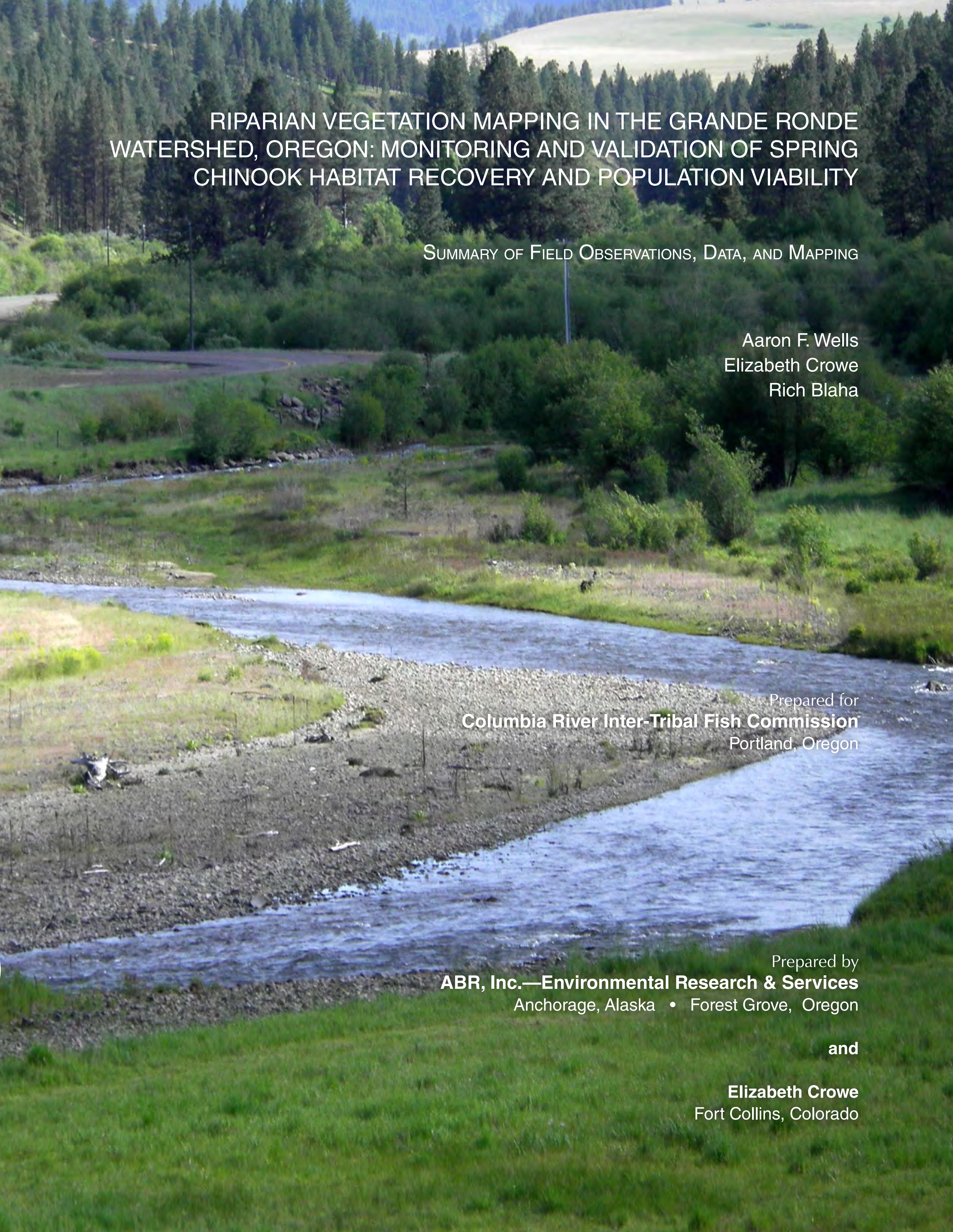

RIPARIAN VEGETATION MAPPING IN THE GRANDE RONDE WATERSHED, OREGON: MONITORING AND VALIDATION OF SPRING CHINOOK HABITAT RECOVERY AND POPULATION VIABILITY

Summary of Field Observations, Data, and Mapping

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Prepared for
Columbia River Inter-Tribal Fish Commission
Portland, Oregon

Prepared by
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Anchorage, Alaska • Forest Grove, Oregon

and

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Fort Collins, Colorado

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Phase 3: Summary of Field Observations, Data, and Mapping

Prepared for

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We thank Dale McCullough, Seth White and Casey Justice of the Columbia River Inter-Tribal Fish Commission for their assistance with field work, field accommodations and field vehicles in the summer of 2014. We appreciate their great advice on the direction of this project and production of the ensuing report, as well as their patience with our delays in our production schedule.

INTRODUCTION

The Columbia River Inter-Tribal Fish Commission (CRITFC) seeks to develop a spatially-based system for modeling abundance, productivity, and growth rate for spring Chinook salmon in the upper Grande Ronde watershed in northeastern Oregon (Figure 1). This watershed has experienced various levels of anthropogenic disturbance, which has compromised the quality of Chinook spawning and rearing habitat. To assess the extent to which current conditions are affecting fish population dynamics, a model of watershed health will be developed based on water temperature, fine sediment (surface and depth), stream flow, and riparian condition. CRITFC is particularly interested in determining the potential to restore the water temperature regime in the watershed, which will require developing a water temperature model. Maps of the current vegetation and potential natural vegetation (PNV) communities are critical to supporting this model.

ABR, Inc.—Environmental Research & Services (ABR) and Elizabeth Crowe worked collaboratively to create a map of existing and potential natural vegetation throughout the extent of the spring Chinook spawning and rearing zone in the upper Grande Ronde watershed. The study was conducted in phases, with phases 1 and 2 focused on development of mapping concepts and draft mapping, respectively.

OBJECTIVES

Phase 3 objectives included:

1. Complete field surveys designed to collect data on vegetation and soil characteristics in the study area
2. Finalize the Integrated Terrain Unit (ITU) mapping initiated in Phase 2, including physiography, geomorphology, soils, existing and potential vegetation, and disturbance.
3. Summarize canopy height and density of existing vegetation by ITU map polygon using existing LiDAR data
4. Assign height classes to potential vegetation classes using data obtained from pre-existing vegetation classifications
5. Prepare a report summarizing the mapping and field observations and data

STUDY AREA

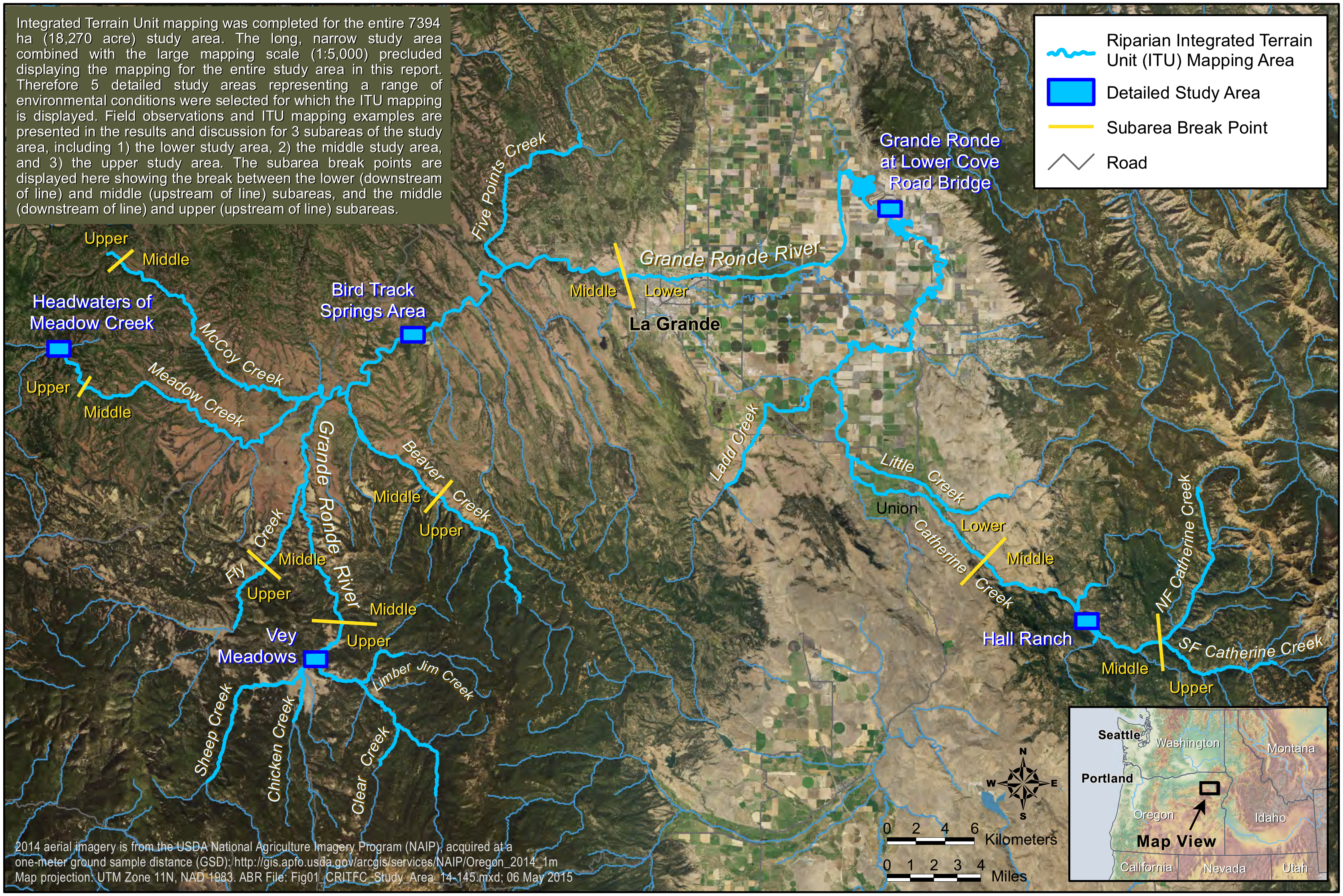
The study area encompasses approximate 7,300 hectares (ha) of the Grande Ronde River watershed in northeast Oregon (Figure 1). The study area is defined by a 100 m buffer along each side of the center of active river channels, including the mainstem of the Grande Ronde River and Catherine Creek and major tributaries from the convergence of Catherine Creek with the Grande Ronde upstream to the headwaters. Major tributaries mapped as part of this effort include North and South Fork Catherine Creek, Little Creek, Ladd Creek, Five Points Creek, McCoy Creek, Meadow Creek, Fly Creek, Sheep Creek, Clear Creek, Limber Jim Creek, and Beaver Creek.

METHODS

FIELD

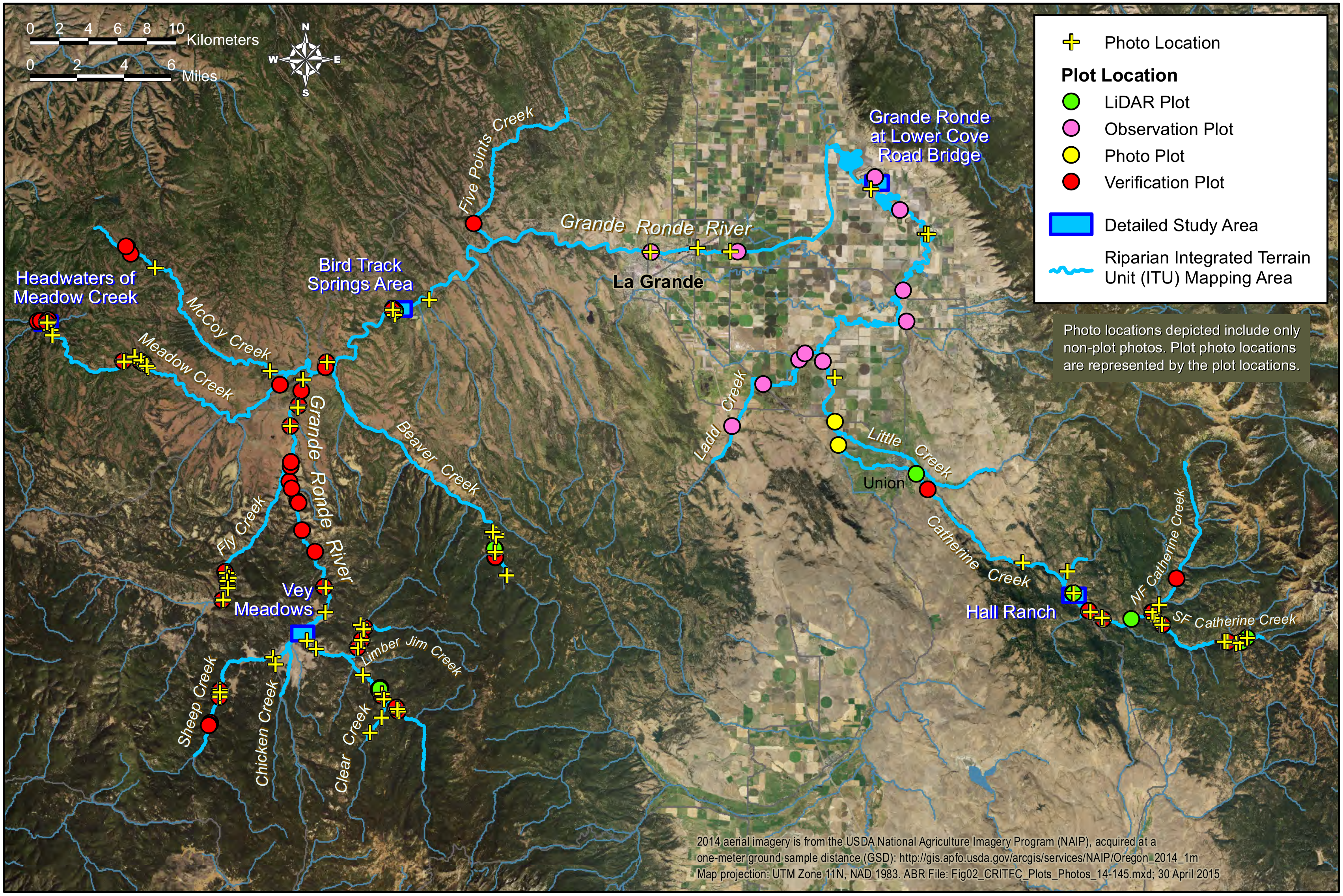
Field surveys were conducted 3–11 June 2015 by two field crews. Each field crew consisted of two individuals, including a field observer, skilled in field botany, vegetation ecology, and soil science; and a field assistant, who assisted with soil pit excavation, recording data, and conducting canopy height and cover measurements. Field crews were based in La Grande, Oregon and traveled to the field each day via pickup truck. The Phase 2 draft mapping was used to stratify the field survey locations across the study area. Field survey locations were limited to public lands or private lands where prior access had been arranged. Survey locations were co-located with stream reaches with existing Columbia Habitat Monitoring Program (CHaMP) plots whenever possible. Field crews used several plot types (described below) to ground-truth data, including verification plots, observation plots, photos plot, and LiDAR plots. A total of 82 plots were sampled across the study area, including 57 verification plots, 12 observation plots, 11 LiDAR plots, and 2 photo plots (Figure 2).

