SECTION VII
RIPARIAN RESERVE EVALUATION

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SECTION VII
RIPARIAN RESERVE EVALUATION

VII.1 - CHARACTERIZATION

This module analyzes the interim Riparian Reserve overlay, regardless of the underlying land use allocation (e.g., whether Matrix or LSR). The Northwest Forest Plan identifies Riparian Reserves as providing "an area along all streams, wetlands, ponds, lakes, and unstable and potentially unstable areas where riparian-dependent resources receive primary emphasis" (USDI 1995a, pg. A-5).

REFERENCE CONDITIONS

ANALYTIC QUESTION VII.1.1

What was the historic condition of riparian vegetation?

Refer to Analytic Question V.1.1 for a description of four riparian forest reference stands in the analysis area.

ANALYTIC QUESTION VII.1.2

What was the historic condition of riparian species and habitats?

Riparian-associated species composition has probably been altered since the beginning of European settlement, about 140 years ago (FEMAT 1993). For example, species associated with red alder may well have increased in abundance and distribution. In contrast, species dependent on historical riparian forests have most likely declined. In many instances habitat loss, fragmentation, degradation, and competition and/or predation from exotics have contributed to declines. For example, species such as southern torrent salamanders and tailed frogs, which require clear, cool water and specific micro-climate conditions have been adversely impacted. Other species, such as beaver, have exhibited population declines due to removal efforts by humans.

CURRENT CONDITIONS

ANALYTIC QUESTION VII.1.3

What criteria were used to delineate interim Riparian Reserve boundaries on intermittent streams?

Riparian Reserve widths are described on pages C 30-31 in the FEIS ROD S&G (USDI 1995a). Riparian Reserve widths are defined based on the most limiting of the following criteria:

- the extent of unstable or potentially unstable areas,
- the top of the inner gorge,
- the extent of riparian vegetation,
- the outer edges of the 100-year floodplain, and
- the height of a site-potential tree.

The following section explains how these criteria have been used to delineate interim Riparian Reserve boundaries on Federal lands.

Extent of unstable or potentially unstable areas

Analyses were performed to evaluate surface erosion (using the Modified Soil Loss Equation [MSLE]) and mass wasting processes (using the Infinite Slope Equation [ISE]). A detailed description of the methods and assumptions used in these analyses are presented in Appendix K. Maps A.26a through A.31a (Appendix A) show the results of the surface erosion modeling (MSLE) in units of tons of soil/ac/year for each subwatershed. It should be noted that the data presented in these maps represent potential surface erosion (on-site losses), but not sediment delivery.

Maps A.26b through A.31b (Appendix A) show results of mass wasting modeling (ISE) for each subwatershed. ISE modeling derives a “factor of safety”. This is a ratio of the opposing forces acting on a slope. Factors of safety approaching one indicate areas with a high probability for failure while higher values indicate decreasing probability of failure.

Maps A.5, A.6, and A.32 (Appendix A) portray geology, landslide potential for soil map units, and potentially unstable lands (TPCC withdrawals) respectively.

Top of the inner gorge

The inner gorge may also be used to delineate Riparian Reserve boundaries in some places. For this evaluation, an inner gorge is defined as the first slope break above the active channel margin and terraces. Typically, an inner gorge break would only be used to define a Riparian Reserve boundary within a canyon or similar geomorphic feature. Brewster Gorge is one example where an inner gorge break may be useful in defining Riparian Reserves.

Extent of riparian vegetation

The extent of riparian vegetation may be used to delineate Riparian Reserves in some places. However, the water-dependant vegetation width is very narrow in this analysis area. It is highly unlikely that riparian vegetation would extend the Riparian Reserve beyond one-quarter to one-half site-potential tree height.

Outer edges of the 100-year floodplain

The width of 100-year floodplains are narrow in the analysis area because most streams are at the base of narrow canyons or dissected slopes and are entrenched (hillslope constrained). A few possible exceptions are the mainstem East Fork Coquille River in Brewster Valley and downstream from the confluence with Weekly Creek.

Height of a site-potential tree

The site-potential tree height for this analysis area was calculated to be 220' (see Appendix L for the site potential tree height determination data).

Application of interim Riparian Reserve delineation criteria

The site-potential tree height defines the widest interim Riparian Reserve boundaries in nearly all areas of the watershed. Using the 220 ft. site-potential tree height and the stream network from the GIS database, total interim Riparian Reserves of approximately 25,047 acres were calculated (≈55% of the federally-managed land, which is 53% of the entire watershed, see Table III.1). This acreage estimate does not distinguish between intermittent and perennial streams. Sources of error in this estimate include unmapped streams and the difference between the actual location of the interim Riparian Reserve boundary (based on actual slope distance) and the computer-generated boundary (based on the District average slope of riparian areas (51%).

ANALYTIC QUESTION VII.1.4

What physical and biological criteria will be used to delineate the upper and lower extent of intermittent streams?

Final identification of intermittent streams must be made in the field, based on the following definition and supporting rationale:

> Intermittent streams are defined as any nonpermanent drainage feature having a definable channel and evidence of annual scour or deposition. This includes what are sometimes referred to as ephemeral streams if they meet these two physical criteria (USDI 1995a:B-14).

Defining the upper extent of intermittent stream channels

The following are interpretations of terms used in the Northwest Forest Plan (USDA and USDI 1994) to aid in the delineation of the upper extent of intermittent streams (Meinzer 1923):

- To be a **nonpermanent drainage feature**, the stream should have a flow duration of less than 80% of the time.

- A **definable channel** should have observable bank and bed features. The channel should be able to convey streamflow, and be essentially continuous. A definable channel can exist even though large organic debris may at times be lying in the channel or partially obscuring the channel.

- **Annual scour** or deposition usually is evidenced by distinct physical features. These may include: a stream scour line on the edges of the active channel; substrate in the channel more rounded than angular; evidence of bank-cutting on the outside of bends; or sediment accumulations behind obstructions in the channel.

Defining the lower extent of intermittent channels at the perennial interface

Flow recession analysis may be used to determine if a stream segment dries in late summer. This procedure involves comparing flow recession at a gaged site to a smaller drainage, using an area adjustment technique.

