APPENDIX J. Key Ecological Attributes of Focal Conservation Targets

This appendix describes key ecological attributes of six focal conservation targets identified in the Comprehensive Conservation Plan or CCP for Steigerwald Lake, Franz Lake, and Pierce National Wildlife Refuges. Located in the Columbia River Gorge, these refuges are collectively called the Gorge Refuges in the CCP. The six focal conservation targets include riparian system, wetland complex, Columbia River shoreline, grasslands, oak woodland and savanna, and anadromous fish and high-gradient streams. These focal conservation targets are the result of aggregating 41 conservation targets (see Appendix D) into major groupings based on similarity of ecological requirements. Conservation targets are the species, species groups, and communities that represent the biodiversity of the Gorge Refuges. Because the number of conservation targets were too numerous to individually assess in the planning process, focal conservation targets were used as surrogates for the 41 conservation targets. Focal conservation targets are a planning tool which the Service and other agencies participating in the planning process used to identify and analyze threats to biodiversity. Many of the management objectives and strategies developed in the Gorge Refuges' CCP were designed to abate these threats or to enhance the viability of conservation targets.

Key ecological attributes are critical components of a target's life history, habitat, physical processes, or community interaction. In other words, those characteristics that, if degraded or missing, would seriously jeopardize the target's integrity. In most cases, the description of a key ecological attribute defines the desired or optimal future condition of that attribute. This condition is typically the historic condition which existed prior to substantial human related changes to the landscape. The desired future condition may not be achievable in all situations due to the degree of change to ecological attributes. However, threats to biodiversity and opportunities to enhance biodiversity are more clearly identified through comparison of desired conditions with existing conditions. Defining existing biodiversity and assessing its health and condition are essential to meeting the Service's policy on biological integrity, biological diversity, and environmental health (601 FW 3).

Table 1. Attribute description for the riparian system focal conservation target.

Attribute	Description
Litter Depth	Well-developed (i.e., provides hiding cover, breeding sites, favorable microclimates, and foraging substrates for herptiles) and deep enough to retain moisture during summer.
Burrows	Sufficient number of burrows to protect herptiles (e.g., western toad) against dehydration and predation.
Tree Canopy Cover	Greater than 50 percent cover of trees greater than 35 feet for riparian forests. Trees over 13 feet covering less than 20 percent for shrub habitat.[2]
Sub-canopy Cover	Greater than 25 percent.[2]
Shrub Cover	30-80 percent cover of shrubs (native species comprise greater than 60 percent of cover) that are 3 - 13 feet tall; scattered herbaceous openings.[2]
Seral Stage	Structurally diverse habitat patches with at least three distinct layers (canopy, sub-canopy, and shrub) or a juxtaposition of early successional (e.g., willow) with older forest (e.g., cottonwood). Greater than 10 percent sapling cover in the understory.[2]
Native Plant Composition	Native shrub layer dominants include but are not limited to willow, snowberry, cascara, Nootka rose, red-osier dogwood, red alder, spirea, and red elderberry and saplings of native canopy trees. Native sub-canopy trees include black hawthorn, vine maple, big leaf maple, willow, ninebark, hazelnut, and young canopy trees. Native canopy trees include Oregon ash and black cottonwood.[2] Frequently, base of harrier nests are formed using thick-stalked plants (e.g., cattail, alder, willow), and completed with grasses, sedges, and rushes.[13]
Invasive Species	Invasive plants that substantially alter habitat for native wildlife should be reduced or eliminated including reed canarygrass and Himalayan blackberry.
Disturbance Regime	Flooding is the primary natural disturbance regime in Columbia River bottomland forest.[6] Fire may also have had an impact on these forests.

Attribute	Description
Patch Size/Shape	Habitat patches (includes cottonwood and adjacent shrub) greater than 40 acres or greater than 0.5 mile in length. Width of riparian woodland and shrub zone adjacent to aquatic habitats greater than 328 feet or equivalent in size to two to three tree heights.[1,2]
Buffers	Riparian buffer widths 2-3 times the height of adjacent riparian vegetation in high-density stands and 5 times in low-density stands protect core vegetation from wind and evapotransporation.
Adjacent Land Uses	Abundance of brown-headed cowbirds provides indicator of potential impacts from adjacent land uses. Habitat should be 0.6 miles from nearest urban/residential area and greater than 3 miles from high-use cowbird areas (e.g., feed lot).[2] Retain natural buffers along western toad breeding sites pools.[17]
Predator Populations	Parasitism rate of nesting birds by cowbirds should not exceed 5 percent.[2] Cowbird use of riparian areas is discouraged by eliminating cattle grazing and maintaining tall grasses in adjacent grasslands. Levels of predation from domestic and human associated predators are not known to be excessive. Bull frogs and some fish may prey on western toad during aquatic lifestages (breeding and egg/juvenile development).