Field data (with the exception of LiDAR plot data, see below) was recorded on rugged, GPS-enabled tablet computers using proprietary digital data forms with built-in data dictionaries


Integrated Terrain Unit mapping was completed for the entire 7394 ha (18,270 acre) study area. The long, narrow study area combined with the large mapping scale (1:5,000) precluded displaying the mapping for the entire study area in this report. Therefore 5 detailed study areas representing a range of environmental conditions were selected for which the ITU mapping is displayed. Field observations and ITU mapping examples are presented in the results and discussion for 3 subareas of the study area, including 1) the lower study area, 2) the middle study area, and 3) the upper study area. The subarea break points are displayed here showing the break between the lower (downstream of line) and middle (upstream of line) subareas, and the middle (downstream of line) and upper (upstream of line) subareas.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD); http://gis.apfo.usda.gov/arcgis/services/NAIP/Oregon_2014_1m
Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig01_CRITFC_Study_Area_14-145.mxd; 06 May 2015

Figure 1. Overview of riparian vegetation mapping study area, including the extent of Integrated Terrain Unit (ITU) mapping, subarea break points, and the detailed study areas at the headwaters of Meadow Creek, Vey Meadows, Bird Track Springs, Hall Ranch, and lower Grande Ronde at Lower Cove Road bridge depicted in subsequent figures. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD): http://gis.apfo.usda.gov/arcgis/services/NAIP/Oregon_2014_1m
Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig02_CRITFC_Plots_Photos_14-145.mxd; 30 April 2015

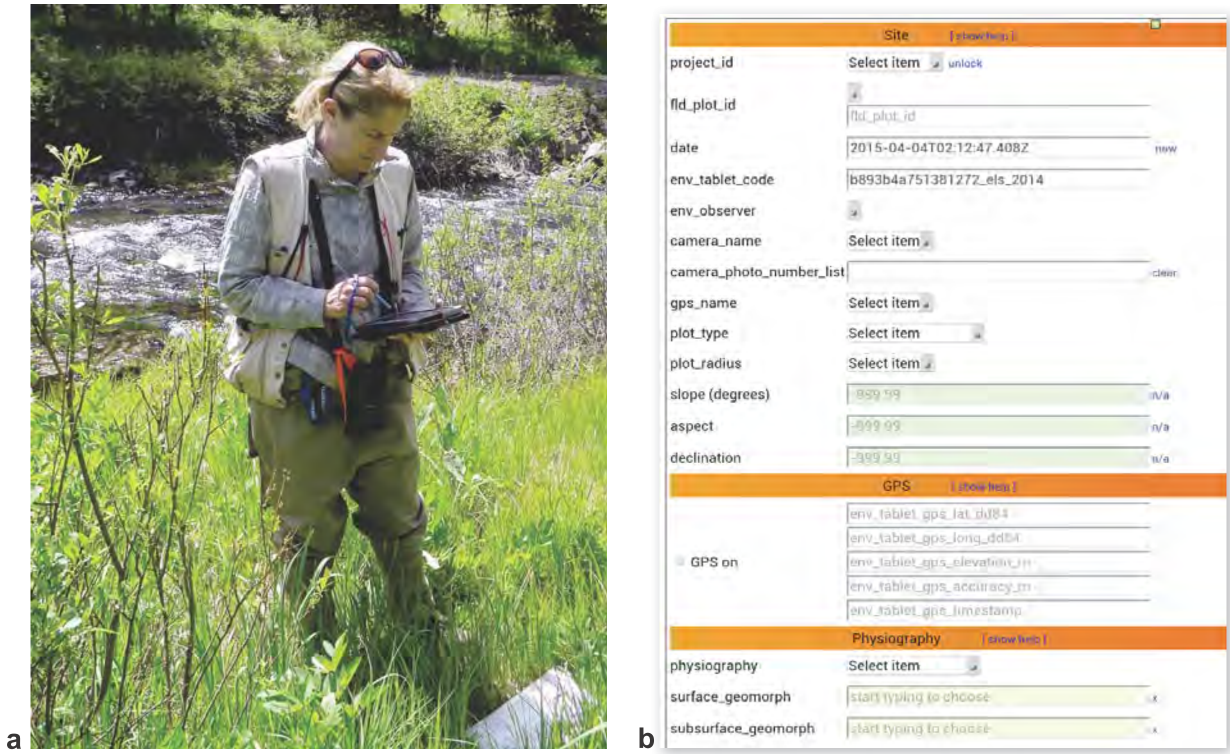
Figure 2. Field plot and photo locations sampled as part of the riparian vegetation mapping study in the Grande Ronde River watershed, northeastern Oregon, 2014.

(Figure 3). The digital data forms integrate directly with the tablet GPS for recording the geographic coordinates (latitude, longitude, elevation) of each plot. Geographic coordinates were also recorded at the center of each plot using a hand-held recreation grade DeLorme Earthmate PN60 GPS unit.

Photos were taken at all plots, and included representative landscape and ground cover views, and photos of the soil pit face. In addition to the plot photos, we captured several types of non-plot photos opportunistically as we traveled to field survey locations, including rapid ground truth photos, methods photos, photos of people, and panoramic photos. Photos were taken using a GPS-enabled Ricoh G700 SE camera with integrated compass. Plot photos were renamed each day in the field to include the plot identifier code followed by a unique number enclosed in parentheses (e.g., grr_v01-01_2014 (1).JPG). Other types of photos were not renamed, but were instead organized into separate photos by photo type.

VERIFICATION PLOTS

Verification plots included the most comprehensive suite of variables and were designed to capture data on vegetation and environment, including soils. Variables measured or estimated at verification plots are described in Appendix 1, and include all variables with data type “Plot,” “General Environment,” “Soils,” and “Vegetation.” Plot variables describe the plot itself, including a unique plot identification code (plot_id), plot dimensions (plot_radius_code), observer initials (env_observer_code), and the date and time at which data collection was initiated (env_field_start_timestamp).



project_id	Select item
fld_plot_id	fld_plot_id
date	2015-04-04T02:12:47.408Z
env_tablet_code	b893b4a751381272_els_2014
env_observer	
camera_name	Select item
camera_photo_number_list	
gps_name	Select item
plot_type	Select item
plot_radius	Select item
slope (degrees)	-999.99
aspect	-999.99
declination	-999.99
☐ GPS on	env_tablet_gps_lat_dd84 env_tablet_gps_long_dd84 env_tablet_gps_elevation_m env_tablet_gps_accuracy_m env_tablet_gps_timestamp
physiography	Select item
surface_geomorph	start typing to choose
subsurface_geomorph	start typing to choose

Figure 3. Data was recorded in the field on rugged, GPS-enabled tablet computers (a) using proprietary digital data forms. The right panel (b) of the figure above shows the first page of the data form used to record general environment data. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

General Environment

General environment variables include physiography; slope gradient and aspect—two basic descriptors of topography that affect microclimate and soil drainage; and descriptors of geomorphology and surface form at several spatial scales, including surface terrain, microtopography, and macrotopography. Observations of recent disturbance were also recorded (disturbance_class_code).

Soils

Soils were sampled using a small (30×30×40 cm) soil pit or plug (Figure 4). To prepare the soil pit or plug, soil materials were excavated carefully, keeping the organic surface layer intact and placing all soil materials on a tarp to protect the soil surface. Upon completing the soils description, soil materials were placed back in the pit and the organic surface layer replaced. Soils variables collected describe the dominant soil texture in the

Figure 4. A series of 4 images depicting soil pit excavation and rehab of pit after completion of soil description, including (from upper left), (a) excavation using tile spade, (b) completed soil pit with intact organic surface plug and excavated soil on tarp, (c) close up of completed soil pit, and (d) soil pit filled in with surface plug in place and rehabilitation complete. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

upper 40 cm of the soil profile, including the dominant mineral soil texture (soil_dominant_mineral_code_40cm); the dominant texture, which could include organic soil material (soil_dominant_texture_code_40cm); and the upper depth of a soil layer with 15% or more rock fragments (soil_rock_depth_probe_cm). The methods focus on the upper 40 cm because this section of the soil profile is easily accessed by hand excavating, is minimally invasive to the landscape, is representative of the present geomorphic environment, and is the most pertinent when considering erosion resistance. We also measured and recorded thickness of the surface organic layer (soil_surface_organic_thick_cm), which provides indirect information on frequency of flooding and sedimentation. Lastly, we recorded the soil moisture status (soil_moisture_code) and water table depth (water_depth_cm).

Vegetation

Vegetation cover data were recorded semi-quantitatively by ocularly estimating percent foliar cover for each of the most common 10–15 species within the plot area. Foliar cover was estimated in increments of 1% for cover values between 1 and 10%, and in 5% increments for cover greater than 10%. Isolated individuals or species with very low cover were assigned a “trace” cover value of 0.1%. Percent cover of abiotic ground cover classes (e.g., bare soil) was recorded using the same methods described above. We collected vegetation structure data by life form groups (e.g., tall shrubs) independent of the individual species cover estimates as an internal check for errors in overall cover estimates and `as an aid to vegetation classification. Crown (e.g., dominant) and size class (e.g., timber) of the dominant needleleaf and broadleaf trees were recorded for forested plots. The existing vegetation class was also recorded at each plot as Level 4 vegetation classes, a four-level hierarchy of existing vegetation classes similar to Viereck et al (1992) which was developed using vegetation classifications that encompass the study area. Plant taxonomy follows Hitchcock and Cronquist (1973) with species codes based on the USDA Plants Database (USDA and NRCS 2015). Voucher specimens were collected for species that were difficult to identify in the field; the specimens were then examined by crew members in the evening with a dissecting scope and identified to species when possible. Specimens that were difficult to identify with certainty were pressed and later sent to a specialist for verification (see Office Methods, below). A listing of all plant species encountered in the field is provided in Appendix 2.

OBSERVATION PLOTS

A reduced set of variables were measured at observation plots; these plots were designed to rapidly capture observations in the field for use in ground-truthing. At observations plots we classified and recorded the level 4 vegetation class; recorded the dominant 6–10 plant species within the plot area (percent foliar cover was not estimated), and recorded detailed field notes. Vegetation structure data were not recorded and we did not excavate a soil pit. General environment data were recorded opportunistically as time allowed.

PHOTO PLOTS

Photos plots comprised the most reduced set of variables recorded and were the most rapid to sample. Detailed field notes were recorded and photos were taken to represent the plot area. Vegetation and general environment data were recorded opportunistically as time allowed. No soils data were recorded, as a soil pit was not excavated.

LIDAR PLOTS

LiDAR plots focused on verifying the LiDAR canopy height and density data. A Geographic Resource Solutions (GRS) densitometer was used to estimate canopy cover of trees and tall shrubs (>1.5 m in height). Densitometer sampling occurred along two 20 meter long transects placed perpendicular to one another. The transects were centered at the middle of the plot and oriented along the cardinal directions (Figure 5). Starting at the plot center, the field observer traversed each transect stopping at sampling points spaced 2 m apart to sight through the densitometer upwards towards the canopy for a total of 20 sampling points (Figure 6. In long, narrow vegetation stands or patches of vegetation smaller than 20 m in diameter, transect length and orientation were modified to fit within the stand. Sample point spacing was also modified so that a total of 20

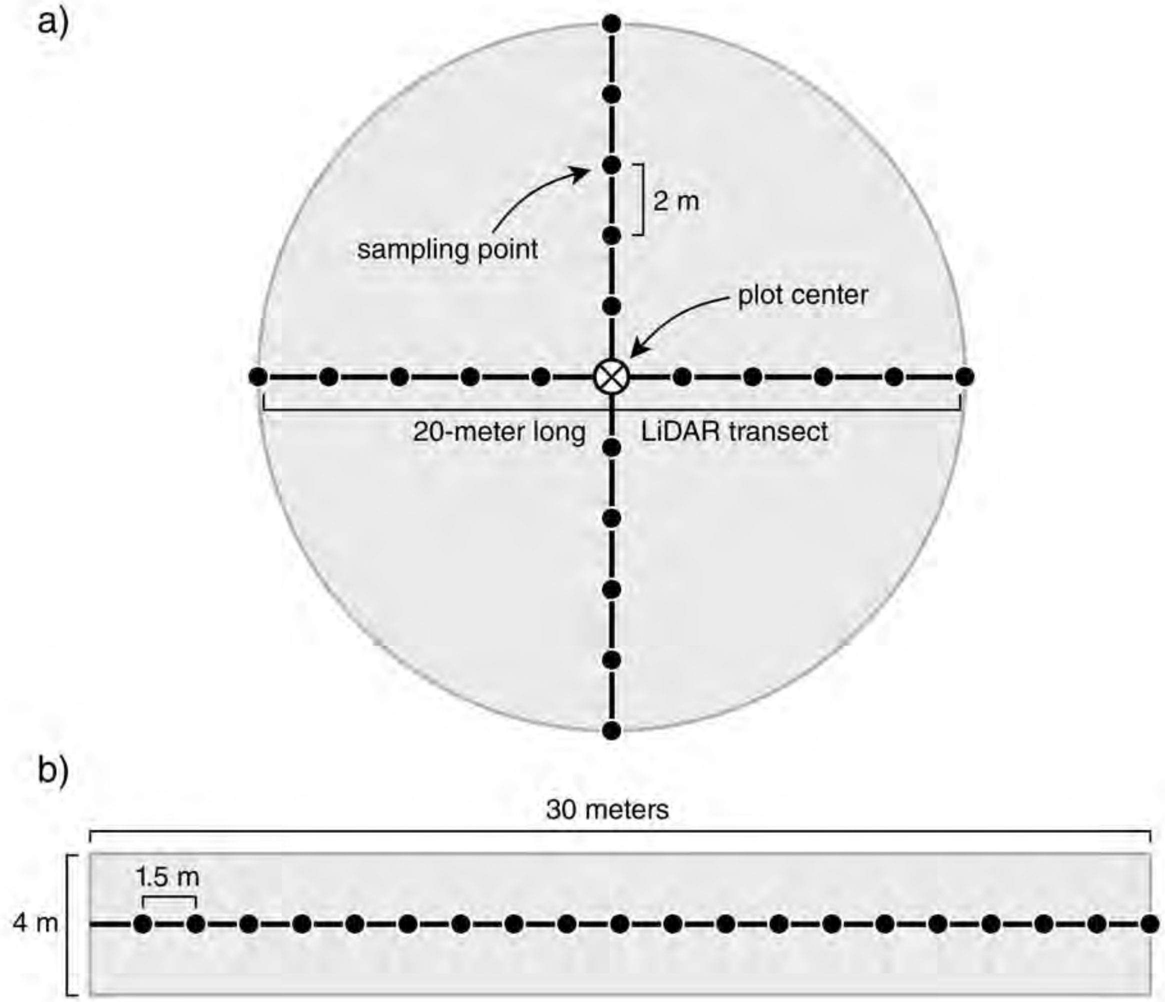


Figure 5. Schematic diagram of densitometer transects and sample points at LiDAR plots showing the standard layout (a), and an example of the layout in a non-standard plot typical of narrow, linear stands of vegetation (b). Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

equally spaced sampling points would fit along the transect. At each sampling point, if any part of a tall shrub or tree intersected the densitometer crosshairs, a “hit” was counted and the species hit recorded on a paper datasheet. If a tall shrub or tree did not intersect the densitometer crosshairs, then “no hit” was recorded. Tree and tall shrub heights were estimated using a laser rangefinder featuring automatically calculating heights. The field observer selected 1–3 individuals of the dominant tree or tall shrub species in a plot that were characteristic of the predominant size class. The field observer positioned themselves at least 10 m away from the target tree with a clear view and sighted the base and top of the tree with the laser rangefinder (Figures 6 and 7). The laser rangefinder then calculated the heights based on the two distance measurements and the angle between the base and top of the tree. The heights were recorded on a paper datasheet along with the tree or tall shrub species code. In extremely thick vegetation, typically tall shrub stands, use of the laser range finder was impossible; instead, tall shrub heights were estimated ocularly into the following categories: 1.5–3 m, 3–5 m, and >5 m.