Biological criteria may also be used to distinguish between perennial and intermittent streams, and to determine the upstream terminus of perennial surface flow. The presence of aquatic invertebrates with protracted larval histories (> 1 year) (*Lara avara, Juga spp., Philocasca rivularis*), larval amphibians (tailed frogs, Southern torrent salamanders, Pacific giant salamanders), or aquatic bryophytes (such as *Brachythecium frigidum*), strongly indicates perennial flow (Wagner 1998).

Once a field determination has been made that a given stream segment is intermittent, this information should be incorporated into the appropriate GIS theme.

ANALYTIC QUESTION VII.1.5

What criteria will be used to delineate final Riparian Reserve boundaries along intermittent streams and other waterbodies?

Any modifications of interim Riparian Reserve boundaries must be analyzed at the watershed and the site level and tailored to specific features of the site. Critical habitats must be protected, unstable landforms avoided, needs of terrestrial wildlife species considered, and risks to infrequent perturbations such as windthrow, wildfire and floods minimized. Furthermore, stream shading, LWD recruitment and other water quality and stream channel processes required to perpetuate a functioning stream delivery system and high water quality need to be maintained. Proposed modifications must maintain or restore all elements identified in the Aquatic Conservation Strategy Objectives. To this end, the following recommendations are intended to guide an interdisciplinary team in subsequent site-level analysis and planning:

- Seeps/springs/wetlands - ensure they are included within Riparian Reserves and that the reserve widths are sufficient to maintain the characteristics of the site (i.e.; shading, cool water, sediments, stable substrates, similar flow patterns/timing, maintenance of riparian vegetation, etc.) Pages C-30 and C-31 of the ROD (USDI 1995a) should be referenced in the decision process for management of wetlands, seeps and springs.

- Rocky habitats - Where rocky habitats occur within interim Riparian Reserves, ensure that buffers are sufficient to maintain the characteristics of the site (i.e., temperature, humidity and wind velocity). For example, interim Riparian Reserve widths should not be reduced where such reductions would isolate rocky habitats identified as TPCC withdrawal areas.

- In order to support well-distributed populations of Northern spotted owls, dispersal habitat (conifer stands 40+ years old) should be maintained in at least 75% of the Riparian Reserve acreage, measured across the watershed as a whole.

- Only ≈ 22% of Riparian Reserves are presently >160 yrs of age (see AQ: IV.1.18); most of which is in the Brummit Creek subwatershed (which is LSR). Therefore, at present the old-growth forest component of the Riparian Reserves may not be adequate to support well-distributed populations of plant, invertebrate, and vertebrate riparian-dependent species throughout the watershed. Additionally, because of the current condition and bimodal ageclass distribution within the Riparian Reserves, very little accrual of functional old-growth habitat is possible for several decades (Appendix A - Map A.33). Any modification of interim reserve widths which reduces functional late-successional or old-growth riparian habitat, or retards the accretion of this habitat from the 80+ age class, is likely to slow or prevent attainment of ACS objectives. Therefore, modifications to interim Riparian Reserve boundaries in areas with functional late-successional or old-growth riparian habitat are not recommended at present.

- Interim Riparian Reserve boundaries should be maintained in areas subject to mass wasting or shallow rapid debris flows (see the ISE maps [Appendix A - Maps A.26b through A.31b]). These and Appendix A - Map A.10 (Slope Classes) are intended to be used by the EA interdisciplinary team to identify areas of relatively high and low stability. In these areas modification of the interim Riparian Reserve boundary may be appropriate. It should be noted that the maps are model outputs and require field verification. The maps are perhaps most useful for prioritizing areas for field review, and graphically illustrating similarities and differences in stability across the landscape. Analysis of unstable areas, including a landslide inventory, is presented in Section III.7.

- Research indicates that the majority (85-90%) of LWD in streams is recruited from within 30 meters of the stream bank. Therefore, harvesting within 30 meters of the channel will result in decreased delivery of woody debris from conifer trees (McDade *et al.* 1990, Ursitti 1991). Riparian Reserves should be at least 100' wide on each side of intermittent streams to maintain LWD dynamics; except:

  - where a ridge line exists within 100' of a stream, in which case the ridge line may be used to delineate the Riparian Reserve boundary, and

- where discontinuous/disjunct stream channels preclude the possibility of downstream conveyance of LWD, in which case an appropriate site-specific prescription could be developed to maintain the characteristics of the site.

- The predictive tools or models used to determine the lower boundaries of intermittent stream channels, and field reviews using observed physical or biological indicators to delineate these channels, need to be monitored to validate the processes. A sample of intermittent channels should be visited in September-October to determine the presence or absence of streamflow and key supporting biological indicators. Flow recession analysis needs to be completed to ensure low flows of the season fall within the 80% flow duration, based on the years of record. This information will help adjust and build the stream delineation methods for intermittent streams.

ANALYTIC QUESTION VII.1.6

What is the theoretical distribution of intermittent streams within Riparian Reserves?

A theoretical stratification process to identify intermittent channels (Appendix A - Map A.34) indicates that approximately 6,339 acres of Riparian Reserve (25.3% of Riparian Reserves in the analysis area) is adjacent to intermittent streams. The theoretical distribution of intermittent streams used various assumptions explained in Appendix M. According to this distribution, there are 231 miles of modeled intermittent channels in the analysis area, 108 miles of which are on BLM lands. If a summer dry period lasts longer than 90 days (without a fall freshet), many second-and third-order streams on high permeability soils will become intermittent.

ANALYTIC QUESTION VII.1.7

What is the current condition of riparian vegetation?

Riparian area vegetation is dominated by a mixed conifer/hardwood overstory. In some areas the distinction between riparian and upland vegetation may be obscured by low moisture gradients between these communities (Pabst and Spies 1998). For example, upland vegetation occurs adjacent to many first order and intermittent streams. On streams with broad floodplains and terraces riparian and upland communities are more distinct. The input of LWD also provides a link between upland and riparian vegetation. Many upland plant species occur in riparian zones on large fallen logs. Riparian vegetation, while representing a small portion of the landscape, provides unique habitats and environmental conditions which are utilized by a distinct suite of plant and animal species.