Table 2. Attribute description for the wetland complex focal conservation target.

Attribute	Description
Hydroperiod	Provide a mosaic of permanent, semipermanent, and seasonal wetlands and low-velocity riverine (stream) systems. Critical hydroperiod for herptiles (e.g., red-legged frog and western toad) is December through May; some non-native predators may be precluded by drying outside this period. **Permanent** water is required for fish and select invertebrates, a food resource for some diving ducks. Shallow margins may support emergent vegetation while deeper areas may only support submergent or floating plant communities; this vegetation would support dabbling and diving species. **Semipermanent** wetlands may host invertebrates tolerant of both permanent or seasonal hydroperiods and species specifically adapted to semipermanent hydrology; this array of invertebrates would favor diverse waterfowl. Occasional draw down of the wetland may promote emergent vegetation benefitting herbivorous and omnivorous waterfowl. **Seasonal** water regime favors annual emergent vegetation which is a primary food resource of some dabbling ducks and swans. This hydrology hosts invertebrate species specifically adapted to seasonally dry or moist conditions, this could be the food source of various waterfowl. Low-velocity wetlands are used by western pond turtle. Standing water that usually exists at least until late spring is preferred for nesting by northern harrier and seed production for Bradshaw's lomatium, but avoid prolonged flooding.[2,24] Significant nesting periods for northern harrier: nest-building (March), incubation (April/May), fledging (June/July).[2] Bradshaw's lomatium emerge in March, flower mostly April to mid-May, set seed in late June or July, dormant mid-July - March.[24]
Water Depth	Provide a range of depths. Red-legged frog and western toad oviposition sites are 10-60 inches and 2-39 inches deep, respectively.[17] For these species, maintain relatively stable water levels from December through May. Western pond turtles in Washington utilize wetlands ranging in depth up to 13 feet. Dabbling ducks require shallow water depths to forage efficiently (4-9 inches) with most duck species utilizing the lower end of range. Dabbling depths for swans exceed 9 inches.[8] Diving ducks will feed on invertebrates and fish at deeper depths.

Attribute	Description
Fish Community	In general, not a critical concern; however, competition for food resources and predation can be a problem.
Vegetation Diversity	Variable diameter emergent plants including grasses and leafy grass-like plants provide oviposition sites; avoid woody stems (e.g. salix and spirea); avoid aggressive smartweeds and cattail; limit/exclude exotic vegetation (e.g., reed canarygrass, iris, loosestrife). Wetlands with reed canarygrass litter cover exceeding 50 percent support few moist soil plant species.[15] High to moderate vegetative diversity offers structural complexity and varied vegetative detritus to the water column favored by a diverse invertebrate community.
Water Quality	Meet or exceed water quality standards of federal, state, and local jurisdictions; avoid excessive components of water conductivity (Ca, Mg, and pH).[17] Also, see water temperature requirements for the anadromous fish focal conservation target.
Invasive Plants	Limit or, if possible, exclude exotic vegetation (e.g., reed canarygrass, iris, loosestrife) that form persistent monocultures. Native wet meadow communities have been largely displaced by reed canarygrass. However, northern harriers will use reed canarygrass for nesting vegetation.
Invasive Animals	Limit or, if possible, exclude both non-native predators to amphibians (e.g. bull frog and some fish) and habitat altering species (e.g. carp). Carp increase turbidity which can reduce zooplankton density (dietary resource for young turtles). Additionally, carp can reduce water quality which may negatively impact plant growth and invertebrate production. Bullfrogs and large-mouth bass are known to feed on hatchling turtles.
Invertebrate Diversity	Preferably high. Invertebrate diversity will partially be determined by hydroperiod. Western pond turtle prey includes larvae of beetles, stoneflies, caddisflies, dragonflies, and other aquatic invertebrates.[5,11]
Coarse Woody Debris	Western pond turtle basking sites include logs and submerged branches; logs on uplands provide aestivating thermal cover. Wood debris adds structural complexity to the water column, providing a substrate for invertebrate production.