Figure 6. Photographs illustrating data collection at LiDAR plots, including use of a densitometer to estimate canopy density (a), and use of a laser rangefinder to estimate tree and tall shrub heights (b). Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

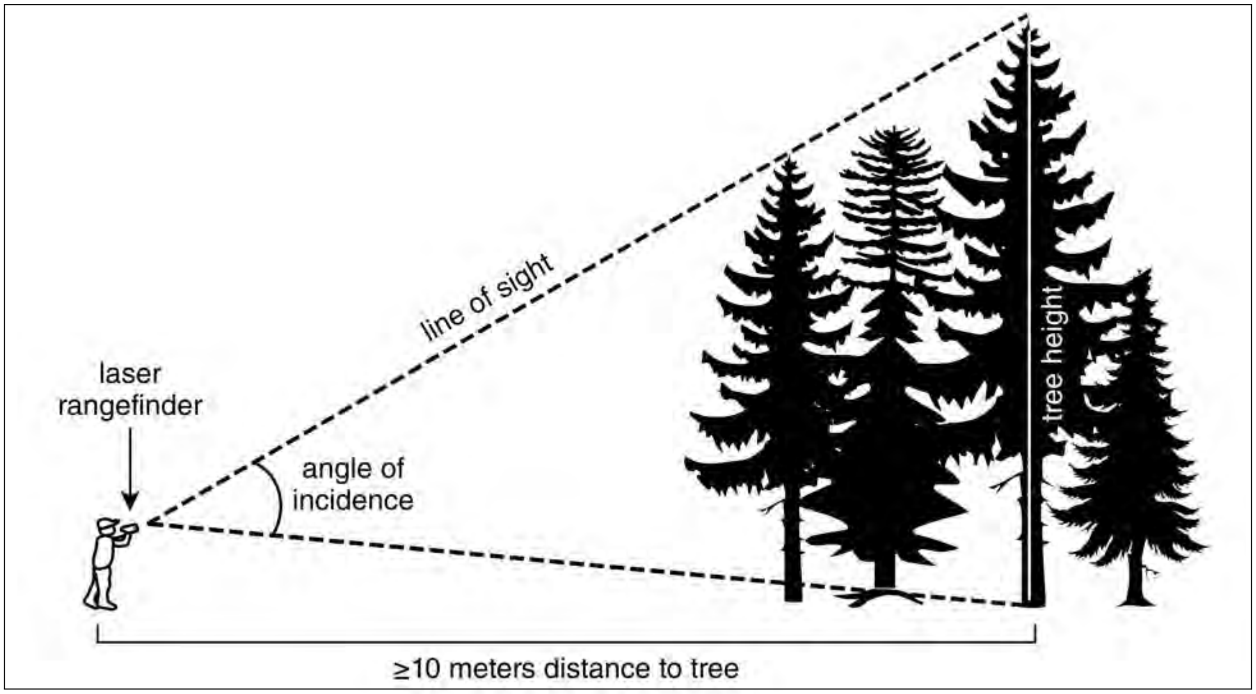


Figure 7. Schematic diagram of field observer using a laser range finder to estimate tree and tall shrub heights at LiDAR plots. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

OFFICE

DATA INTEGRATION

Tabular Data

In the office, the data collected on the handheld tablet computers was uploaded to the project PostgreSQL (PostgresSQL Global Development Group 2014) database. During the upload process a series of Quality Assurance and Quality Control (QAQC) routines were performed to ensure that all data were accounted for. LiDAR plot data from paper datasheets were entered into digital format and subsequently uploaded to the project database. These data also were proofed to ensure all data were entered into the database.

Plot Location Data

Plot location data collected on the handheld tablet computers was uploaded to the project database as described above. The plot locations collected on the handheld DeLorme GPS units were processed as described below. In the office, the raw GPS Exchange Format (gpx) files were backed up on the ABR server. The GPX to Features tool in the Conversion tools in ArcToolBox was used to convert the gpx files to an ArcGIS compatible feature class. The accuracy of the plot locations feature class was verified by comparing it against the plot locations collected on the tablet computers. The handheld GPS locations were considered the definitive plot locations. An exception to this was when plot locations were missing from the handheld GPS; in these instances the plot location recorded on the tablet was used instead. Upon completing the plot location review, a final plot location feature class was created and the final plot locations were uploaded to the project database.

Field Photos

Field photos also were backed up on the ABR server in preparation for further processing. The location and heading information assigned to each photo by the GPS-enabled cameras in the field was extracted from the Exchangeable image file format (Exif) data associated with each photo using Python and the Pexif library. The extracted Exif information was then inserted into the project database and used to create a view that references the photo files and constructs a relative path to each photo. We then used the photo locations and the PostGIS extension to PostgreSQL to create an ESRI ArcGIS file geodatabase that contained the photo locations and headings. The photos were then copied to the network folder specified in the relative path field in the database, thus making them available as a relative hyperlink within ArcMap when used in conjunction with the photo location geodatabase. A QAQC review of the photo locations was then conducted by comparing the photo locations against the plot locations. Plot photos that were located outside of the plot area were reviewed and adjusted as needed to place them within the plot. Non-plot photos were reviewed for accuracy based on field notes and the locations were adjusted as needed.

Plant specimens

Voucher specimens collected and pressed in the field were cataloged in the office and entered into the project database. Specimens requiring verification were sent to Carex Consultants, Inc. in Moscow, ID and were verified and annotated by Joy Mastrogiuseppe. The verifications were then entered into the project database. The specimens will be delivered to CRITFC along with the other data deliverables upon completion of the project.

CLASSIFICATION OF ECOLOGICAL COMPONENTS

We classified and mapped several ecosystem components in the study area using standardized classification and coding systems developed for northeastern Oregon. The classification systems are described in detail below.

Physiography and Geomorphology

Physiography characterizes the dominant tectonic and geomorphic processes controlling the landscape and was classified following Jorgenson et al. (2008) with modifications for northeastern Oregon when appropriate (Tables 1 and 2). The geomorphology classification incorporates landforms and landscape processes into an integrated process-geomorphic classification (Tables 1 and 3). For example, Meander Active Overbank Deposit (Fmoa) incorporates the concepts of floodplain (landform) with flood recurrence interval (process); for Fmoa, the flood recurrence interval is estimated at 2–25 years.

Table 1. Standard classification system developed for classifying and mapping physiography and geomorphology in the Grande Ronde River watershed, northeastern Oregon, 2014.

Code	Title
PHYSIOGRAPHY CODING	
L	Lowland
R	Riverine
S	Subalpine
U	Upland
GEOMORPHOLOGY CODING	
Bx	Bedrock - undifferentiated
ch	Hillside Colluvium
ff	Alluvial Fan
fmoa	Meander Active Overbank Deposit
fmob	Meander Abandoned Overbank Deposit
fmoi	Meander Inactive Overbank Deposit
Fmolp	Levee-protected Floodplain
fmrac	Meander Coarse Active Channel Deposit
fmri	Meander Inactive Channel Deposit
Fmrox	Old Oxbow
fto	Old Alluvial Terrace
ftr	Recent Alluvial Terrace
H	Human Modified
Of	Organic Fen
Wh	Human Modified Waterbody
Wr	Rivers and Streams

Soils

The base map for delineating ITUs is a merger of soil mapping layers produced by the Union County Soil Survey (Dyksterhuis and High 1985) and the Wallowa-Whitman National Forest Soils Database (USDA, NRCS, Soil Survey Division_a 2013). This layer contains 111 soil series. As an additional mapping reference, data from unpublished riparian soil mapping on the Wallowa-Whitman National Forest (Ottersberg 2012) were used where available. These riparian soil map units contain an additional 12 soil series. Many of the soil series were similar enough to support nearly identical existing vegetation types and/or potential plant association groups (PAGs). Consequently, the soil series were aggregated into generalized soil units to simplify ITU mapping (Appendix 3). The soil series were aggregated by reviewing profile descriptions and typical pedons for each series from the three data sources discussed above and from official soils series descriptions (USDA, NRCS, Soil Survey Division_b 2013). Soil cross sectional diagrams (Appendix 4) were created for all series and compared to determine which could be combined. The criteria used as the basis for combining series included horizon textural classes; horizon coarse fragment content (gravels, cobbles, stones); depth to root restricting layers (e.g. bedrock, duripans, clay) and/or perched water tables; strong chemical characteristics; and soil temperature and soil moisture classes. Horizon texture, coarse fragment content, profile depth, and chemical composition strongly influence Levels I through III of the vegetation classification. Soil temperature and moisture classes are also very important influences on plant species occurrence, density, and structure and will be considered when polygons are attributed with Level IV classes. Ultimately, 14 generalized soil units were developed from the original 123 soil series (Tables 4 and 5). Four additional non-soil classes were added to the soil classification for mapping purposes, including Roads, Rock Outcrop, Urban Complex, and Water.

Existing Vegetation

A four-level hierarchy of existing vegetation classes (Appendix 5; Table 6) similar to Viereck et al (1992) was developed using vegetation classifications that encompass the study area (Crowe and Clausnitzer 1997; Crowe et al 2004; Johnson and Clausnitzer 1992; Johnson and Simon 1987; Wells 2006). Level I comprises major lifeform groups (forest, shrub and herbaceous) as well as vegetation complexes, agricultural land, barren land, developed land and water. Level II divides Level I vegetation classes into broad growth forms (conifer forest, broadleaf/deciduous forest, tall shrub, low shrub, forb and graminoid). Level III depicts canopy closure classes. Level IV identifies the dominant overstory species or species group in a Level III class. The mapping codes and descriptions for Level IV existing vegetation are found in Table 7.

Table 2. Physiography class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Physiography Class	Description
L : Lowland	Flat to gently sloping and concave areas of the landscape at elevations lower than adjacent uplands. Typically zones of water accumulation.
R : Riverine	Areas of the landscape subject to regular (<5–25 yrs) to irregular (25–100 yrs) channel and overbank flooding by rivers or streams
S : Subalpine	Moderate to steeply sloping and convex areas of the landscape in the upper elevation range of forested vegetation. In the study area subalpine physiography is limited to elevations greater than approximately 1,450–1,500 m.
U : Upland	Moderate to steeply sloping and convex areas of the landscape at elevations below subalpine physiography. Typically water shedding.

Potential Vegetation

Potential upland vegetation (also refered to as the climax community) is defined for this mapping project as the "...stable condition that would result if the present climatic and biotic conditions continues, and there were no further disturbances by fire, grazing, logging, blow downs, large-scale insect-caused mortality, etc." (Daubenmire 1968). Potential riparian vegetation is defined for this mapping project as assemblages of native riparian vegetation occurring together in equilibrium with the environment for a given fluvial surface. This fluvial surface environment includes characteristic flooding frequencies and the associated deposition and erosion of long-term average quantities and sizes of particles. Streams are assumed to be connected with the floodplain during seasonal high-water events and the floodplain water table to be accessible to plant roots on abandoned floodplains and lower geomorphic surfaces. The potential vegetation types within the study area have been classified and described as plant associations and community types in vegetation classifications (Crowe and Clausnitzer 1997, Crowe et al 2004, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Kauffman et al 1985, and Wells 2006) and climax plant communities in ecological site descriptions (ESDs) (USDA, NRCS, Ecological Sciences Division 2014).To simplify mapping of potential vegetation, the 153 plant associations and plant community types and 11 climax plant communities applicable to the mapping area were organized into plant association groups (PAGs). Three additional plant community types were added based on field plot sampling in 2014. The PAG development process followed the methodology employed for the Blue Mountains National Forest lands by Powell et al. (2007). The first step is to divide the vegetation into physiognomic groups. We used the groupings created for existing vegetation, coniferous forests, deciduous forests, shrubland and herblands. The next step is to group plant associations, community types, and climax plant communities into groups "representing similar ecological environments as characterized by temperature and moisture regimes" (Powell et al 2007). Relative scales of temperature and moisture were developed that are only applicable to the group of plant associations and plant community types located in the mapping area. These scales do not represent absolute biophysical environments with quantifiable atmospheric or soil temperature and moisture ranges. Rather, they are based on best professional judgement of the relative differences in environment in which the PAGs occur. For example, the Cool-moist Grand Fir Forest PAG occupies sites with cooler daily temperatures (especially below the overstory tree canopy) and higher average annual soil moisture than the Warm Dry Grand Fir Forest PAG. 56 PAGs were created and eight miscellaneous categories were used in mapping non-vegetated areas. The canopy closure classes to which forest and shrub PAGs were assigned correspond to the average canopy closure of the plant associations in the published

Table 3. Geomorphic class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Code and Title	Description
Bx : Bedrock - undifferentiated	Areas unlain by bedrock within the upper 50 cm of the soil surface. This class may include metamorphic, igneous, or sedimentary rock types.
ch : Hillside Colluvium	Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff (USDA, NRCS 2015a).
ff : Alluvial Fan	A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream (USDA, NRCS 2015a).
fmoa : Meander Active Overbank Deposit	Vertical accretion deposits on low portions of the floodplain environment in close proximity to the meandering river channels. Flood return intervals are approximately 2 to 25 years on these surfaces. The deposits are comprised of silts and fine sands that have a laminar, interbedded structure formed by changes in velocity and deposition during waxing and waning floods. Frequent flooding and sedimentation results in surface organics rarely accumulating more than 5cm between flood events (i.e., buried organic horizons are ≤ 5cm thick).
fmob : Meander Abandoned Overbank Deposit	Vertical accretion deposits of meandering floodplains that no longer are associated with the present fluvial regime or where flooding is sufficiently infrequent that recent fluvial sediments form a negligible component of surface material. Flood return intervals are approximately 100 to 250 years. Surface materials often include a mixture of fluvial, eolian, and organic materials.
fmoi : Meander Inactive Overbank Deposit	Vertical accretion deposits formed on higher portions of the overbank environment in close proximity to meandering river channels in areas subject to infrequent flooding. Flood return intervals are approximately 25 to 100 years. Soils are typically comprised of interbedded organics, silts and fine sands.
Fmolp : Levee-protected Floodplain	A floodplain cut off from annual overbank flooding by a levee.
fmrac : Meander Coarse Active Channel Deposit	Lateral accretion deposits formed in meandering channels that wind freely in regular to irregular, well-developed, S-shaped curves. Channels range from highly sinuous to only slightly meandering. Riverbed material can range from from gravels and cobbles to gravelly-cobbly sand, and lateral accretion deposits along point bars typically are sandier. Surface organic materials are absent, or if present are not imbedded into the mineral soil surface, and are therefore often washed away by flood waters. These deposits occur primarily on mid-channel and lateral bars.
fmri : Meander Inactive Channel Deposit	Mixed lateral and vertical accretion deposits in inactive (“high water” or “cut-off”) channels of meander rivers that are flooded only during high-water events. Riverbed material often has a thin layer of fine-grained material over the coarse channel deposits and surface is usually vegetated.