Vegetation composition at the site level in Coast Range riparian forests appear to be variable; similar sites (i.e., same topographic position, aspect, slope) can have different plant communities. This variability results from the combination of several factors, including:

- hillslope processes and associated moisture gradients,
- hydrologic disturbances,
- tolerance to saturated, valley-floor soils,
- individual species tolerance to shade, and
- mineral soil disturbance (Pabst and Spies 1998).

Other factors that may further influence vegetation along riparian zones include landform, topography, proximity to stream channels and overstory tree composition. Pabst and Spies (1998) determined that riparian vegetation in Coast Range forests are highly variable and that vegetation composition is ordered along an interaction of different environmental gradients (moisture, shade, and slope position) from streamside to hillslope.

Riparian overstory vegetation consists of conifers; Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western red-cedar (*Thuja plicata*), and Port-Orford-cedar (*Chamaecyparius lawsoniana*). Hardwood trees include; bigleaf maple (*Acer macrophyllum*), myrtle (*Umbellaria californica*), and red alder (*Alnus rubra*). Hardwoods, especially bigleaf maple, within riparian areas are festooned with epiphytic bryophytes. In some cases, the biomass and mineral content of these bryophytes is greater than the leaves on the host tree (Nadkarni 1984). These plant communities include an unique assemblage of other vascular and non-vascular plant species.

Streams with higher disturbance frequencies are primarily dominated by red alder. However, the associated terraces and floodplains are normally dominated by longer-lived hardwoods, such as bigleaf maple and myrtle. In the high disturbance communities, the understory is almost always composed entirely of salmonberry (*Rubus spectabilis*). According to Henderson (1978) and Hemstrom and Logan (1986) the red alder/salmonberry association is a climax plant community. An example of this plant community is evident along West Fork Brummit Creek just above Jackson Park (T28S, R10W, Section 3).

Salmonberry is a shade-intolerant species (Barber 1976; Pabst and Spies 1998) with an important competitive characteristic; it breaks dormancy very early in the spring. This characteristic helps it get established and out-compete other shrub and herbaceous species which are common to drier sites. This trait also allows it to inhibit establishment of other plants including conifer trees. Carlton (1988) found that species diversity was lower in the red alder/salmonberry community than other red alder community types.

Along with red alder and bigleaf maple, myrtle is one of the three dominant hardwood trees found in riparian areas. This species typically occurs on mesic sites, such as well-drained alluvial benches and terraces, valley bottoms occasionally subjected to seasonal inundation, or well-watered slopes and along streams (Burns and Honkala 1990b). In certain areas (primarily alluvial benches and terraces) myrtle forms dense closed-canopy stands with little or no understory vegetation; probably a result of chemical properties in the leaf litter, an allelopathic property (Tinnin and Kirkpatrick 1985). In other areas, myrtle is a co-dominant with other hardwoods and conifers. Myrtle is considered a climax species within these riparian habitats (Barbour 1987). Following disturbances myrtle has the ability to sprout from the root crown (Burns and Honkala 1990b) giving it a competitive edge over other species.

Streams with low disturbance regimes are dominated by vegetation which more closely resembles the upland vegetation. The overstory canopy is dominated primarily by conifer species with a minor hardwood component. Examples of this can be seen along upper Deadhorse Creek (in T28S, R9W, Section 5) and upper portion of the East Fork Coquille mainstem (in T28S, R9W, Section 9).

ANALYTIC QUESTION VII.1.8

What is the current distribution of riparian species?

See Appendix N for development of list of "species of concern" for Riparian Reserves. The following discusses species of concern, as defined by the Federal Guide for Watershed Analysis (Version 2.2), Riparian Reserve Evaluation Techniques and Synthesis, in Appendix B (as shown below on Table VII.1).

Table VII.1
Ecological Classification for Species Of Concern

SPECIES	HABITAT ASSOCIATIONS						
	Late-Success.	Riparian	Aquatic-Lentic	Aquatic-Lotic	Seeps, Springs	Rock Outcrops	Other
BRYOPHYTES							
Diplophyllum plicatum	X	X					
Kurzia makinoana	X						
FUNGI							
Clitocybe subditopoda	X						
Phlogiotis helvelloides		X			X		
LICHENS							
Lobaria linita	X						
Nephroma occultum	X						
Pannaria rubiginosa	X	X					
Pseudocyphellaria rainierensis	X						
Calicium spp.	X						
Chaenotheca spp.	X						
Usnea longissima		X					
Cetrelia cetrarioides		X					
Leptogium saturninum		X					
Platismatia lacunosa		X					
Ramalina thrausta		X					
VASCULAR PLANTS							
Iliamna latibracteata		X					

SPECIES	HABITAT ASSOCIATIONS						
	Late-Success.	Riparian	Aquatic-Lentic	Aquatic-Lotic	Seeps, Springs	Rock Outcrops	Other
Euonymus occidentalis		X					
AMPHIBIANS							
Dunn's salamander	X	X			X	X	talus
Southern torrent salamander	X	X	X		X		
Tailed frog	X	X	X		X		
FISH							
Chinook salmon (fall)				X			
Coastal cutthroat trout			X	X			
Coho salmon			X	X			
Pacific lamprey				X			
Winter steelhead				X			
MAMMAL							
White-footed vole		X					
BIRDS							
Northern spotted owl	X						snags
Bald eagle	X	X	X	X			snags

Bryophytes

Diplophyllum plicatum

This species has recently been documented on the boles of old-growth western hemlock and western red cedar along the Doerner Fir trail near a 1st order stream. Another new site is near the Cherry Creek Research Natural Area in the adjacent North Fork Coquille watershed. This new site, along the lower slope of a Riparian Reserve, is currently the southern-most known location, indicating the species may be more widespread than previously thought. Christy and Wagner (1996) suggest the habitat for this species occurs in areas where humidity is high and temperatures are cool throughout the year. This species (at least in the southern part of its range) would most likely be considered riparian dependent, since the environmental conditions indicated by Christy and Wagner (1996) are more common in riparian zones. This species currently is not known to occur on hardwoods.