Attribute	Description
Loafing Sites	Provide lobed edges and low berms in wetlands to optimize amphibian oviposition sites. Berms, islands, shorelines, and logs offering security and good visibility of the surroundings are preferred loafing sites for waterfowl; however, loafing sites are not an essential habitat component.
Human Disturbance	Minimize disturbance. Areas of particular concern for western pond turtle are basking and feeding sites and terrestrial nesting and overwintering sites.[10] For waterfowl, minimize disturbance to preferred feeding and nesting areas.[12] Protect northern harrier nests: no human activity within 400 feet radius of nest, delay mowing/haying until after July 15, and limit grazing near nests.[2]
Proximity to Other Wetlands	A variety of wetland habitat with differing hydroperiods in close proximity to each other reduces the risk of inbreeding depression within amphibian populations and provides alternate spawning sites when habitat conditions are unfavorable elsewhere.[17] Wetlands in close proximity is energetically advantageous to waterfowl.[7]
Proximity to Buffers	Wetland buffers provide pre/post amphibian spawning cover, moderate water fluctuations, and trap sediments and insoluble pollutants.[17] Perennial woody vegetation in buffers provide thermal cover for waterfowl, as well as nesting cavities for select species. Also, adds woody debris to the aquatic environment.
Patch Size	Variable wetland conditions across the landscape might best meet the nutritional and physiological requirements for waterfowl. However, larger wetlands often equate to permanent water that can host predatory fish, amphibians and reptiles.[17] Pond turtles in Washington use wetlands as small as 0.4 acres; however, wetlands of this size can be ephemeral.

Table 3. Attribute description for the Columbia River shoreline focal conservation target.

Attribute	Description
Habitat Loss	Former open cobble habitats associated with the Table Mountain Slide/Columbia River Cascades were inundated by the pools of Bonneville Dam. Limited stretches of this rocky substrate still exists along the shorelines and island margins below the Dam. These are among the locations of the remnant populations for yellowcress. Habitat suitability of these sites are threatened by sedimentation. It is speculated that the yellowcress populations may have been transient with gravel bars that were transported by the river. Gravel bars have been reduced by damming and maintenance of navigation channels. Currently, the population is sufficiently small and geographically restricted increasing its vulnerability to habitat manipulations.
Flooding Regime	In summer, declining Columbia River water levels expose cobble shoreline, allowing plant growth in this zone. (Note: during inundation, this aggregate has periodically been conducive to chum salmon spawning.)
Sedimentation	Sediment deposition in cobble shoreline is associated with declined counts of Columbia yellowcress.
Competition	Attenuation of the spring freshet has allowed riparian and upland plant species (e.g., willow, mint, grasses, sedges, smartweeds) to encroach into areas of the formerly sparsely vegetated cobble habitat and compete with Columbia yellowcress.
Adjacent Land Use Practices	Known and viable yellowcress habitats must be safeguarded from physical disturbances. Public uses including boating, fishing, camping, picnicking, and hiking which would occur along shoreline habitats could inadvertently impact yellowcress habitat and populations. Grazing in Oregon and Washington have damaged populations of yellowcress by herbivory and trampling.

Table 4. Attribute description for the oak woodland/savanna focal conservation target.

Attribute	Description
Habitat Loss	Many of the fauna species associated with oak habitats are of conservation concern due to close associations with declining habitat.[6]
Disturbance Regime/ Seral Stages	Oak habitats were formerly maintained by fires of various frequency. Areas of infrequent fire supported shrub cover. Fire is credited with reducing encroachment by conifers and other competing species. Post-fire establishment and survival of oak saplings is increased. Successional changes in grassland and oak woodland habitats may have been a factor in the decline of western pond turtles.[9]
Native Plant Diversity	Locally, oak woodlands occupy a zone between prairie and conifers and infrequently occur in perched riparian areas. Oak may be co-dominated by Douglas-fir, Oregon ash, and bigleaf maple. Native understory to oak woodlands include ocean spray, oval-leafed viburnum, California hazelnut, serviceberry, snowberry, trailing blackberry, indian plum, poison oak, rose, Oregon grape, and others.[9]
Invasive Species	Invasive species which alter habitat conditions are a threat to native plant communities. Over 50 percent of understory cover should be in native plant species. Himalayan blackberry should be less than 10 percent of the shrub layer.[2]
Canopy Closure	In oak woodlands, oaks should comprise $25 percent of the canopy; if total canopy coverage by all species is less than 25 percent, oak should account for at least 50 percent of the canopy cover.[2] Canopy for nuthatch should be 40-80 percent with non-oak cover less than 10 percent. Mean stand level diameter at breast height (dbh) of oaks should exceed 21 inches, with over 20 percent of oaks greater than 28 inches in diameter.[2] Nesting sites for western pond turtle are open areas with sun exposure dominated by grasses, herbaceous vegetation, and few trees/shrubs. Overwintering sites are associated with shrub and tree cover with 15-90 percent closure.[9]
Spacial Attributes	Maintain contiguous patches of oak woodlands exceeding 100 acres.[2]
Leaf litter	Microclimates created by leaf litter and herbaceous cover support acorn germination and subsequent radicle formation, thus improving forest health and forest viability. Additionally, leaf litter conceals acorns from seed eating birds and mammals increasing potential of natural seedlings. Turtles burrow in deep leaf or needle litter for overwintering.[9]

Table 5. Attribute description of grassland (wet meadow and upland prairie) focal conservation target.