Table 3. Continued.

Code and Title	Description
Fmrox : Old Oxbow	The crescent-shaped, often ephemeral body of standing water situated by the side of a stream in the abandoned channel (oxbow) of a meander after the stream formed a neck cutoff and the ends of the original bend were silted up.
fto : Old Alluvial Terrace	Relatively flat surfaces resulting from the dissection of former floodplain areas. Old terraces are typically higher in elevation than Recent Alluvial Terraces (relative to the present day river channel), are never subject to flooding under the current regime (above the 100yr flood stage), and were formed previous to the end of the Little Ice Age (> 150 years).
ftr : Recent Alluvial Terrace	Relatively flat surfaces resulting from the dissection of former floodplain areas. Recent terraces are typically lower in elevation than Old Alluvial Terraces (relative to the present day river channel), are never subject to flooding under the current regime (above the 100yr flood stage), and were formed since the end of the Little Ice Age (< 150 years).
H : Human Modified	A terrestrial geomorphic unit that has been modified by humans, typically by use of heavy machinery.
Of : Organic Fen	Minerotrophic wetlands with thick (>40 cm) organic matter accumulations developed in basins fed by mineral-rich surface water or groundwater.
Wh : Human Modified Waterbody	A natural waterbody modified byhumans or a waterbody created by humans.
Wr : Rivers and Streams	A natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea (USDA, NRCS 2015a)

Table 4. Standard classification system developed for classifying and mapping generalized soils in the Grande Ronde River watershed, northeastern Oregon, 2014.

Code	Title
AsilovCF	Ashy silt loam over coarse frags
AsilovL	Ashy silt loam over loam
AsilovSk	Ashy silt loam over skeletal
DpCF	Deep w/coarse fragments
DpSiCL	Deep - silt to clay loam
LGr	Loamy-gravelly
LiShC	Lithic/Shallow to Clay
LovSk	Loam over skeletal
LSil	Loam/Silt Loam
LSilbr	Loam/Silt Loam - brackish
LSilor	Loam/Silt Loam - organic-rich
MDpCF	Mod. deep w/coarse frags
Roads	Roads
Rock	Rock Outcrop
SSkEnt	Sandy-skeletal Entisols
StmBkHG	Streambanks - high gradient
Water	Water

Table 5. Generalized soil class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Code and Title	Description
AsilovCF : Ashy silt loam over coarse frags	Soils with ashy silt loam textures within 50 cm below soil surface and horizons with sandy loam to gravelly loam textures between 50 cm and 100 cm below soil surface
AsilovL : Ashy silt loam over loam	Soils with ashy silt loam textures within 50 cm below soil surface and horizons with ashy silt loam or silt loam textures between 50 cm and 100 cm below soil surface
AsilovSk : Ashy silt loam over skeletal	Soils with ashy silt loam textures within 50 cm below soil surface and horizons with at least 35% gravels, cobbles and/or stones between 50 cm and 100cm below soil surface
DpCF : Deep w/coarse fragments	Soils without bedrock or clay horizon within 100 cm below soil surface; at least one horizon within 50 cm below soils surface contain at least 15% gravels, cobbles or stones
DpSiCL : Deep - silt to clay loam	Soils without bedrock or clay horizon within 100 cm below soil surface; horizon textures within 50 cm below soil surface are silt loam to clay loam
LGr : Loamy-gravelly	Soils occurring on alluvial fans with silt loam, loam, sandy loam or gravelly silt loam textures within 50 cm below soil surface
LiShC : Lithic/Shallow to Clay	Soils with bedrock or clay horizon within upper 50 cm below soil surface
LovSk : Loam over skeletal	Soils with at least one horizon with loam or sandy loam texture above a horizon with at least 35% gravels, cobbles or stones all within 50 cm below soil surface
LSil : Loam/Silt Loam	Mollisols and soils in which all horizons within 50 cm below soil surface have textures of silt loam or loam and less than 15% gravels, cobbles or stones
LSilbr : Loam/Silt Loam - brackish	Soils occurring in contemporary or prehistoric lake basins with at least one horizon with silt loam texture within 50 cm below soil surface
LSilor : Loam/Silt Loam - organic-rich	Mollisols and Histosols (organic soils) occurring in valley bottom meadows
MDpCF : Mod. deep w/coarse frags	Soils with bedrock or clay horizon within 100 cm below soil surface; at least one horizon within 50 cm below soils surface contain at least 15% gravels, cobbles or stones
Roads : Roads	Soil, gravel or paved road surface
Rock : Rock Outcrop	Rock outcrop
SSkEnt : Sandy-skeletal Entisols	Entisols (poorly developed soils) with sandy textures and at least 35% by volume gravels, cobbles and/or stones within 50cm below soil surface
StmBkHG : Streambanks - high gradient	Soils with high ash content and high water tables occurring along streambanks of narrow, high elevation streams
Water : Water	River, stream, lake or pond
Urban : Urban Complex	Developed areas in cities and townships encompassing a complex of homes, yards, roads, sidewalks, and stores.

Table 6. Standard classification system developed for classifying and mapping existing vegetation (level IV classes) in the Grande Ronde River watershed, northeastern Oregon, 2014.

Code	Title
bbg	Barren
bpa	barren agricultural
bpvh	Barren partially vegetated herbaceous
fbcc	Closed Black Cottonwood Forest
fbcs	Open Willow Forest (lower valley)
fboc	Open Black Cottonwood Forest
fbos	Closed Willow Forest (lower valley)
fbwc	Black Cottonwood Woodland
fmbcdfc	Closed Black Cottonwood-Douglas-fir Forest
fmbcdfo	Open Black Cottonwood-Douglas-fir Forest
fmbceso	Open Black Cottonwood-Engelmann Spruce Forest
fmbcgfo	Open Black Cottonwood-Grand Fir Forest
fmbcppo	Open Black Cottonwood-Ponderosa Pine Forest
fncdf	Closed Douglas-fir Forest
fnces	Closed Engelmann Spruce Forest
fncg	Closed Grand Fir Forest
fncl	Closed Lodgepole Pine Forest
fncpp	Closed Ponderosa Pine Forest
fndfw	Douglas-fir Woodland
fngfw	Grand Fir Woodland
fnodf	Open Douglas-fir Forest
fnoes	Open Englemann Spruce Forest
fnog	Open Grand Fir Forest
fnol	Open Lodgepole Pine Forest
fnopp	Open Ponderosa Pine Forest
fnscf	Closed Subalpine Fir Forest
fnsfo	Open Subalpine Fir Forest
fnsfw	Subalpine Fir Woodland
fnwl	Lodgepole Pine Woodland
fnwpp	Ponderosa Pine Woodland
hca	agricultural croplands
hfm	Forb Meadow
hgd	Dry Graminoid Meadow
hgm	Moist Graminoid Meadow
hgw	Wet Graminoid Meadow
hgwmcc	Wet-Moist Graminoid Meadow Complex
hpa	agricultural pasture
hus	Upland Steppe
rd	Roads
smxlc	Closed Low Elevation Mixed Shrubland
smxlo	Open Low Elevation Mixed Shrubland
ssa	Sitka Alder
stcat	Closed Thinleaf Alder
stcbh	Closed Black Hawthorn
stcw	Closed Tall Willow
stoat	Open Thinleaf Alder
stobh	Open Black Hawthorn
stow	Open Tall Willow
suc	Closed Upland Shrubland
suo	Open Upland Shrubland
ub	Buildings and Other Structures
wf	Fresh Water
xa	agricultural complex
xd	Urban Complex
xr	Riverine Complex

classifications. The PAG canopy closure classes do not correspond to the canopy closure classes in Level III of the existing vegetation classification. For example, a polygon in which the existing vegetation was mapped as Closed Douglas-fir may be potential vegetation mapped as Open Moist Douglas-fir Forest. A forest stand may have a greater number of trees in a denser pattern with a greater canopy closure in a mid-seral (or mid-development) stage than it does in a later (climax) stage.

Three riverine complexes of PAGS were classified to describe areas along narrow streams where individual fluvial surfaces and their associated PAGs were too small to be mapped as separate polygons. Four low elevation complexes were created to depict mosaics of PAGs that could occur on the fluvial surfaces of restored riverine systems in the lower elevations of the mapping area.

Appendix 6 provides a crosswalk between the PAGs and the plant associations, community types and climax plant communities from the literature, while Table 8 lists the potential vegetation mapping codes and titles. Appendix 7 provides descriptions of the complex potential vegetation classes. Figure 8 is an example of how a forest stand develops from an early seral stage to its potential plant association. The diagram illustrates the complexity of the pathways that stand

Table 7. Existing vegetation class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Code and Title	Description
bbg : Barren	Barren areas of the landscape with less than 5% cover of vascular species.
bpa : barren agricultural	Agricultural lands with less than 5% cover of vascular species.
bpvh : Barren partially vegetated herbaceous	Partially vegetated areas of the landscape with 5 to 25% cover of vascular species.
fbcc : Closed Black Cottonwood Forest	Forested areas with ≥60% cover of *Populus trichocarpa*.
fbcs : Open Willow Forest (lower valley)	Forested areas with 25–60% cover of *Salix alba* var. *vitellina*.
fboc : Open Black Cottonwood Forest	Forested areas with 25–60% cover of *Populus trichocarpa*.
fbos : Closed Willow Forest (lower valley)	Forested areas with ≥60% cover of *Salix alba* var. *vitellina*.
fbwc : Black Cottonwood Woodland	Forested areas with 10–25% cover of *Populus trichocarpa*.
fmbcdfc : Closed Black Cottonwood-Douglas-fir Forest	Forested area with ≥60% cover of tree species. *Populus trichocarpa* and *Pseudotsuga menziesii* both contributing 25–75% of the tree cover.
fmbcdfo : Open Black Cottonwood-Douglas-fir Forest	Forested area with 25–60% cover of tree species. *Populus trichocarpa* and *Pseudotsuga menziesii* both contributing 25–75% of the tree cover.
fmbceso : Open Black Cottonwood-Engelmann Spruce Forest	Forested area with 25–60% cover of tree species. *Populus trichocarpa* and *Picea engelmannii* both contributing 25–75% of the tree cover.
fmbcgfo : Open Black Cottonwood-Grand Fir Forest	Forested area with 25–60% cover of tree species. *Populus trichocarpa* and *Abies grandis* both contributing 25–75% of the tree cover.
fmbcppo : Open Black Cottonwood-Ponderosa Pine Forest	Forested area with 25–60% cover of tree species. *Populus trichocarpa* and *Pinus ponderosa* both contributing 25–75% of the tree cover.
fncdf : Closed Douglas-fir Forest	Forested areas with ≥60% cover of *Pseudotsuga menziesii*.
fnces : Closed Engelmann Spruce Forest	Forested areas with ≥60% cover of *Picea engelmannii*.
fncg : Closed Grand Fir Forest	Forested areas with ≥60% cover of *Abies grandis*.
fncl : Closed Lodgepole Pine Forest	Forested areas with ≥60% cover of *Pinus contorta*.
fncpp : Closed Ponderosa Pine Forest	Forested areas with ≥60% cover of *Pinus ponderosa*.
fndfw : Douglas-fir Woodland	Forested areas with 10–25% cover of *Pseudotsuga menziesii*.
fngfw : Grand Fir Woodland	Forested areas with 10–25% cover of *Abies grandis*.
fnodf : Open Douglas-fir Forest	Forested areas with 25–60% cover of *Pseudotsuga menziesii*.
fnoes : Open Englemann Spruce Forest	Forested areas with 25–60% cover of *Picea engelmannii*.
fnog : Open Grand Fir Forest	Forested areas with 25–60% cover of *Abies grandis*.
fnol : Open Lodgepole Pine Forest	Forested areas with 25–60% cover of *Pinus contorta*.
fnopp : Open Ponderosa Pine Forest	Forested areas with 25–60% cover of *Pinus ponderosa*.
fnscf : Closed Subalpine Fir Forest	Forested areas with ≥ 60% cover of *Abies lasiocarpa*.
fnsfo : Open Subalpine Fir Forest	Forested areas with 25–60% cover of *Abies lasiocarpa*.
fnsfw : Subalpine Fir Woodland	Forested areas with 10–25% cover of *Abies lasiocarpa*.
fnwl : Lodgepole Pine Woodland	Forested areas with 10–25% cover of *Pinus contorta*.
fnwpp : Ponderosa Pine Woodland	Forested areas with 10–25% cover of *Pinus ponderosa*.
hca : agricultural croplands	Agricultural lands planted with crops.

Table 7. Continued.

Code and Title	Description
hfm : Forb Meadow	Non-forested areas with <25% shrubs and ≥25% forbs.
hgd : Dry Graminoid Meadow	Non-forested areas with <25% shrubs and ≥25% grasses, sedges, or rushes. Soils dry for most of the growing season.
hgm : Moist Graminoid Meadow	Non-forested areas with <25% shrubs and ≥25% grasses, sedges, or rushes. Soils moist for most of the growing season.
hgw : Wet Graminoid Meadow	Non-forested areas with <25% shrubs and ≥25% grasses, sedges, or rushes. Soils wet for most of the growing season.
hgwmcc : Wet-Moist Graminoid Meadow Complex	Non-forested areas with <25% shrubs and ≥25% grasses, sedges, or rushes . Soils moisture status through the growing season a complex of wet and moist.
hpa : agricultural pasture	Agricultural lands used for pasturing livestock.
hus : Upland Steppe	Non-forested areas with <25% shrubs and ≥25% grasses that occur in upland physiographic areas.
rd : Roads	Soil, gravel or paved road surface
smxlc : Closed Low Elevation Mixed Shrubland	Tall shrublands with ≥75% cover of a mix of Mackenzie's (Rigid) Willow, Coyote Willow, Black Hawthorn, Red-osier Dogwood and Woods Rose.
smxlo : Open Low Elevation Mixed Shrubland	Tall shrublands with 25–74%% cover of a mix of Mackenzie's (Rigid) Willow, Coyote Willow, Black Hawthorn, Red-osier Dogwood and Woods Rose.
ssa : Sitka Alder	Tall shrublands with ≥25% cover of *Alnus sinuata*.
stcat : Closed Thinleaf Alder	Tall shrublands with ≥75% cover of *Alnus incana*.
stcbh : Closed Black Hawthorn	Tall shrublands with ≥75% cover of *Crataegus douglasii*.
stcw : Closed Tall Willow	Tall shrublands with ≥75% cover of willows (*Salix* sp.).
stoat : Open Thinleaf Alder	Tall shrublands with 25–74% cover of *Alnus incana*.
stobh : Open Black Hawthorn	Tall shrublands with 25–74% cover of *Crataegus douglasii*.
stow : Open Tall Willow	Tall shrublands with 25–74% cover of willows (*Salix* sp.)
suc : Closed Upland Shrubland	Upland physiographic areas with ≥75% cover of shrubs.
suo : Open Upland Shrubland	Upland physiographic areas with 25–74% cover of shrubs.
ub : Buildings and Other Structures	Buildings and other man-made structures, including but not limited to homes, barns, garages, and warehouses.
wf : Fresh Water	Freshwater waterbodies, including rivers, streams, ponds, and lakes.
xa : agricultural complex	Agricultural areas encompassing a complex of farm homes, barns, pastures, yards, driveways, and croplands.
xd : Urban Complex	Developed areas in cities and townships encompassing a complex of homes, yards, roads, sidewalks, and stores.
xr : Riverine Complex	Riverine areas with 3 or more types of vegetation with no one type encompassing more than 2/3 of the area.