Kurzia makinoana

There are no known locations of this species in the watershed, although its habitat is present. This is probably because the species is minuscule and difficult to detect. Very little is known about this species because so few sites are known in the Pacific Northwest. It is thought that this species occurs in moist, shady areas on organic substrates (Christy and Wagner 1996). The Northwest Forest Plan (USDA and USDI 1994: Appendix J2) states that this species occurs on well-shaded rotten wood and humic soil at low elevations, especially on stream terraces and other cool, moist late-successional forest locations. This species would most likely occur within the outer half of Riparian Reserves. This species would not be considered riparian dependent, but one benefitting from Riparian Reserves.

Fungi

Clitocybe subditopoda

This species is a saprobe occurring in needle duff. There are no known locations in the analysis area. The nearest known location in Oregon occurs on the Mt. Hood National Forest (Castellano and O'Dell 1997) but the Addendum (Species Information) to Appendix B of the Riparian Reserve Evaluation Version 2.2 (REO 1995) indicates the suspected range includes most of Coos County. This species is most likely dependent on late-successional habitats and would not be considered riparian dependent. It would occur in the outer half of Riparian Reserves.

Phlogiotis helvelloides

This species occurs on soil, apparently growing on buried woody debris (USDA and USDI 1994, Appendix J2) in very moist areas near seeps (REO 1995). It appears this species is riparian dependent, occurring in cool moist riparian zones, including small intermittent streams. It also is dependent on a supply of LWD. Very few locations of this species are known in the Pacific Northwest, but it is suspected to occur throughout the region. Reduction of Riparian Reserve widths or implementing projects within these areas may have a direct effect on this species by altering the microclimate and reducing the quantity/quality of LWD.

Lichens

Lobaria linita

This species is an epiphyte on conifer trees and shrubs (McCune and Geiser 1997) within late-successional forests. There are no known occurrences of this species locally, but potential habitat is present in late-successional forests. This species would not be considered riparian-dependent, but may occur within these areas when habitat is present.

Nephroma occultum

This is another late-successional species that occurs on the bark and wood of conifer trees (McCune and Geiser 1997). This species is not considered riparian dependent, but would benefit from Riparian Reserves, especially those with appropriate habitat conditions. Although the species has not been found in the Coos Bay District, recent discoveries on the Roseburg District suggest that it may also occur within the analysis area.

Pannaria rubiginosa

This wide-ranging, but rare species occurs on bark of conifers and hardwoods within cool moist late-successional habitats (McCune and Geiser 1997). There are no known locations in the area, but habitat appears to be present. While this species appears not to be riparian dependent, it would benefit from maintenance of existing Riparian Reserves.

Pseudocyphellaria rainierensis

This species appears to be restricted to moist old-growth forests at low to mid-elevations (McCune and Geiser 1997). It is not known in the analysis area, but like *Nephroma occultum*, it was found on the Roseburg District. This is one of the rare species occurring in the lower and mid-canopy of these forests. This is not a riparian-dependent species, but benefits from Riparian Reserves. This species most likely would occur in the outer half of these reserves, but could occur throughout if appropriate conditions are present.

***Calicium* and *Chaenotheca* spp.**

These diminutive lichen species resemble small pin heads arising from the bark of leaning tree boles and hard snags in late-successional forests. They typically occur in sheltered microsites with high humidity provided by late-successional forest conditions (Goward 1992). They are specific to substrates and texture. Some species occur on rough textured Douglas-fir bark, while others occur on the smoother bark of cedars, true firs and hemlock. They can occur in younger forests, providing the structures are present, but are more abundant in late-successional/old-growth forests. Because of their habitat specificity, these species are considered dispersal limited. These species would not be considered riparian dependent, but could occur throughout riparian habitats if the appropriate substrate and environmental conditions are present.

Usnea longissima

This species is near the southern extent of its range (McCune and Geiser 1997). Sites are scattered throughout the analysis area and it can be locally abundant. Sites in the analysis area occur along the East Fork Coquille mainstem and major tributaries (lower Brummit Creek). This species occurs within riparian habitats (occasionally can occur in upland sites), typically draping on conifers and hardwood branches. It primarily occurs in broadened valleys in areas with cold air drainage. This species is dispersal limited, since its primary mode of reproduction is through fragmentation of its thalli. These fragments typically only disperse locally.

Cetrelia cetrarioides*, *Leptogium saturninum*, *Platismatia lacunosa*, and *Ramalina thrausta

These are a few species which appear to be restricted to hardwood bark, especially older red alder (McCune and Geiser 1997). No locations are known, but the analysis area is within the suspected range and potential habitat is present. These species are known sporadically throughout their range, indicating that few surveys have been done. Critical conditions for these species is the defoliation of hardwood leaves in the fall which allows more light penetration and direct moisture into the canopy. This frequency of lighting and moisture are important conditions which greatly influence their distribution and abundance.

Vascular Plants

Iliamna latibracteata

This species is endemic to southwest Oregon and northwest California. It occurs in moist habitats in conifer forests and stream sides (Hickman 1993). Locations are not known within the analysis area but one location is known in the Big Creek subwatershed, adjacent to the south. It is likely that the analysis area may be beyond the range of this species. While not a true riparian species, it would benefit from existing Riparian Reserves.

Euonymus occidentalis

This species appears to be relatively uncommon, but occurs over a wide range. One location has been documented within the Camas Creek sub-basin (T28S, R9W, Section 21). Habitat is moist coniferous forests (Abrams 1951) to streambanks (Hickman 1993). This species appears to be a riparian-dependent occurring primarily in mixed hardwood conifer forests. It's wide range is most likely a result of dispersal of seeds by birds.

Amphibians, Mammals and Birds

For a description of these species of concern listed in Table VII.1 and their habitat requirements refer to Analytic Question V.3.1.

ANALYTIC QUESTION VII.1.9

What Riparian Reserve habitat types are present and what species are associated with them?

Late-successional Forest

Forested stands greater than 80 years-old are considered late-successional habitats (USDI 1995a). Currently, the Riparian Reserves contain approximately 9,568 acres (38.2% of 25,047 acres) of this habitat (see Figure V.2). Late-successional forest habitats in Riparian Reserves are typically confined to low-order streams where terrestrial vegetation occurs adjacent to streams, or to the periphery of the water-influence zone on high-order streams. The distribution of these habitats is discussed above (see AQ VII.1.5 and Appendix A - Map A.33). Although important for riparian-dependent species, these habitats also provide benefits to many terrestrial species. They provide dispersal corridors within and between LSRs and the vertical structure supports a diversity of different species groups. For example, these habitats provide foraging, roosting, reproduction, and hibernation sites for bats and dispersal corridors for martens and northern spotted owls. They also provide refugia for dispersal-limited species such as mollusks and lichens, which can re-colonize adjacent terrestrial habitats as they become available.

