. Limnol., Vol. 18, pp. 292-302. Stutgart, November, 1972.

McDonald, L.H., A.W. Smart, and R.C. Wissmer, 1991. Monitoring Guidelines to Evaluate Effects of Forestry Activities on Streams in the Pacific Northwest and Alaska. U.S. Environmental Protection Agency, Seattle, WA., 166 pp.

McIntosh, B. A., S. E. Clark, and J. R. Sedell. 1992. Summary Report for Bureau of Fisheries Stream Habitat Surveys - Willamette River Basin 1934-1942. USDA Forest Service, Oregon State University, Corvallis, Oregon. 476 pp.

Miller, Glen. 1993. Personal communication. Oregon Department of Agriculture, Lowell, Oregon.

Miller, Eric. A., 1994. Summary of Grazing for the South Fork McKenzie Drainage, Prepared for: Willamette National Forest, Eugene, Oregon, July, 1994.

Moring, J.R.. 1975. The Alsea Watershed Study: Effects of Logging on the Aquatic Resources of Three Headwater streams of the Alsea River, Oregon Part II - Changes in Environmental Conditions. Fishery Research Report Number 9, Oregon Department of Fish and Wildlife, Corvallis, Oregon.

Oregon Department of Agriculture Noxious Weed Control Program, 1995. Noxious Weed Policy and Classification System, 1995.

Oregon Department of Environmental Quality, 1988. Oregon Statewide Assessment of Non-Point Sources of Water Pollution. Planning and Monitoring Section, Water Quality Division, Oregon Department of Environmental Quality, Portland, OR.

Oregon Department of Environmental Quality, 1994a. Outstanding Resource Waters. 1992-1994 Water Quality Standards Review. Department of Environmental Quality. Standards and Assessment Section. Portland, OR.

Oregon Department of Environmental Quality, 1994b. Outstanding Resource Waters, 1992-1994 Water Quality Standards Review - Draft Issue Paper. December, 1994.

Pickford, S.D., G. Fahnestock, and R. Ottmar. 1980. "Weather, fuels, and lightning fires in Olympic National Park". Northwest Sci. 54:92-105

Potts, D.F., D.L. Peterson, H.R. Zuuring. 1989. Estimating Postfire Water Production in the Pacific Northwest. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station. Research Paper PSW-197.

Priest, G. R., and B. F. Vogt. 1982. Geology and Geothermal Resources of the Cascades, Oregon. State of Oregon Department of Geology and Mineral Industries, Portland Oregon. Open-File Report O-82-7.

Taylor, Ronald J. 1990. Northwest Weeds, the Ugly and Beautiful Villians of Fields, Gardens, and Roadsides. 177 pgs. Mountain Press Publishing Company.

Tilstra, J.R., K.W. Malueg, and C.F. Powers. 1973. A Study of Disposal of Campground Wastes Adjacent to Waldo Lake, Oregon. Working Paper #7. National Eutrophication Research Program. Pacific Northwest Environmental Research Laboratory, an Associate Laboratory of National Environmental Research Center, Corvallis, Oregon.

USDA Forest Service, 1968. Draft Range Management Plan, Grasshopper Allotment, Oakridge Ranger District, Willamette National Forest, June, 1968.

USDA Forest Service, 1979. Chucksney Mountain Undeveloped Roadless Recreation Management Plan, Blue River Ranger District, Willamette National Forest, October, 1979.

USDA Forest Service, 1990. Land and Resource Management Plan, Willamette National Forest. USDA Forest Service, Pacific Northwest Region.

USDA Forest Service, 1992. Environmental Assessment and River Management Plan - North Fork of the Middle Fork of the Willamette Wild and Scenic River. Oakridge Ranger District, Willamette National Forest; January, 1992.

USDA Forest Service, 1993a. Integrated Weed and Management Plan, Willamette National Forest, Eugene, Oregon, April 1993.

USDA Forest Service, 1993b. Willamette National Forest Native Vegetation Policy, 1993

USDA Forest Service, 1993c. Final Environmental Impact Statement, Warner Fire Recovery Project. Oakridge Ranger District, Willamette National Forest. Pacific Northwest Region.

USDA Forest Service, 1993d. A First Approximation of Ecosystem Health on National Forest System Lands. Pacific Northwest Region, June, 1993.

USDA Forest Service 1994a. Soil Resource Inventory Data Dictionary, Willamette National Forest, July, 1994.

USDA Forest Service, 1994b. Soil Resource Inventory, Willamette National Forest

USDA Forest Service, 1994c. Willamette National Forest Special Forest Products Environmental Assessment; Pacific Northwest Region.

USDA Forest Service, USDI Bureau of Land Management, 1993. Conservation Strategy, Frasera umpquaensis. USFS Pacific Northwest Region, Umpqua, Rogue River, Willamette, and Siskiyou National Forests; USBLM, Meford and Eugene Districts. September, 1993.

USDA Forest Service, USDI Bureau of Land Management, 1994a. Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl - Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. April, 1994.

USDA Forest Service, USDI Bureau of Land Management, 1994b. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl, Volume I. February, 1994.

USDA Forest Service/USDI Bureau of Land Management, 1995. Ecosystem Analysis at the Watershed Scale, Version 2.1 (The Revised Federal Guide for Watershed Analysis) Review Draft. United States Department of Agricultural and United States Department of the Interior, Portland Oregon, March 24, 1995.

USDA, 1995b. Willamette National Forest Wildlife Habitat Data Base, 4/28/95

Wade, M. A. and J. S. Ziller, 1995. Upper Willamette Fish District Stock Status Review; April 11, 1995. Oregon Department of Fish and Wildlife, Springfield, Oregon.

Willamette Basin Task Force, 1969. The Willamette Basin, A Comprehensive Study of Water and Related Land Resources. Pacific Northwest Basin Commission.

Willamette Kayak and Canoe Club, 1986. Soggy Sneakers Guide to Oregon Rivers. p.78.