Table 8. Standard classification system developed for classifying and mapping potential vegetation in the Grande Ronde River watershed, northeastern Oregon, 2014.

Code	Title
a	Agricultural Fields
bbg	Barren
fbbcwf	Black Cottonwood/Willows Floodplain Forest
fbcf	Black Cottonwood Floodplain Forest
fbclf	Low Elevation Black Cottonwood Floodplain Forest
fbcmmlfc	Low Elevation Black Cottonwood/Moist Meadow Floodplain Complex
fbct	Black Cottonwood Terrace Forest
fbww	White Willow Forest
fdfd	Dry Douglas-fir Forest
fdflm	Low Elevation Moist Douglas-fir Forest
fdfm	Moist Douglas-fir Forest
fdfmo	Open Moist Douglas-fir Forest
fdfwm	Warm-moist Douglas-fir Forest
fes	Engelmann Spruce Forest
fgfc	Cold Grand Fir Forest
fgfcm	Cool-moist Grand Fir Forest
fgfcmo	Open Cool-moist Grand Fir Forest
fgfes	Grand fir-Engelmann Spruce Forest
fgfeso	Open Grand fir-Engelmann Spruce Forest
fgfwd	Warm-dry Grand Fir Forest
fgfwdo	Open Warm-dry Grand Fir Forest
flpd	Dry Lodgepole Pine Forest
flpmm	Lodgepole Pine Moist Meadow
flpwm	Lodgepole Pine Wet Meadow
fppd	Dry Ponderosa Pine Forest
fppm	Moist Ponderosa Pine Forest
fppmo	Open Moist Ponderosa Pine Forest
fsfd	Dry Subalpine Fir Forest
fsfes	Subalpine Fir-Engelmann Spruce Forest
fsfeso	Open Subalpine Fir-Engelmann Spruce Forest
hbwif	Bluebunch Wheatgrass-Idaho Fescue Herbland
hfmm	Moist Forb Meadow Herbland
hgfgb	Graminoid-Forb Gravel Bar Herbland
hgmccwmc	Cold Wet-Moist Meadow Complex Herbland
hgmcwmc	Wet-Moist Meadow Complex Herbland
hmcm	Cold-moist Meadow Herbland

Table 8. Continued.

Code	Title
hmd	Dry Meadow Herbland
hmm	Moist Meadow Herbland
hss	Subalpine Steppe Herbland
husd	Dry Upland Steppe Herbland
husgbwc	Dry Upland Steppe-Moist Great Basin Wildrye Complex
hwm	Wet Meadow Herbland
hwmc	Cold Wet Meadow Herbland
rd	Roads
ro	Rock
sbh	Black Hawthorn Shrubland
scs	Red-osier Dogwood Shrubland
smaf	Mountain Alder Floodplain Shrubland
smalf	Low Elevation Mountain Alder Floodplain Shrubland
smawm	Mountain Alder Wet Meadow Shrubland
smm	Moist Meadow Shrubland
smmgrlfc	Low Elevation Moist Shrub/Graminoid Floodplain Complex
smxl	Low Elevation Mixed Shrubland
ssa	Sitka Alder Shrubland
sud	Upland Dry Shrubland
sum	Upland Moist Shrubland
swgb	Willows Gravel Bar Shrubland
swmm	Tall Willows Moist Meadow Shrubland
swmmgrblfc	Low Elevation Brackish Wet-Moist Shrub/Graminoid Floodplain Complex
swmmgrlfc	Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex
swwm	Tall Willows Wet Meadow Shrubland
ub	Buildings and Other Structures
wf	Fresh Water
wpps	Ponderosa Pine Steppe Woodland
xd	Developed Sites
xrl	Low-elevation Riverine Complex
xrm	Mid-elevation Riverine Complex
xru	Upper-elevation Riverine Complex
xu	Urban Complex

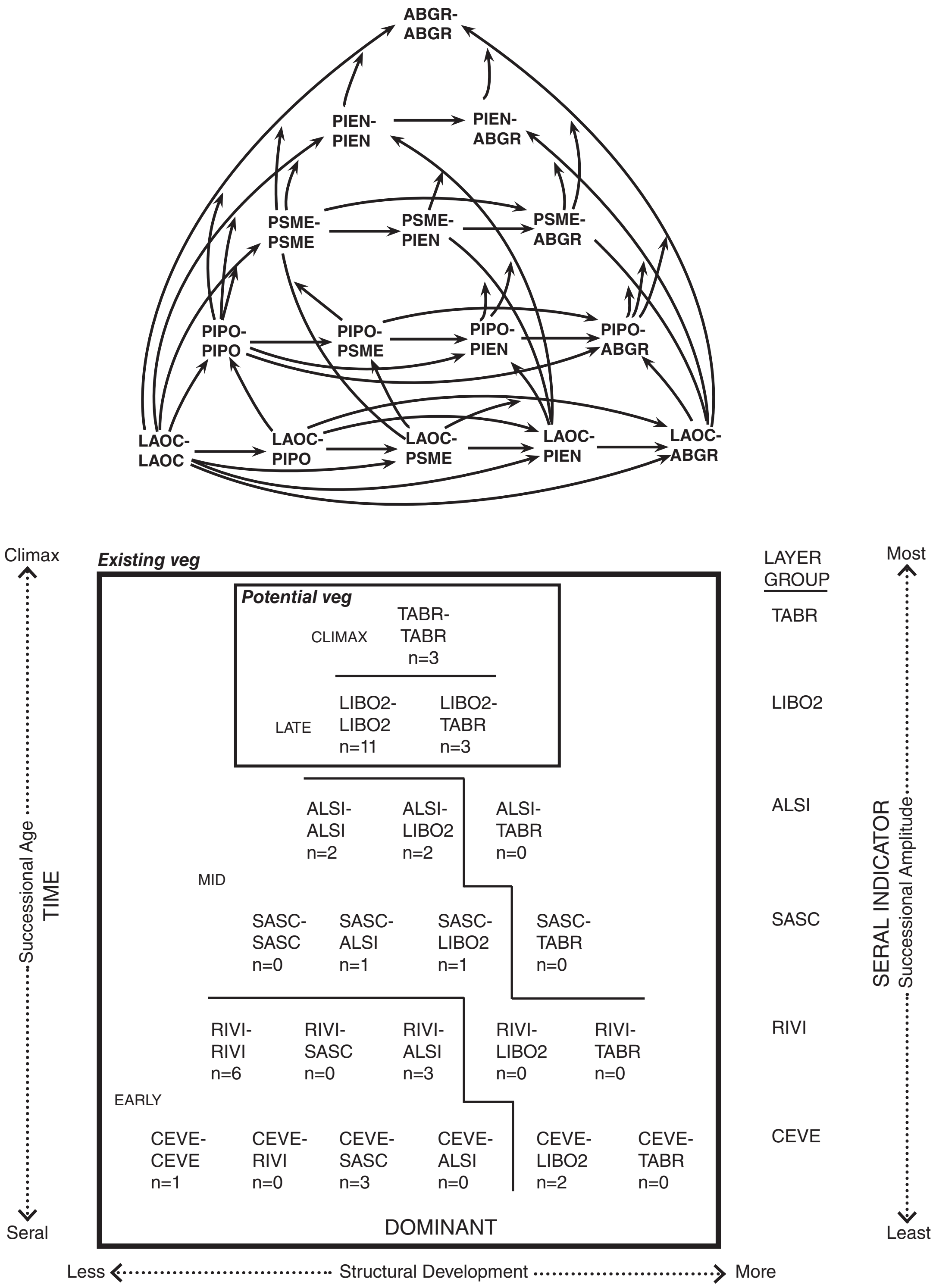


Figure 8. Succession classification diagrams of the Grand fir/Pacific yew/queen's cup beadlily plant association showing the successional pathways for the tree layer (above) and the successional dynamics of the shrub layer (below). The diagrams illustrate the conceptual relationship between the existing and potential vegetation classification. The existing vegetation classification may include any seral stage from early through climax, while the potential vegetation includes only late and climax seral stages. Figure modified from Figure 2 and 3 of Clausnitzer (1993), respectively.

development can take and why it is not possible for every existing Level IV vegetation type to be directly correlated to only one potential vegetation type (PAG).

Disturbance

Disturbance characterizes recent (<10–20 years) or ongoing landscape disturbance, and includes both natural (e.g., forest fire) and anthropogenic (e.g., agricultural field) classes (Tables 9 and 10).

Table 9. Standard classification system developed for classifying and mapping disturbance in the Grande Ronde River watershed, northeastern Oregon, 2014.

Code	Title
A	ABSENT, NONE (mature vegetation)
DC	Disturbance complex
Ha	Agricultural Field
Hac	Crops
Haf	Feedlot/livestock holding pen
Hag	Livestock Grazing
Hah	Hayfield
Hc	Clearings (Non-agricultural or undifferentiated)
Hcl	Logged
Hd	Human Developed Sites (urban complex)
Hdr	Residential Development
He	Excavation/Pits (undifferentiated)
Hf	Fill
Hfgrp	Paved Road
Hfgru	Unpaved road
Hft	Mine Tailings
Hp	Pasture
Hrr	Railroad
Hsb	Building
Hsisd	Abandoned/historic splash dam
Hwc	Canal
Hwd	Ditch
Hwe	Water-filled excavation
Hwi	Drainage Impoundment
Hwl	Levee
Nf	Fire
Ngfd	Fluvial Deposition
Ngfe	Fluvial Erosion/channel migration

MAPPING OF ECOLOGICAL COMPONENTS

AERIAL IMAGERY

Polygon delineation was completed on-screen in a Geographic Information System (GIS) by photo-interpretation of aerial imagery. Field plot data were used to inform the mapping of vegetation types based on ocular interpretation of the aerial imagery color and texture signatures. Mapping was typically initiated in areas with field plot data to build a relationship between the photo signatures and the ground data (Figure 9). The mapping was then carried outward into sections of the study area without plot data; the interpretation of photo signatures in these areas extrapolated from areas with plot data. The primary aerial imagery used for mapping included the 2014, 2012 and 2011 NAIP natural color imagery (streamed from NAIP,1.0-m pixel resolution) and the 2012 4-band (including near-infrared [NIR]) 1.0-m resolution NAIP imagery acquired July-August 2012 (Figure 10). The imagery was obtained from the National Aerial Imagery Program (NAIP). The NIR band provided additional information that assisted in differentiating between vegetation classes (e.g., needleleaf vs. broadleaf). Secondarily, mapping was conducted on a CRITFC-supplied NAIP natural color orthophotography mosaic acquired in 2009 with 1.0-m pixel resolution. Google Earth was used to supplement the NAIP imagery and provided a higher-resolution imagery to aid in the interpretation of aerial imagery signatures.

LIDAR

A LiDAR dataset (1.0-m resolution), provided by CRITFC and generated by Watershed Sciences, Inc. (2009), and LiDAR data of the lower watershed, flown by the U.S. Bureau of Reclamation in 2007 and 2009, were also used to assist the mapping effort. The BareEarth raster datasets were further processed by ABR into an elevation-independent hillshade, using the ESRI Spatial Analyst toolset in ArcMap 10.2.1 (Figure 11 upper panel). This was used to delineate valley bottom and channel location, physiography, geomorphic surfaces, and disturbances, particularly under forest canopy. The Canopy mosaic datasets from WSI and the generated data from BOR were used to assess tree and shrub

Table 10. Disturbance class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Code and Title	Description
A : ABSENT, NONE (mature vegetation)	No recent disturbance. Recent disturbance includes any disturbance occurring within the last 5 to 10 years.
DC : Disturbance complex	Areas on the landscape with 3 or more disturbance types that co–occur spatially and cannot be split into individual disturbance types given the minimum map unit size, and no single disturbance type is dominant (>2/3 of the area)
Ha : Agricultural Field	Active or abandoned agricultural fields.
Hac : Crops	Agricultural lands cultivated with crops.
Haf : Feedlot/livestock holding pen	Areas of landscape utilized as livestock feedlots or holding pens.
Hag : Livestock Grazing	Areas of the landscape affected by regular (annual or bi-annual) livestock grazing.
Hah : Hayfield	Agricultural lands cultivated as hayfields
Hc : Clearings (Non-agricultural or undifferentiated)	Areas cleared of vegetation unrelated to agriculture.
Hcl : Logged	Areas of the landscape that have experienced recent logging.
Hd : Human Developed Sites (urban complex)	Developed areas in cities and townships encompassing homes, yards, roads, sidewalks, and stores, or a combination of these mapped as a complex
Hdr : Residential Development	Areas of residential development, including ranches and homesteads.
He : Excavation/Pits (undifferentiated)	Recently excavated areas of the landscape.
Hf : Fill	Areas of the landscape characterized by gravel or other fill material.
Hfgrp : Paved Road	Paved roads
Hfgru : Unpaved road	Unpaved roads, including gravel and dirt roads.
Hft : Mine Tailings	Areas of the landscape characterized by mine tailings
Hp : Pasture	Agricultural lands utilized as pasture for livestock.
Hrr : Railroad	Tracks and other railroad related infrastructure.
Hsb : Building	Areas of the landscape affected by buildings and other structures. Typically mapped with the vegetation class "Buildings and Other Structures"
Hsisd : Abandoned/historic splash dam	Remnants of a splash dam historically used for logging and since abandoned.
Hwc : Canal	Canals and areas of the landscape otherwise affected by canals.
Hwd : Ditch	Ditches and areas of the landscape otherwise affected by ditches.

Table 10. Continued.