Riparian

Riparian habitat is found within the zone of water influence, including channel margins, low terraces and floodplains. These areas may be characterized by the presence of multiple terraces, woody debris deposited during high flows, or variable soil moisture conditions. True riparian areas exhibit vegetative communities much different than adjacent terrestrial vegetative communities (see AQ VII.1.7). Riparian areas provide habitat for a wide range of species, depending on the vegetative characteristics. Some riparian-associated species, such as beavers, bats and amphibians, depend on these habitats for all or portions of their life cycle.

Aquatic (lotic)

These habitats include the streams themselves and the immediate streambank and splash zones. The analysis area contains approximately 998 miles of lotic habitats, ranging from low-gradient 7th order streams, to high gradient, intermittent streams (Appendix A - Map A.35). Most of the aquatic species of concern depend on stream habitats for all or part of their life cycle. For example, southern torrent salamanders inhabit high-gradient headwater perennial streams with high quality water and low temperature. Pacific giant salamanders inhabit headwater and lower order perennial streams. Tailed frogs are found primarily in larger perennial streams, often with high gradient. Foothill yellow-legged frogs inhabit still larger streams. Beaver use low-gradient streams with wide floodplains.

Aquatic (lentic)

Numerous pond habitats have been identified, primarily on private land. In addition to those created by beaver, the most notable ponds are located in the floodplain/terrace along the East Fork Coquille mainstem downstream of Elk Creek, the sinks in T28S, R10W, Section 16, and on the north side of Brewster Gorge in T28S, R10W, Section 9 NW¼ (see Map A.35). Lentic habitats are also provided by numerous pump chances and two heliponds in the analysis area.

Seeps and Springs

Seeps and springs are unique among aquatic habitats because they contain microclimate and habitat conditions not found elsewhere. These special habitat conditions support rare and unique species (such as amphibians, molluscs, and other invertebrates), and facilitate dispersal (by providing aquatic "stepping stones") across the watershed for other aquatic associates (Gibbs 1993, Dodd and Cade 1998). Seeps and springs often are associated with geologic faults and soils having low permeability rates (0.2- 0.6"/hr), such as the Preacher-Bohannon soil type (46). Additionally, seeps and springs may be located along contact zones where low permeability soils occur downslope from highly permeable soils. In such situations, groundwater travels downslope through permeable soil until it encounters less permeable soils (or bedrock), at which point the ground water may be forced up to the surface. Roads that intercept groundwater may also produce seeps.

Rocks and Talus

These habitats include rocky outcrops and talus slopes. Like seeps and springs, they provide habitat-types (such as rocky crevices) not found elsewhere. These habitats are relatively common in the analysis area, and critically important for species such as the peregrine falcon, Dunn's salamander, bat species (roosting, reproduction, and hibernating locations), as well as many invertebrates, fungi and lichens. See Appendix A - Map A.35 (Special habitat types) for locations of known rocky outcrops. See Sections V.2 and V.3 for further discussion.

Down Logs

Numerous wildlife species including many invertebrates depend heavily on down log habitat. Riparian Reserves contain critically important down log habitat at higher levels than are available in the adjacent GFMA (Spies *et al.* 1988). Due to their distribution, Riparian Reserves will provide this habitat across the landscape to serve as centers for re-colonization. Down log habitat in the Riparian Reserves is particularly important for pine marten denning and foraging, bat roosts and as habitats for a myriad of amphibians and invertebrates. Their proximity to streams offer the possibility of unique microclimates which are cooler and moister than similar habitats inupland areas.

Down log habitat is scarce on private lands. Given the level of salvage in the past and road location on BLM-administered lands, many Riparian Reserves have already been salvaged and are deficient in down log habitats. See Sections V.2 (AQ V.2.3 & V.2.8) and V.3 (AQ V.3.3) for further discussion.

Snags

Numerous wildlife species including many invertebrates depend heavily on snags. Snag habitat in Riparian Reserves is critically important since management restrictions allow for

providing substantially higher levels of snag habitat than will be possible in the GFMA (Spies *et al.* 1988). High densities of snags in Riparian Reserves in a network across the landscape may serve as centers for re-colonization. These habitats are particularly important for pine marten (denning and foraging), bats (roosting, reproduction, and hibernation), as well as a large number of invertebrates and molluscs. Snag habitat is less abundant on private lands, but also is deficient in many areas on BLM land because of past salvage. See Sections V.2 and V.3 for further discussion.

POTENTIAL FUTURE CONDITION

ANALYTIC QUESTION VII.1.10

What is the likely future condition of vegetation and habitat in Riparian Reserves?

Under the current management strategy, riparian vegetation in areas without frequent disturbances will advance into older forest age classes. Over time these habitats will become more contiguous and structurally diverse (i.e., more heterogeneous canopy, snags, down wood). However, this transition may not occur in areas with frequent disturbance; while in other areas it may take many decades.

Riparian areas with periodic larger-scale disturbance events (landslides, debris torrents, etc.) will be dominated primarily by hardwoods such as red alder and shrubs such as salmonberry. These conditions may be considered a disturbance climax plant community (Hemstrom and Logan 1986). Under these conditions these stands will most likely remain the same over time.

ANALYTIC QUESTION VII.1.11

What is the likely future condition of riparian species?

Species composition in the future will most likely remain the same as today. In areas where forests mature, species dependent on these habitats will most likely increase. This will depend on the distribution of remnant populations and the ability of individual species to re-colonize. Landscape-level connectivity will facilitate the dispersal of aquatic/riparian and terrestrial species. Improved connectivity within the riparian/aquatic systems and across the landscape will facilitate movements and genetic interchange of wildlife; however, more limited riparian protection on interspersed private lands will continue to hinder connections for some species, particularly less mobile species. In riparian areas with widespread chronic disturbances, the species composition will most likely remain the same (FEMAT 1993).