Attribute	Description
Fire	Prairies may support trees and shrubs; however, periodic fire reduces woody vegetation and promotes herbaceous species. Fire frequency of two to three times in six years may be sufficient to maintain population viability.[24]
Litter Cover	Adequate litter and vegetative cover reduces predation of brush prairie pocket gopher and other small mammals. This cover may additionally buffer animals and their burrows to climatic extremes. Residual standing vegetation within grasslands (previous year's growth) is cover for nesting harriers.[2]
Vegetation Cover	Native prairie systems are essentially low-stature (i.e. less than 3 feet tall) communities.[25] Variable grass height less than 30 inches tall cut after July 1.[22] Nesting habitat for western meadowlark is characterized by relatively high grass cover (mean 84 percent), litter/residue (13 percent), and bare ground (6 percent).[1] Plant cover near the burrows of brush prairie pocket gophers must be diverse during all seasons to provide adequate food supply, since the species does not range far and does not hibernate. Sedge dominated meadows (wet meadow) are generally 3 feet in height. The short stature of wet meadows are probably important for successful hunting by predatory birds.[25]
Woody Plant Cover	Woody vegetation can serve as loafing and foraging sites for raptors. However, shrub and tree cover should be less than 10 percent.[2]
Patch Size	Maintain a mosaic of appropriate habitat (wetland, wet meadow, and non-managed field) in greater than 400 acre blocks. Minimum 200 acre contiguous mosaic of native and agricultural grasslands.[2]

Table 6. Attribute description for the anadromous fish and high-gradient stream focal conservation target.

Attribute	Description
Habitat Connectivity	Spawning and rearing tributaries are connected to ocean migration routes. For Cascade torrent salamander, aquatic habitats used for egg and larval development must be connected to adjoining moist sites for adults.
Habitat Complexity (structure within the aquatic habitat)	Large wood debris (LWD) quantity and distribution are important, as are high channel sinuosity, multiple channels/sloughs, beaver impoundments, or backwaters typically provide high-quality habitat.
Water Depth/ Velocity	Water velocities should not scour redds. Egg deposition optimally is within a range of depths/velocities that minimizes the risk of desiccation as water levels recede. Conditions should ensure the exchange of water between the surface and substrate interstices to maintain high oxygen levels and remove metabolic wastes from the redd. Low velocity side channels, backwaters, sloughs, spring fed tributaries may be sought out by salmonids during periods of high flow or for rearing. Typical occurrences of Cascade torrent salamander are in shallow, slow flowing streams or off-channel habitats. This species may also use seeps and spray-zones of waterfalls.
Water Temperature	Juvenile and resident salmonids are variable in their temperature requirements, though most species are vulnerable when temperatures exceed 73-77 Fahrenheit.[3] Cold-adapted species seek out groundwater seeps and congregate around the mouths of cooler tributaries or at the bottom of thermally stratified pools. Several salmon species may seek out areas of upwelling or areas influenced by ground water for spawning, these include sockeye, chum, coho, and bull trout.[4,16,18,19] Cascade torrent salamanders inhabit cold streams and cool moist environments.
Channel Stability	Gravels with low concentrations of fine sediments and organic materials are important to salmon spawning and incubation. Quantity of LWD is an indicator of channel stability.
Turbidity	Levels should not be high enough to cause salmon to delay or abandon spawning runs.[14,20,21] Fine sediments should not impact developing redds or negatively change the composition of invertebrates and other prey of salmonids in aquatic habitats. Cascade torrent salamanders inhabit gravel and rock rubble that is largely silt-free.

Riparian Vegetation	Riparian forest cover should form a continuous ribbon of vegetation with a mosaic of different stand ages and species. Functioning intact riparian habitat reduces sedimentation, filters impurities, creates moist microclimates, maintains water temperatures, contributes LWD, and provides organic materials for invertebrate production.
Nonnative, Predatory Fish	Juvenile salmon are subject to predation by exotic fish including; northern pike-minnow, bass, bluegill, crappie, walleye, and channel catfish.
Intragravel Dissolved Oxygen	The concentration of dissolved oxygen (DO) integrates numerous other factors, including temperature, bed material particle size, and deposition of fine sediments and particulate organic matter. Suggested one- and seven-day minimum values for intragravel DO are 5.0 and 6.5 mg oxygen/L, respectively.[23] Dissolved oxygen is presumably significant in the development of Cascade torrent salamander egg and larval stages.

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