Code and Title	Description
Hwe : Water-filled excavation	Small waterbodies created by soil excavation and subsequent infilling by water
Hwi : Drainage Impoundment	Reservoirs or other waterbodies created by the impoundment of water
Hwl : Levee	An artificial embankment constructed along the bank of a watercourse to protect land from inundation and/or to confine streamflow to its channel (USDA, NRCS 2015a).
Nf : Fire	Areas of the landscape affected by recent wildfire.
Ngfd : Fluvial Deposition	Riverine areas affected by recent fluvial sediment deposition.
Ngfe : Fluvial Erosion/channel migration	Riverine areas affected by recent fluvial erosion or channel migration.

height and density (e.g., Open vs. Closed Needleleaf Forest) (Figure 11 lower panel).

ANCILLARY GIS DATASETS

In addition to the aerial imagery and LiDAR, several ancillary datasets were used to assist the mapping process (Table 11). The Forest Cover Loss 2000–2013 layer from Hansen et al. (2013) in conjunction with the Oregon Department of Forestry Fire Occurrence layer (ODF 2015) was used as a check on the mapping of the disturbance classes, “Logging” and “Fire”. Polygons occurring in areas with forest cover loss between the years 2000–2013 were compared to locations of fire occurrences between 1993–2013. Map polygons that occurred in areas where forest loss and fires occurred during the above period were confirmed as forest fire disturbance, while polygons in areas where forest loss occurred and fires were absent were confirmed as logging disturbance. The Forest Cover Loss data was mapped at a relatively coarse resolution (30-m pixels) compared to the ITU mapping. Consequently, in some cases, the Forest Cover Loss data did not capture changes in forest cover in the study area. For these cases we relied on the Fire Occurrence Layer to assign forest fire disturbance to map polygons, and on the time series of NAIP Imagery (2009–2014) to confirm recent forest cover loss due to logging.

The 2013 TIGER/Line Shapefile of primary and secondary roads in Oregon (U.S. Census Bureau 2013) was compared to the mapping of roads. The roads that were mapped matched well with the TIGER layer. The TIGER roads layer shows many additional roads than were mapped, but these roads were not visible in either the LiDAR, the NAIP, or other imagery used in mapping.

The Wallowa-Whitman National Forest existing vegetation polygon shapefile (USDA Forest Service, Wallowa-Whitman National Forest, 2004), the Wallowa-Whitman National Forest Soils Database (USDA, NRCS, Soil Survey Division_a) and Union County Soil Survey Survey (Dyksterhuis and High 1985) were used to verify existing vegetation and determine potential vegetation. Vegetation information found in both the soil series descriptions in the Survey document and in the official soil series descriptions (USDA, NRCS, Soil Survey Division_b) was compiled and joined to the attribute table for the Union County Soil Survey polygon shapefile. In addition, unpublished riparian ecological unit inventory line mapping (Ottersberg 2012) provided verification of vegetation mapping along narrow streams on National Forest lands.

The U.S. Forest Service ecology program plot shapefile (USDA, Forest Service, Wallowa-Whitman National Forest, 2015a) was used to verify potential vegetation mapping. All plot points are attributed with the classified potential plant association or plant community type. The Blue Mountains range pasture boundary shapefile (USDA, Forest Service, Wallowa-Whitman National Forest, 2015b) and the Blue Mountains Surface ownership shapefile (USDA, Forest Service, Wallowa-Whitman National Forest, 2015c) were used to determine current land uses as they pertained to mapping disturbance attributes.

MAPPING STANDARDS

Map polygons were delineated at a mapping scale of 1:2,000 to 1:3,000 for a final map scale (the scale at which the mapping is valid for landscape analysis) of 1:5,000. The minimum mapping size for polygons (a ‘polygon’ is defined here as an area delineated on the map as a single unit) was 0.10 ha for waterbodies, 0.81 ha for complexes, and 0.20 ha for all other classes. Exceptions to the minimum map unit size included polygons that occurred on the edge of the mapping and would continue outside the mapping boundary if the study area boundary were to be extended. Minimum width for mapping the active (i.e., permanently flooded) riverbed was set at 5 m, below which the stream bed was not mapped but was instead aggregated with the surrounding floodplain. Several complex vegetation classes were used to map highly heterogeneous areas associated with dynamic geomorphic processes and anthropogenic disturbance. Complexes were used for polygons where at least 3 vegetation classes were present, the dominant cover type occupied <65% of the polygon, and inclusions were below the minimum size for mapping.

INTEGRATED TERRAIN UNITS

Individual ecological components were mapped simultaneously as compound codes called Integrated Terrain Units (ITUs). Integrated Terrain Units comprise five parameters assigned to each map polygon describing physiography, geomorphology, generalized soils, existing vegetation, potential vegetation, and disturbance (e.g., Lowland/Meander Abandoned Overbank Deposit/ Ashy silt loam over loam/Lodgepole Pine Woodland/Lodgepole Pine Moist Meadow/ Absent). The mapping parameters were attributed using a standardized coding scheme (Tables W–Z); following from the above example, e.g., L/fmob/AsilovL/fnwl/flpmm/A (Figure 10).

AGGREGATION OF ECOLOGICAL COMPONENTS

ECOTYPES

Individual ecological components for each polygon in the ITU mapping were concatenated to create ITU code combinations (e.g., L/fmob/AsilovL/fnwl/flpmm/A). The ITU code combinations were aggregated based on physiography, and similarities in soils and existing vegetation into ecological types (ecotypes). Ecotypes are local-scale ecosystems that represent a hierarchical organization of physical and biological variables. The advantage of this hierarchical methodology is that the combination of physiography (strongly associated with geomorphic units), soils, and vegetation composition and structure yields classes that effectively differentiate both soil characteristics and vegetation composition.

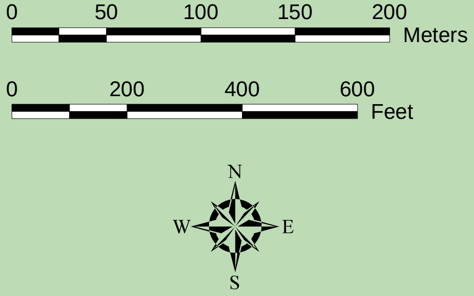
Ecotype classes were assigned to each unique ITU code combination to create a crosswalk (Appendix 8). The ITU/ecotype crosswalk was then joined to the ITU mapping layer in ArcGIS based on the ITU field and each polygon assigned an ecotype. The ITU mapping layer could then be symbolized on ecotype to create the ecotype map.

EROSION SENSITIVITY CLASSES

Erosion sensitivity classes were generated by aggregating ITU code combinations based on existing vegetation, geomorphology, and soils (Table 12). The erosion sensitivity classification incorporates characteristics of soils that make them more or less prone to erosion. For instance, sandy soils are more prone to erosion than loamy soils, and soils with higher coarse fragment content are less prone to erosion than soils with fewer coarse fragments. Integrated with soil characteristics in the erosion sensitivity classification are vegetation characteristics that either increase or decrease a soil’s susceptibility to erosion. For instance, dense, multi-layer forested vegetation protects the soil surface and reduces erosion, while vegetation dominated by annual grasses increases the susceptibility of erosion (Figure 12). Lastly, soil moisture is incorporated into the erosion classification for herbaceous types. The drier the soils, the more prone to erosion because the rooting layer is typically shallower and the roots less dense. In contrast, wetter soils typically have a thicker rooting zone and denser roots, resulting in a reduced sensitivity to erosion. Similar to ecotypes, erosion sensitivity classes were assigned to each unique ITU code combination to create a crosswalk (Appendix 8). The ITU/erosion sensitivity crosswalk was then joined to the ITU mapping layer in ArcGIS based on the ITU field and each

Figure 9.
Map of integrated terrain units and field plot locations with field verification photographs, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Approximate map scale = 1:4,000



● Verification Plot

Integrated Terrain Unit (ITU) Mapping

V07-01

V07-03

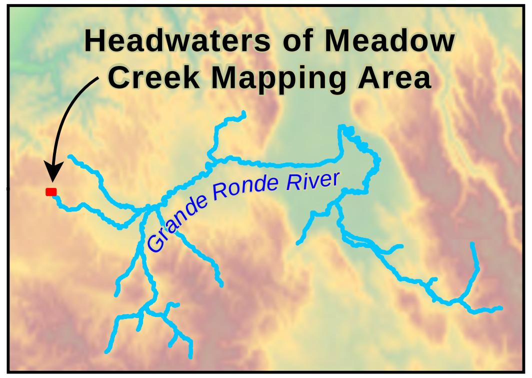
V07-04

V07-02

V07-05

Field plot data, including photographs (shown here for transect v07) and tabular data on vegetation composition and soils (not shown), were used to inform the mapping of vegetation types based on ocular interpretation of the aerial imagery color and texture signatures. Mapping was typically initiated in areas with field plot data to build a relationship between the photo signatures and the ground data. The mapping was then carried outward into sections of the study area without plot data; the interpretation of photo signatures in these areas extrapolated from areas with plot data.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD).



Map projection: UTM Zone 11N, NAD 83. ABR file: Fig09_CRITFC_PlotsFieldPhotos_HMC_14-1451.mxd, 08 Jun 2015

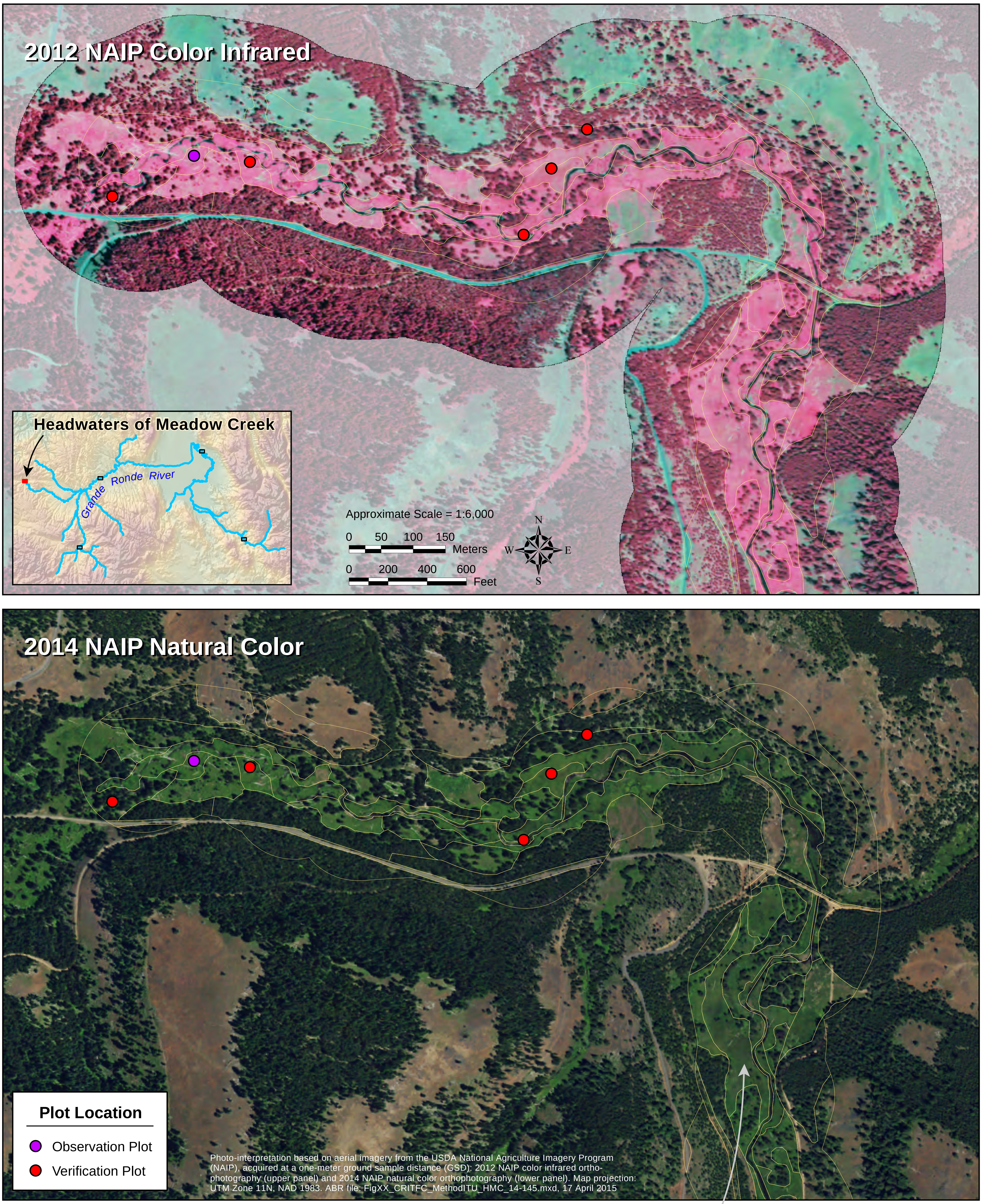


Photo-interpretation based on aerial imagery from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD): 2012 NAIP color infrared orthophotography (upper panel) and 2014 NAIP natural color orthophotography (lower panel). Map projection: UTM Zone 11N, NAD 1983. ABR file: FigXX_CRITFC_MethodITU_HMC_14-145.mxd, 17 April 2015

Integrated Terrain Unit (ITU) mapping is an integrated approach to mapping landscape elements. It is a mulitvariate mapping process in which terrain unit map boundaries are visually interpreted and digitized over high-resolution imagery so that the boundaries are increased coincidence between the boundaries and occurrences of interdependent ITU variables, such as physiography, geomorphology, soils and vegetation units (Jorgenson et al. 2003). The method of combining various ITUs allows for the preparation of thematic maps that can be customized for specific study needs, including the base maps physiography, geomorphology, soils, existing and potential vegetation, and disturbance, as well as derived maps, including ecotype and erosion sensitivity maps.