VII.2 - RIPARIAN RESERVES VALUES

ANALYTIC QUESTION VII.2.1

What are the physical and biological values associated with these Riparian Reserves?

See Section V for the detailed discussion of ecological values of riparian areas. Riparian Reserves are designed to protect the physical and biological values (described in the ACS objectives [USDA and USDI 1994]) associated with riparian areas and benefit upland species. These physical and biological values include:

Structural Complexity

Riparian zones are characterized by assorted physical processes, such as: earth movement, deposition, erosion and disturbance which create an array of terraces, old channels, standing and down wood, snags, etc. Streamside vegetation often offers a structural contrast to upland habitats within Riparian Reserves.

Diverse Array of Soil Moisture Conditions

In the eastern half of the analysis area (Tyee formation) the soil textures are generally of the sandy or sandy loam type. These soils infiltrate moisture quickly but hold little in reserve for plant growth. Some soil types (4D, 14, 15, and 38F) are very dry in the summer and tend to support species that can endure more xeric conditions.

In the western half of the analysis area the soils carry a higher percentage of clay and are slower to infiltrate, but have higher available moisture contents later in the summer. These soil types (22 D & E, 46 D -F) and the soils found on the agricultural terraces along the mainstem, support species that can endure more mesic conditions. Hay fields and hardwood communities are found growing on the terraces, and tree species such as cedar and grand-fir grow on the uplands.

In addition to this general trend, there are many soil types that have layers that restrict or increase the infiltration of water to the ground water reserves. At times, contact between soil types can lead to water being held higher in the soil profile against the forces of gravity. When these situations are interrupted, such as adjacent road cuts or stream channels, the water emerges from the side of the hill. This can cause springs and seeps to develop, but the flow of water is minimal and does not normally establish a defined channel.

Riparian Reserves within the analysis area experience variable moisture regimes. Climatically, the western part of the analysis area is within the Coastal Maritime influence zone while the east end is in the Camas Valley rain shadow. However, orthographic lifting from west to east tends to decrease variation in average precipitation. The most moisture falls in the snow zone (see Appendix A - Map A.12); the higher elevation areas within Brummit, Upper East Fork and Camas subwatersheds. However, lower elevation areas in these eastern three subwatersheds

do not receive as much moisture as do areas at the same elevation in the western three subwatersheds (those under the influence of Coastal Maritime climate).

In addition to orthographic lifting and distance from the ocean, aspect is another factor which alters soil moisture in Riparian Reserves. North- and east-facing slopes always are wetter than equivalent south- or west-facing slopes. For example, an area in the Brummit subwatershed (generally south-facing) could be drying out while an area in the Camas subwatershed with the same soil type and elevation could be releasing groundwater to an intermittent stream.

Diversity of soil moisture conditions provides habitat parameters necessary for many plant and animal species to complete their life cycle. In the riparian area some plants and animals may depend on the continued moisture throughout the summer even if it is at a very low quantity.

Plant and Animal Diversity

Diversity and complexity of habitat features is important for maintaining plant and animal species diversity across the landscape (Noss and Cooperrider 1994). Interfaces between upland and riparian forest and those between riparian vegetation and stream channel promote riparian species diversity, as does the proximity of water in general.

The Riparian Reserve network is designed to maintain and restore well-distributed populations of native riparian-dependant and aquatic species and facilitate the appropriate plant and animal diversity.

Sediment Regime

Disturbance in the form of extensive fires and harvest-related operations have occurred in the last 140+ years. As a result, delivery and storage of sediment in all sizes has varied dramatically. Removal of large woody debris (for navigational purposes) and splash damming in the lower river section decreased sediment storage and allowed channels to downcut, delivering even greater quantities of stored materials from the bank margins.

Harvest operations and road construction have increased the rate of landslides (an in-depth discussion can be found in AQ III.7.5, and III.7.6). Those that occurred after fires or harvest operations have replaced some exported sediments. However, road construction activities adjacent to and crossing over the stream network have increased the amount of fines – while also limiting the delivery of coarse materials (through interception). This has resulted in a disproportionate amount of fine sediments delivered to streams. Delivery of woody materials associated with landslides (and necessary for proper riparian function) have been reduced by the same interception.

The amount, type, and rate of sediment delivery can alter the water quality and habitat for many different aquatic organisms. Seasonal changes affect organisms at different stages in their life cycles. Some species may be unable to cope with excessive delivery of sediment during normally low-delivery periods in the late summer. Others may be affected by movement of bed-load in a stream during winter storms or peak runoff times. Maintaining a balance between the incoming, stored and exported sediment is the key for obtaining a proper sediment regime.

Changes in any of these parameters may upset the balance, and exceed an organism's ability to survive.

Water Quality

Riparian areas maintain and restore water quality through interception of sediments and nutrients (Daugharty and Douglas 1994). In addition, topographic and vegetative shading in the riparian area is largely responsible for maintaining desirable water temperatures. Riparian structures (LWD and tree roots) reduce water velocity and maintain bed and bank integrity, thereby reducing erosion from in-channel sources and moderating turbidity.

Water Quantity and Delivery

Riparian areas store and release water, helping to maintain summer base flows and to moderate high flows. Riparian areas also are largely responsible for delivery of LWD to streams, which enhances channel complexity and in-channel storage.

Connectivity and Interspersion of Habitat Features

The network of riparian ecosystems provide spatial and temporal connectivity across the landscape. In addition to providing protective pathways for riparian-associated animals, riparian zones facilitate dispersal between widely distributed upslope habitat areas. Riparian Reserves support two functions for connectivity:

- Landscape scale - Riparian Reserves facilitate the movements of mobile species associated with late-successional habitat as they move between LSRs. Riparian Reserves can serve as "stepping stones", linking late-successional habitat between LSRs.

- Subwatershed/Site scale - Riparian Reserves support persistent populations of relatively immobile species associated with late-successional and riparian habitat, thereby facilitating genetic interchange between adjacent populations and preventing population isolation.

Nutrients

Riparian areas are "sinks" for nutrients. Riparian areas provide the foundation for aquatic foodwebs through the contribution of organic material (leaf and needle litter and animal matter). In turn, invertebrates produced in the aquatic system provide a major food source for many terrestrial animals. Bilby *et al.* (1996) indicates that nutrient cycling within riparian areas results in redistribution of carbon and nitrogen to terrestrial ecosystems.