Integrated Terrain Unit (ITU) Mapping

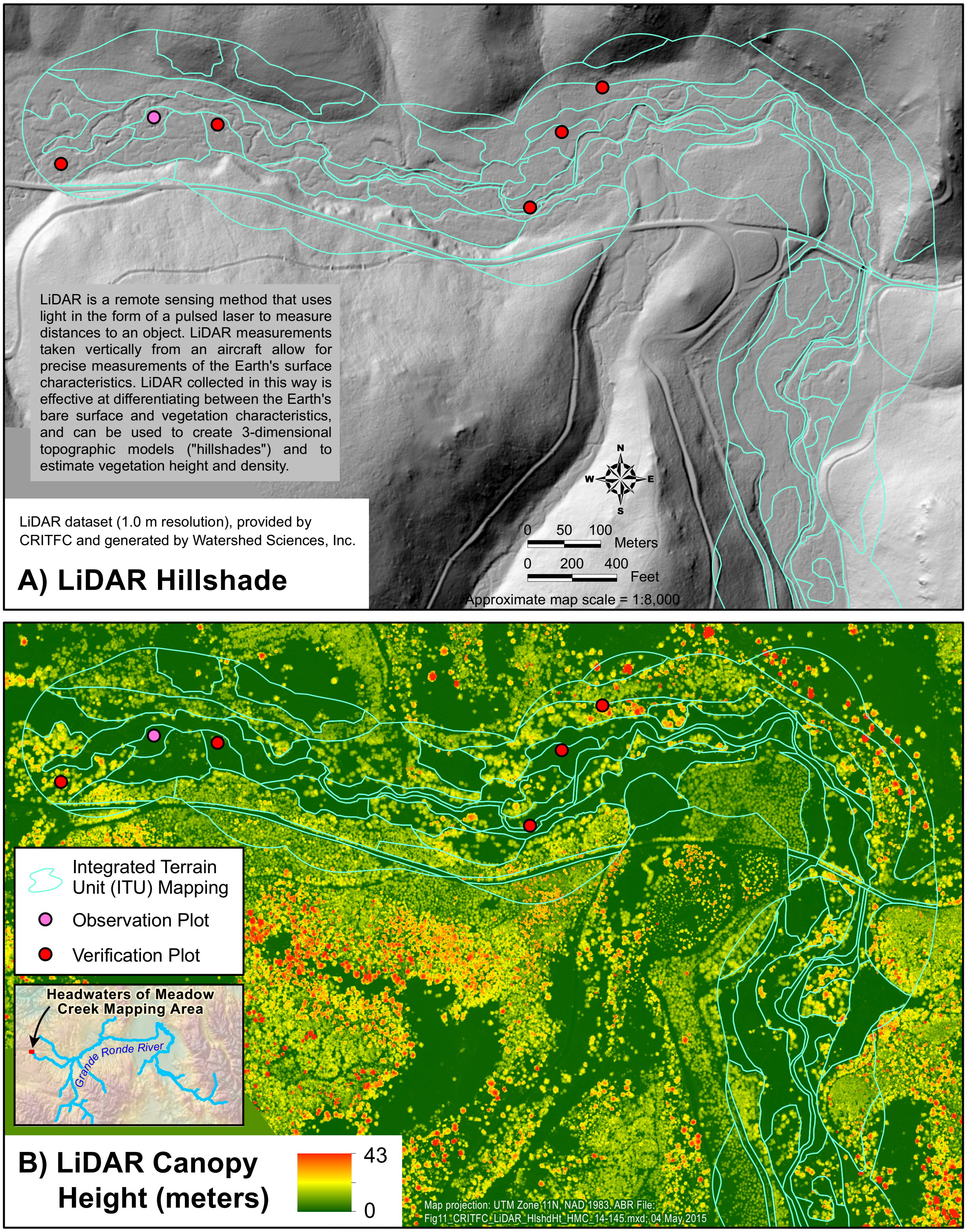
ITU Polygon

ITU Code example:

fmob	L	LSilor	hgm	hmm	Hag
Geomorphology	Physiography	Generalized Soils	Existing Veg Level 4	Potential Vegetation	Disturbance

fmob : Meander Abandoned Overbank Deposit /
L : Lowland /
LSilor : Loam/Silt Loam - organic-rich /
hgm : Moist Graminoid Meadow /
hmm : Moist Meadow Herbland /
Hag : Livestock Grazing

Figure 10. Map of integrated terrain units and field plot locations overlaid on the NAIP aerial imagery, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



LiDAR is a remote sensing method that uses light in the form of a pulsed laser to measure distances to an object. LiDAR measurements taken vertically from an aircraft allow for precise measurements of the Earth's surface characteristics. LiDAR collected in this way is effective at differentiating between the Earth's bare surface and vegetation characteristics, and can be used to create 3-dimensional topographic models ("hillshades") and to estimate vegetation height and density.

LiDAR dataset (1.0 m resolution), provided by CRITFC and generated by Watershed Sciences, Inc.

Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig11_CRITFC_LiDAR_HlshdHt_HMC_14-145.mxd; 04 May 2015

Figure 11. Integrated Terrain Unit (ITU) mapping and field plot location depicting A) the LiDAR hillshade used for delineating topographic features, and B) the LiDAR canopy height data used for determining vegetation height and structure classes (e.g., closed tall vs. open low shrub), headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Table 11. List of GIS data sources used.

Category of Data	Type of Data	Spatial Data File Name	Source of Spatial Data	Link to Spatial Data
Base Layers	NAIP Photography 2012	N.A.	ArcGIS Server	Stream from: http://gis.apfo.usda.gov/ArcGIS/Services/NAIP/Oregon_2012_1m_NC/ImageServer
	NAIP Photography 2011	N.A.	ArcGIS Server	Stream from: http://gis.apfo.usda.gov/ArcGIS/Services/NAIP/Oregon_2012_1m_NC/ImageServer
	NAIP Photography 2014	N.A.	ArcGIS Server	Stream from: http://gis.apfo.usda.gov/ArcGIS/Services/NAIP/Oregon_2012_1m_NC/ImageServer
	NAIP Photography 2012	naip4b_sa	USGS National Map	http://viewer.nationalmap.gov/viewer/
	Natural Color Aerial Photography	These are .jpg images, not spatial data.	CRITFC	NA - not available online
	Natural Color Aerial Photography Indices	Indices are organized into spatial files by stream, e.g. Beaver_Creek.shp.	CRITFC	NA - not available online
	LiDAR	LiDAR.gdb	CRITFC	NA - not available online
	LiDAR	cc2007_be_dem	BOR	NA - not available online
	LiDAR	cc2007_hh_dem	BOR	NA - not available online
	LiDAR	wc2007_be_dem	BOR	NA - not available online
	LiDAR	wc2007_hh_dem	BOR	NA - not available online

Table 11. Continued.

Category of Data	Type of Data	Spatial Data File Name	Source of Spatial Data	Link to Spatial Data
Soils	W-W and Umatilla NF - Riparian EUI Line Segment Mapping Units	WW_lineseg_fluv.shp	Craig Busskohl, Soil Quality and Ecosystems, NRCS National Soil Survey Center; phone: (402) 437-5316	NA - not available online
	Blue Mtns Landtype Associations	LTA_02_05_2013.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
Upland Vegetation	W-W Existing Vegetation	Vegetation_Stand.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
	Union County Historical Vegetation -1958	veghist_union_1958.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
Geology	Oregon Geologic Data Compilation	G_MAP_UNIT.SHP	OR geospatial library / DOGAMI	http://spatialdata.oregonexplorer.info/geoportal/catalog/search/resource/details.page?uuid={D9B42C23-07E9-496F-8188-7C06A6D0E891}

Table 11. Continued.

Category of Data	Type of Data	Spatial Data File Name	Source of Spatial Data	Link to Spatial Data
Water/Valleys	Valley/Stream Segment Classification	originally part of gronde_gis_data0.gdb\Hydrography in \PNVData_08-Feb-2013\v10\; NetStream_reaches_cu	CRITFC	NA - not available online
Data Points and Associated Data for Existing Riparian Work	USFS Ecology Plot Points and Data	EcologyPlot.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
Fire and Harvest Occurrence History	Blue Mountains NFs Fire History Points	FireHistoryPoints.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
	Blue Mountains NFs Fire History Polygons	FireHistoryPl.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
	Fire Occurrence	ODF Fires	Oregon Department of Forestry	http://www.oregon.gov/odf/Pages/gis/GISDataExport.aspx

Table 11. Continued.

Category of Data	Type of Data	Spatial Data File Name	Source of Spatial Data	Link to Spatial Data
	Forest Cover Loss	Forest Cover Loss 2000-2013	Earth Engineer Partners	http://earthenginepartners.appspot.com/science-2013-global-forest
Infrastructure	2013 TIGER/Line Shapefile	Roads_FS_Tiger_CRITFC_100m_terrainslope.shp	CRITFC	NA - not available online
Management Designations	Blue Mountains NF Range Pastures	rum_subunit.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml
	Blue Mountains Surface Ownership	SurfaceOwnership.shp	Malheur, Umatilla, Wallowa-Whitman National Forests GIS Data Library	http://www.fs.fed.us/r6/data-library/gis/umatilla/index.shtml

Table 12. Erosion sensitivity class descriptions. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Title	Description
High	The erosion sensitivity class with the greatest susceptibility to erosion. This class includes barren and partially vegetated area and vegetated areas with relatively simple canopy structure and shallow root systems. Soils are typically dry to moist, and sandy and/or unconsolidated.
Low	The erosion sensitivity class with the lowest susceptibility to erosion. This class includes vegetated areas with robust, complex canopy structure and deep root systems. Soils are typically well consolidated, moist to wet, loamy or organic, and/or high in coarse fragments.
Moderate	The erosion sensitivity class with a medium susceptibility to erosion. This class includes grasslands and forblands with soils that are typically well consolidated, dry to moist, and high in coarse fragments. This class also includes riverine complexes that are characterized by a mosaic of vegetation and soil types that include both high (barrens and partially vegetated sand and cobble bars) and low (forests on floodplains and terraces) erosion sensitivity classes.
Negligible	This erosion sensitivity class includes areas on the landscape where erosion is not typically an issue, including human developments, roads, and waterbodies.

polygon assigned an erosion sensitivity class. The ITU mapping layer could then be symbolized on erosion sensitivity to create the erosion sensitivity map.

EXISTING VEGETATION CANOPY HEIGHT, DENSITY, AND COMPLEXITY

LiDAR data, provided by CRITFC (Watershed Sciences, 2009) and the U.S. Bureau of Reclamation (2007, 2009) was compiled for the study area, and processed using ArcGIS 10.2.1 with the Spatial Analyst extension. Three procedures were performed on the data.

First, the canopy rasters were summarized across all height strata by Mean Canopy Height, Maximum Canopy Height, and Standard Deviation (SD) of Mean Canopy Height by ITU polygon, using the Extract to Table tool. Second, the mean and SD of canopy heights were calculated for 3 height strata of interest (0–1.5 m, >1.5 m–3 m, and >3 m) using the Con (Conditional) tool. The generated rasters were run through the Extract to Table tool for joining to the ITU geodatabase. Finally, the rasters were reclassified into “Canopy Hit” or “No hit” along the height strata, and the resulting raster was extracted in a similar fashion to the Mean/SD data. The number of hits were then summed and divided by the area of the individual polygons to get a canopy coverage value. Depending on what information is needed, the ITU mapping layer can be symbolized on any of the relevant metrics to summarize canopy information.

For the purposes of this study, SD was used as the metric of canopy complexity. A high SD is indicative of many different canopy heights within the polygon and suggests a complex height character of the vegetation in that polygon. A small SD indicates a more uniform stand, with less complexity.

Some notes regarding the LiDAR data. The LiDAR data summaries by map polygon matched well with the vegetation on the ground, based on visual review of field photos. There are some variations, however, depending on canopy/LiDAR hits present, size of polygons, and data processing glitches.

Values coded as <null> occur when there is no LiDAR for an area, no occurrences of a hit within a height strata (e.g., no high hits in an exclusively low grassland polygon), or the aforementioned glitches.

There are some rare exceptionally high hits (e.g., 706 m) that are likely the result of a bird,

Figure 12. Field photos showing examples of streambank erosion along middle Meadow Creek (a) and upper Sheep Creek (b). In the upper photo large blocks of soil have been eroded from the adjacent terrace which is dominated by meadow foxtail *(Alopecurus pratensis)* an introduced perennial grass with a weak, shallow root system. In the lower photo a portion of fence is suspended following erosion of soil around it. For scale, shovel in upper photo is approximately 1.1 meters tall. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

balloon, or tower in the mapping area at the time the LiDAR data was collected. Those outliers were retained. Lastly, it is important to note that the LiDAR data summaries are supplementary to the field observations, and are not replacements for field data.

POTENTIAL VEGETATION HEIGHTS

Potential vegetation density was estimated using canopy cover averages for trees and shrubs in each PAG. Data for canopy cover were taken from datasets used in developing local vegetation classifications (Crowe and Clausnitzer 1997, Crowe et al 2004, Johnson and Clausnitzer 1992, Johnson and Simon 1987, and Wells 2006). Canopy cover data for each potential vegetation class are provided in an Excel spreadsheet that accompanies this report (PAG_Species_Constancy_Canopy_Cover_Tables.xlsx).

Using site index information in the upland vegetation classifications for the Blue Mountains (Johnson and Simon 1987, Johnson and Clausnitzer 1992), the average height of trees in most of the forested PAGs was calculated. The site indices in these classifications were for the estimated height of individual species in 100-year old stands in plant associations. The species site indices were weighted by average cover of each species within the plant association to produce an average 100-year stand height for each plant associations. These average 100-year stand heights were then averaged for the PAGs to which the plant association had been assigned (see Appendix 6). Where data were lacking for coniferous PAGs (except for Lodgepole Pine), the average stand height of a similar PAG was assigned. For example, Open Subalpine Fir-Engelmann Spruce Forest was assigned the same 100-year stand height as Subalpine Fir-Engelmann Spruce Forest. Dry Lodgepole Pine Forest was assigned a 100-year stand height based on site index values for Lodgepole Pine found in the dry Subalpine Fir plant associations (Johnson and Simon 1987, Johnson and Clausnitzer 1992). Lodgepole Pine/Wet Meadow and Lodgepole Pine/Moist Meadow were assigned a 100-year stand height based on some height and age data collected for these plant associations that were never published. The Black Cottonwood PAGS were assigned a 100-year stand height of 31 m (DeBell 1990). White Willow was assigned a 100-year stand height of 22 m based on the LiDAR height data for polygons mapped as White Willow because the trees we observed in the field appeared to have reached their full height potential.

Potential shrub heights were obtained from Steele and Geier-Hayes (1987, 1989, 1992, 1993, 1994) and from species descriptions in the Fire Effects Information System (2015). Shrub heights were weighted by average cover of each species within shrub PAGs to produce an average maximum shrub canopy height. Potential vegetation canopy height data for each potential vegetation class were compiled into a crosswalk table. The crosswalk table was then imported into ArcGIS and a tabular join between the ITU mapping and the crosswalk was used to assign potential height classes to each polygon based on the potential vegetation class.

LIDAR FIELD VERIFICATION

LiDAR field plot data were summarized and compared to the estimates of existing vegetation canopy height and density data by map polygon. First, a spatial join was conducted between the LiDAR plot locations and the ITU mapping to extract the height and density data for each map polygon associated with each plot. Second, the LiDAR plot densitometer data was aggregated to percent cover for each species by dividing the number of hits of each lifeform, including trees and tall shrubs, by the total number of densitometer measurements within a plot (i.e., 20). Third, the mean and SD of LiDAR plot height data was calculated across all tree species within a plot. We the plotted paired bar charts for each plot that compare the LiDAR plot data against the density and mean height for each ITU map polygon estimated from the LiDAR data. For density we compared the combined cover of tall shrubs and trees from the plot data against the combined density of the 1.5–3.0 m and >3.0 m strata layers (i.e., cano_1pt5to3_density + cano_gt3_density). For height we compared the mean and standard deviation of trees measured in the LiDAR plots against the mean and SD of the mean >3.0 m strata layer (e.g., cano_gt3_mean and cano_gt3_SD) from the ITU mapping.