Refugia

Riparian zones provide refugia for organisms during stress and disturbance. For example, terrestrial animals such as elk and deer utilize riparian zones for thermal regulation during winter and summer months; fish find refugia from high flows in floodplains and off-channel stream habitats. Riparian Reserves play an important role in providing refugia for sessile and less-mobile late-successional species (FEMAT 1993) by maintaining higher quality habitat conditions in relation to adjacent GFMA lands (i.e., high levels of down logs and snags). They also serve as species source-areas for repopulating adjacent areas undergoing harvest and subsequent recovery.

ANALYTIC QUESTION VII.2.2

What are the hazards to these physical and biological values?

Table VII.2 summarizes the risks to Riparian Reserve resource values from potential hazards. It evaluates the likelihood that a given resource value will experience a decrease in function in the short term (zero-to-ten years) and long term (beyond ten years) if a listed hazard occurs. It is important to note that the type and severity of hazard will effect the vulnerability, and that those listed below are intended to reflect the likelihood of exposure. For a detailed discussion on the effects of various management activities on riparian resources, see Section V.

Table VII.2
Hazards to Values Associated with Riparian Reserves

Resource Value	Zone of Effect[1]	Associated species groups by habitat-type	Hazard	Vulnerability of Resource Value to Decrease in Function (short/long term[2])
Structural Complexity	1-5	Late-successional Riparian Lotic Lentic	Harvest Windthrow Landslide Peak/Base Flow Changes Fire	Moderate/Moderate Low/Low Low/Low Moderate/Low Low/Low
Soil Moisture	2 -5	Late-succesional Riparian Seeps/Springs	Harvest Windthrow Landslides Peak/Base Flow Changes Fire	Moderate/Low Low/Low Moderate/Moderate High/Moderate High/Moderate
Microclimate	2-5	All	Harvest Windthrow Landslides Peak/Base Flow Changes Fire	High/Moderate Moderate/Low Moderate/Moderate Moderate/Moderate High/Moderate
Plant & Animal Diversity	1-5	All	Harvest Windthrow Landslides Peak/Base Flow Changes Fire	Moderate/Moderate Low/Low Moderate/Low Moderate/Low High/Moderate
LWD Recruitment-Aquatic	1-4	Late-successional Riparian Lotic Lentic Seeps/Springs	Harvest Windthrow Landslide Peak/Base Flow Changes Fire	High/High Low/Low Low/Low Low/Low Low/Low

Resource Value	Zone of Effect[1]	Associated species groups by habitat-type	Hazard	Vulnerability of Resource Value to Decrease in Function (short/long term[2])
Down Logs	2-4	Late-successional Riparian	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/High Low/Low Low/Low Low/Low Low/Low
Sediment Regime	1-4	Lotic Lentic Riparian Seeps/Springs	Harvest Windthrow Landslide Peak/Base Flow Changes Fire	High/Moderate Low/Low High/Moderate High/High High/High
Streambank/ Slope Stability	1 & 2	All	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/Low Moderate/Low High/Low Moderate/Moderate High/Low
Water Temperature	1-3	Riparian Lotic Lentic Seeps/Springs	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/High Moderate/Low Low/Low Moderate/Moderate High/Moderate
Water Quantity	1-5	All	Harvest Windthrow Landslide/Debris Flow Fire	Moderate/Low Low/Low Low/Low High/Low
Connectivity	1-5	All	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/Moderate Moderate/Moderate Low/Low Moderate/Moderate High/Moderate
Nutrients	1-5	All	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/Low Low/Low Low/Low Moderate/Moderate High/Low
Refugia	2-5	All	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/Moderate Moderate/Low Moderate/Moderate Moderate/Moderate High/Moderate
Snags	3-5	Late-successional Riparian	Harvest Windthrow Landslide/Debris Flow Peak/Base Flow Changes Fire	High/High Moderate/Moderate Moderate/Moderate Low/Low Moderate/Moderate

[1] Zones of Effect:
Zone 1 - Aquatic (includes streams and seeps

Zone 2 - Stream bank (includes splash zone) Zone 3 - Zone of riparian influence (includes area inhabited by riparian vegetation)
Zone 4 - ½ site potential tree height (approximately 110')
Zone 5 - One site potential tree height

[2]Vulnerability/Susceptibility is defined as the potential for the relevant resource value to experience a decrease in function as a result of the identified hazards (should they occur).

VII.3 - SYNTHESIS AND INTERPRETATION

ANALYTIC QUESTION VII.3.1

What is the condition of the Riparian Network with respect to ACS objectives?

There are nine ACS Objectives presented in the ROD (pg. B-11). These are abbreviated below, along with the Analytic Questions (AQ) which discuss each objective.

1)- "Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features...."

Refer to Sections III.7 and III.9 for a discussion of erosion and disturbance processes. Also see AQ V.2.7 and V.2.8 for a discussion of management activities affect on special habitats.

2)- "Maintain and restore spatial and temporal connectivity within and between watersheds...."

Refer to the connectivity discussion within AQ V.2.3 and to Appendix A - Map A.22 (Links). Note that the transportation system has severed connections within the stream network.

3)- "Maintain and restore the physical integrity of the aquatic system...."

See AQ IV.2.1 for a summary of past human affects on aquatic habitat. AQ III.8.2 presents a description of stream types, and AQ III.8.4 discusses their current condition.

4)- "Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems...."

Refer to Section IV.1 for a discussion of water quality.

5)- "Maintain and restore the sediment regime under which aquatic ecosystems evolved...."

Refer to Section III.7 for a discussion of erosion processes. Particularly note AQ III.7.7, as it discuss the affect of sediment delivery on hydrologic processes. Also see AQ VII.2.1.

6)- "Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats to retain patterns of sediment, nutrient, and wood routing...."

Refer to AQ III.8.3 for a description of notable hydrologic features and processes.

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

Refer to AQ III.8.6 for a discussion of causes of change between historical and current hydrologic conditions, and the trend of those conditions.

8)- "Maintain and restore the species composition and structural diversity of plant communities and wetlands...."

Refer to AQ V.1.7 for a discussion of the potential for adequate down wood to streams and riparian areas. AQ IV.1.16 and IV.1.17 discuss relationships between riparian vegetation and water quantity/quality. See AQ V.1.9 for a discussion of trends in riparian area vegetation.

9)- "Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependant species."

See AQ VII.1.9 for a discussion of Riparian Reserve habitat types and associated species.

ANALYTIC QUESTION VII.3.2

What is the significance of differences between expected and existing wildlife habitat in Riparian Reserves?

Because of past management practices, many Riparian Reserves do not currently function at their potential (Spence *et al.* 1996). In order for Riparian Reserves to contribute to connectivity and refugia forwildlife, the majority must be in late-successional habitats and include snag and down log habitats. Only 38.2% of Riparian Reserves currently are in late-successional forests (>80 years of age). It will take about 40 years before more than half of Riparian Reserves are in late-successional condition. More than 80 years are required for the majority of Riparian reserves to contain stands >160 years of age. Many Riparian Reserves contain recent harvest units or have been subject to salvage or snag falling activities which have left them deficient in snag and down log habitat.

ANALYTIC QUESTION VII.3.3

What is the trajectory for the Late-successional Riparian Reserve habitats?

Currently, connectivity and refugia functions for relatively mobile late-successional dependant species are at some risk due to past management activities. However, conditions will improve significantly as habitats in Riparian Reserves mature. The relatively high proportion of Reserves in the analysis area should support the long-term connectivity and refugia functions for relatively mobile wildlife species.

Connectivity for less-mobile organisms should improve as Riparian Reserves attain late-successional status and culverts are upgraded. However, the long-term ability to retain connectivity between areas of optimal habitat will always be compromised as long as riparian roads persist and private lands intersect public lands.

Site-scale Riparian Reserve Characteristics

The following characteristics are important in understanding riparian ecosystem structure and function at the site scale (Gregory *et al.* 1991):

- reference condition,
- position in the stream network,
- duration of flow (i.e., perennial vs. intermittent),
- soil type,
- local climate,
- local topography,
- disturbance regime and history,
- presence and distribution of riparian-dependent and associated species,
- floodplain dynamics,
- fluvial geomorphology (stream type),
- aspect/potential exposure to solar radiation,
- proximity to key habitat features, and
- forest diseases.

ANALYTIC QUESTION VII.3.4

What is the Susceptibility of Riparian Values to Hazards Introduced by Management Activities?

While Table VII.2 discussed the relative vulnerability/susceptibility of the physical and biological riparian reserve values to various hazards, Table VII.3 is an evaluation of the likelihood that the *rate* or *magnitude* of those hazards will increase if certain management activities are carried out.

Table VII.3
Evaluation of the Susceptibility of Various Hazards to Increases in Rate or Magnitude Following a Given Management Activity

Activities Management (carried out with usual BMP under ACS requirements)	Hazard	Susceptibility Of Values To Hazard (from a given management activity)	
		Short Term (< 10 years)	Long Term (10+ years)
Reduction in Riparian Reserve Width (Regen Harvest and accompanying activities)	Landslide/Debris Torrent	Low-Moderate	Low
	Peak/Base Flow Changes	Low	Low
	Water Quantity/Quality	Low	Low
	Sediment Regime	Low	Low
	Temperature/Humidity	Moderate-High	Moderate-High
	Windthrow	Low-Moderate	Low
Density Management, Thinning, PCT, Port-Orford Cedar Treatments	Landslide/Debris Torrent	Low	Low
	Peak/Base Flow Changes	Low	Low
	Water Quantity/Quality	Low	Low
	Sediment Regime	Low	Low
	Temperature/Humidity	Moderate	Low
	Windthrow	Moderate	Moderate
Road-building and reconstruction	Landslide/Debris Torrent	Moderate	Low-Moderate
	Peak/Base Flow Changes	Low-Moderate	Low-Moderate
	Water Quantity/Quality	Moderate	Moderate
	Sediment Regime	Low-High	Moderate
	Temperature/Humidity	Low-Moderate	Low-Moderate
	Windthrow	Low	Low
Road-decommissioning	Landslide/Debris Torrent	Moderate	Low
	Peak/Base Flow Changes	Low	Low
	Water Quantity/Quality	Low-Moderate	Low
	Sediment Regime	Low-Moderate	Low
	Temperature/Humidity	Low	Low
	Windthrow	Low	Low
Riparian Silviculture	Landslide/Debris Torrent	Low-Moderate	Low
	Peak/Base Flow Changes	Low	Low
	Water Quantity/Quality	Low-Moderate	Low
	Sediment Regime	Low	Low
	Temperature/Humidity	Moderate-High	Low
	Windthrow	Moderate	Low
In-stream Projects	Landslide/Debris Torrent	Low	Low
	Peak/Base Flow Changes	Low	Low
	Water Quantity/Quality	Low-Moderate	Low
	Sediment Regime	Low-Moderate	Low
	Temperature/Humidity	Low	Low
	Windthrow	Low	Low

Management Activities Appropriate for Riparian Reserves

The implementation of certain management activities in Riparian Reserves may be appropriate if the effects of those actions *meet* or *do not retard or prevent attainment* of ACS objectives.

Actions proposed for Riparian Reserves should maintain existing conditions or restore the desired condition/ecological function of the site, as defined above (see AQ V.1.11) and the ROD (USDI 1995a: B9-11).

Site-specific analysis is required in order to determine the suitability of a given management action for implementation in a Riparian Reserve. However, management activities listed in Table VII.3 which pose moderate-to-high risk in both the short AND long term should be undertaken with extreme caution or avoided. For example, road-building across stream channels is likely to prevent or retard attainment of ACS objectives in both the short and long term, unless carefully engineered to provide physically unobstructed routes for aquatic and riparian-dependent species and maintain sediment and LWD transport.

Activities (such as road decommissioning, POC treatment, riparian silviculture, in-stream projects) may retard attainment of ACS objectives in the short term (i.e., by increasing sedimentation or by removing riparian vegetation). However, these actions help attain ACS objectives in the long term and are therefore appropriate for Riparian Reserves.

ANALYTIC QUESTION VII.3.5

What are the specific guidelines for modification of Riparian Reserve widths?

Specific guidelines for modification of Riparian Reserve widths are located with other recommendations in Section VIII.