RESULTS AND DISCUSSION

INTEGRATED TERRAIN UNIT MAPPING

Integrated Terrain Unit mapping was completed for the entire 7,394 ha (18,270 acre) study area (Figure 1). The long, narrow study area, combined with the large mapping scale (1:5,000) precluded displaying the mapping for the entire study area in this report. Instead, 5 detailed study areas representing a range of representative environmental conditions were selected for which the ITU mapping is displayed (Figure 1). Figures 13–21 display the full suite of individual ITU mapping components for the headwaters of Meadow Creek detailed study area. These figures *do not* represent the full range of ITU mapping classes encompassing the entire study area, rather, the headwaters of Meadow Creek detailed study area maps are presented as an example of the final products of the ITU mapping. Tables 13–19 display the total area of all individual ITU components summarized *across the entire study area*.

MAPPING OF AGGREGATED ECOLOGICAL COMPONENTS

ECOTYPES AND EROSION SENSITIVITY CLASSES

A total of 2,078 unique ITU code combinations from across the entire study area were aggregated into 66 ecotype classes and 4 erosion sensitivity classes. Figures 22 and 23 display the ecotype and erosion sensitivity mapping for the headwaters of Meadow Creek detailed study area. Tables 20 and 21 display the total area of all ecotype and erosion sensitivity classes summarized *across the entire study area*.

EXISTING VEGETATION CANOPY HEIGHT, DENSITY, AND COMPLEXITY

Canopy height and density were estimated from LiDAR data and mapped across the study area in 4 canopy height categories as described in Methods above. Canopy complexity was mapped as an expression of the standard deviation of mean canopy height across all canopy layers. Figures 24–27 present examples of the canopy height and density mapping, and Figure 28 displays the canopy complexity mapping in the headwaters of Meadow Creek detailed study area.

POTENTIAL VEGETATION CANOPY HEIGHT

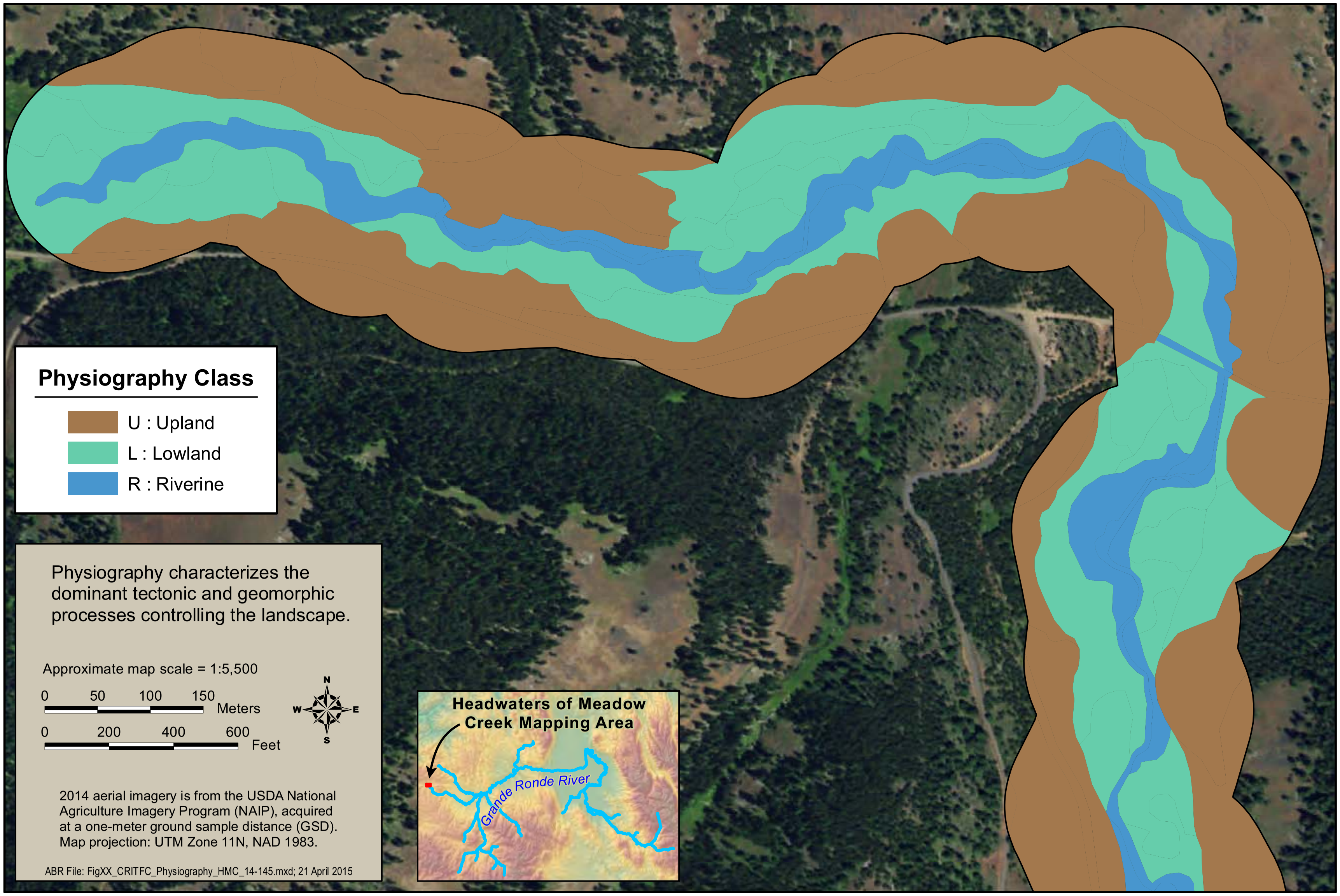
A potential vegetation canopy height corresponding to each PAG was assigned to individual polygons following the methods outlined above. A map of potential vegetation canopy heights is not provided in this report. However, the potential vegetation canopy heights can be symbolized in ArcGIS using the field “PNV_Height_m_100y” in the ITU mapping layer.

FIELD OBSERVATIONS AND MAPPING

Field observations and ITU mapping examples are presented in the following sections for 3 subareas of the study area, including 1) the lower study area, 2) the middle study area, and 3) the upper study area (Figure 1). The subareas were partitioned based on the approximate elevation breaks lower (<900 m), middle (900–1,200 m), and upper (>1,200 m). Figure 29 shows the locations of field photos displayed in figures in the following sections.

LOWER STUDY AREA

Agriculture has been an important land use in the Grande Ronde Valley since post-European settlement, and as such, agricultural development covers much of the present-day valley (Figure 30). Figures 31 and 32 display the existing and potential vegetation, and geomorphology and disturbance mapping for the Lower Cove Road bridge detailed study area on Catherine Creek. The mapping shows that agricultural development occupies most of the floodplain, leaving a narrow corridor of existing native riparian vegetation, including Closed and Open Black Hawthorn (*Crataegus douglasii*) and Closed and Open Low Elevation Mixed Shrubland characterized by *Salix exigua, S. rigida, Cornus stolonifera, and Rosa gymnocarpa*. The corridor is surrounded by agricultural fields (Figure 33). The Catherine Creek channel in much of the the Grande Ronde Valley (Reaches 1–7 in Catherine Creek Tributary Assessment [U.S. Bureau of Reclamation 2012a]) is deeply incised with a narrow floodplain. Many portions of floodplains and former oxbows in the lower study area are cut-off from annual flooding by levees, i.e., Levee-protected Floodplain (Figure 32). In other sections of the lower study area, flood-plain agricultural lands abut the river channel (Figure 34).



Physiography characterizes the dominant tectonic and geomorphic processes controlling the landscape.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: FigXX_CRITFC_Physiography_HMC_14-145.mxd; 21 April 2015

Figure 13. Integrated terrain unit mapping depicting physiography, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

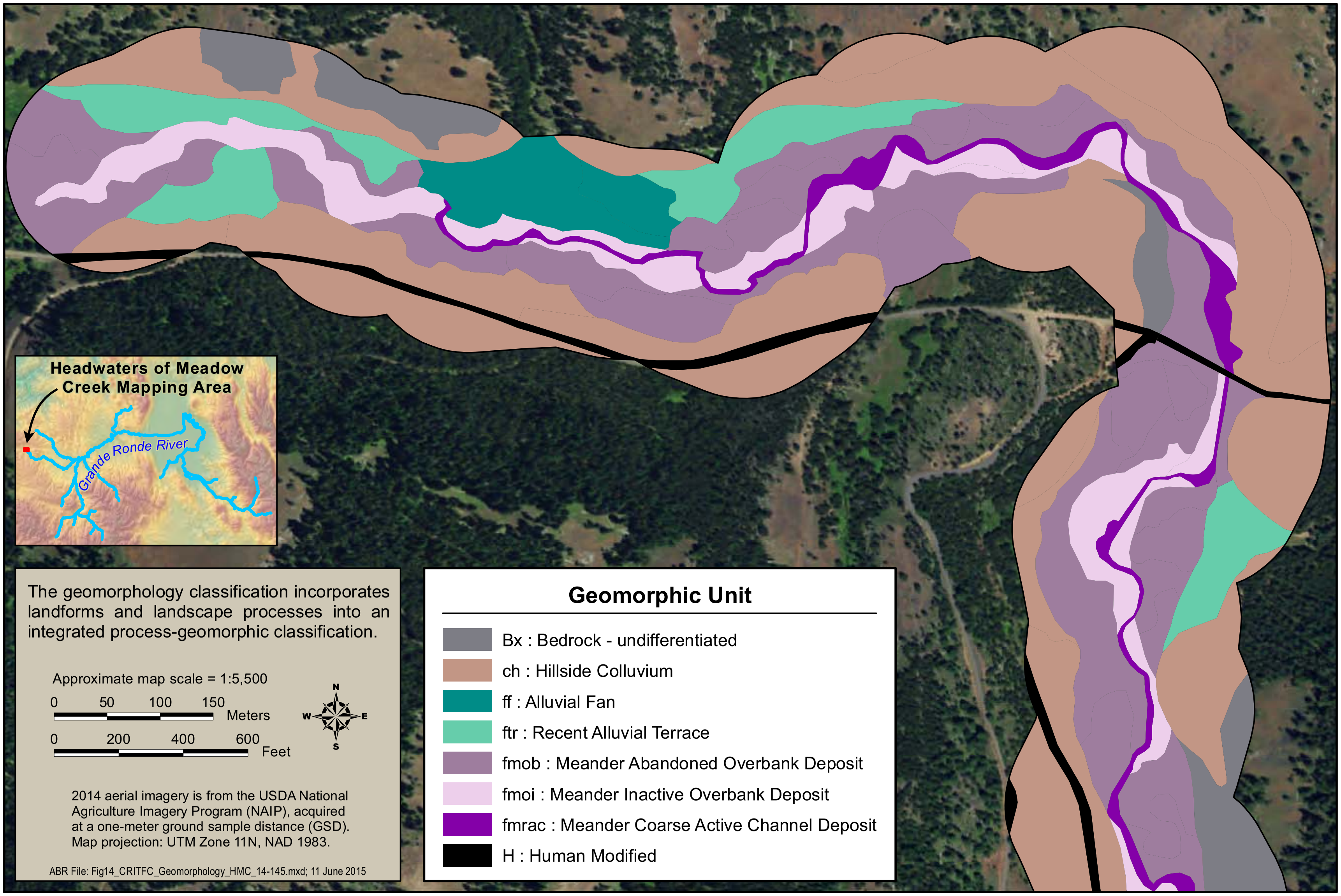
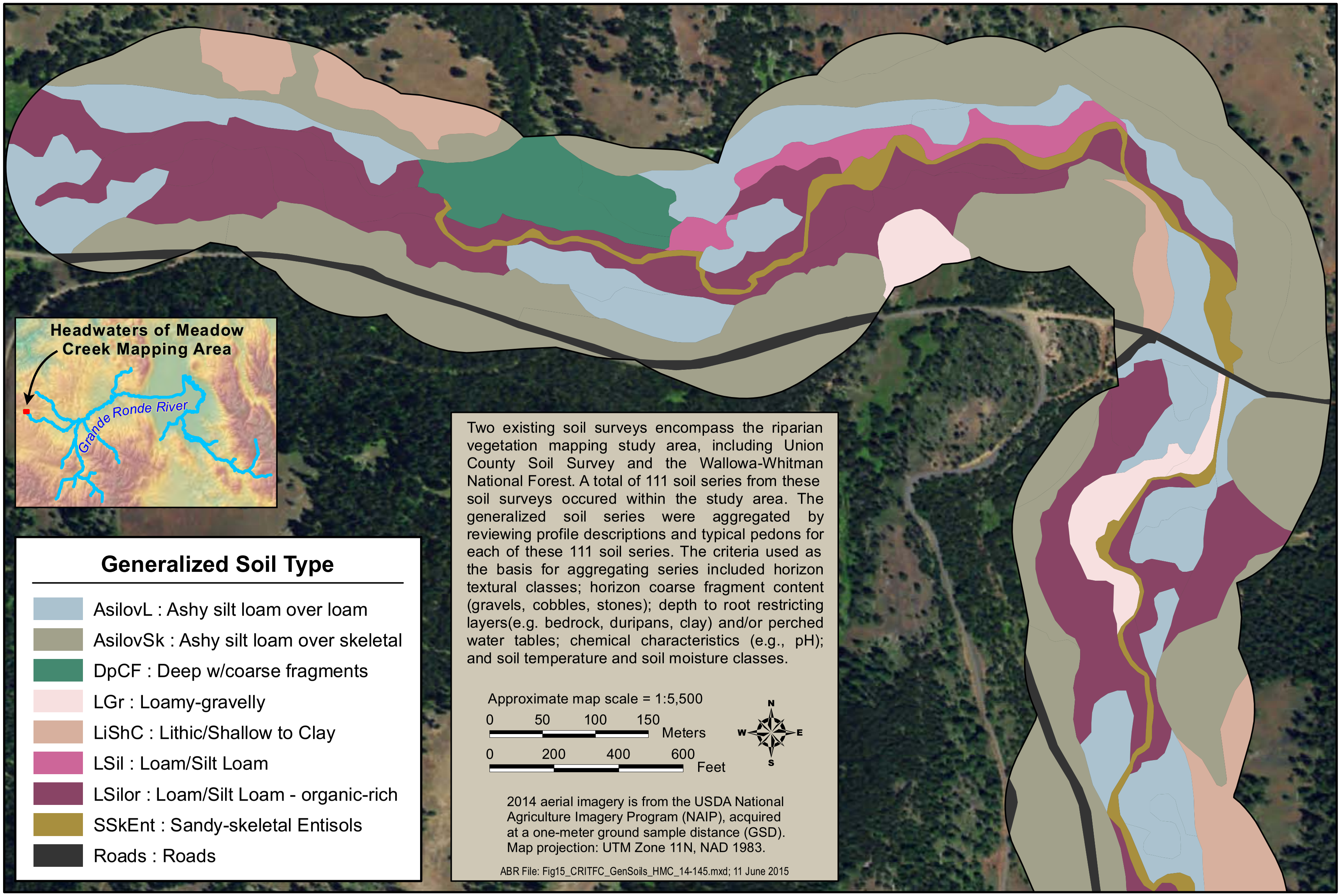


Figure 14. Integrated terrain unit mapping depicting geomorphology, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

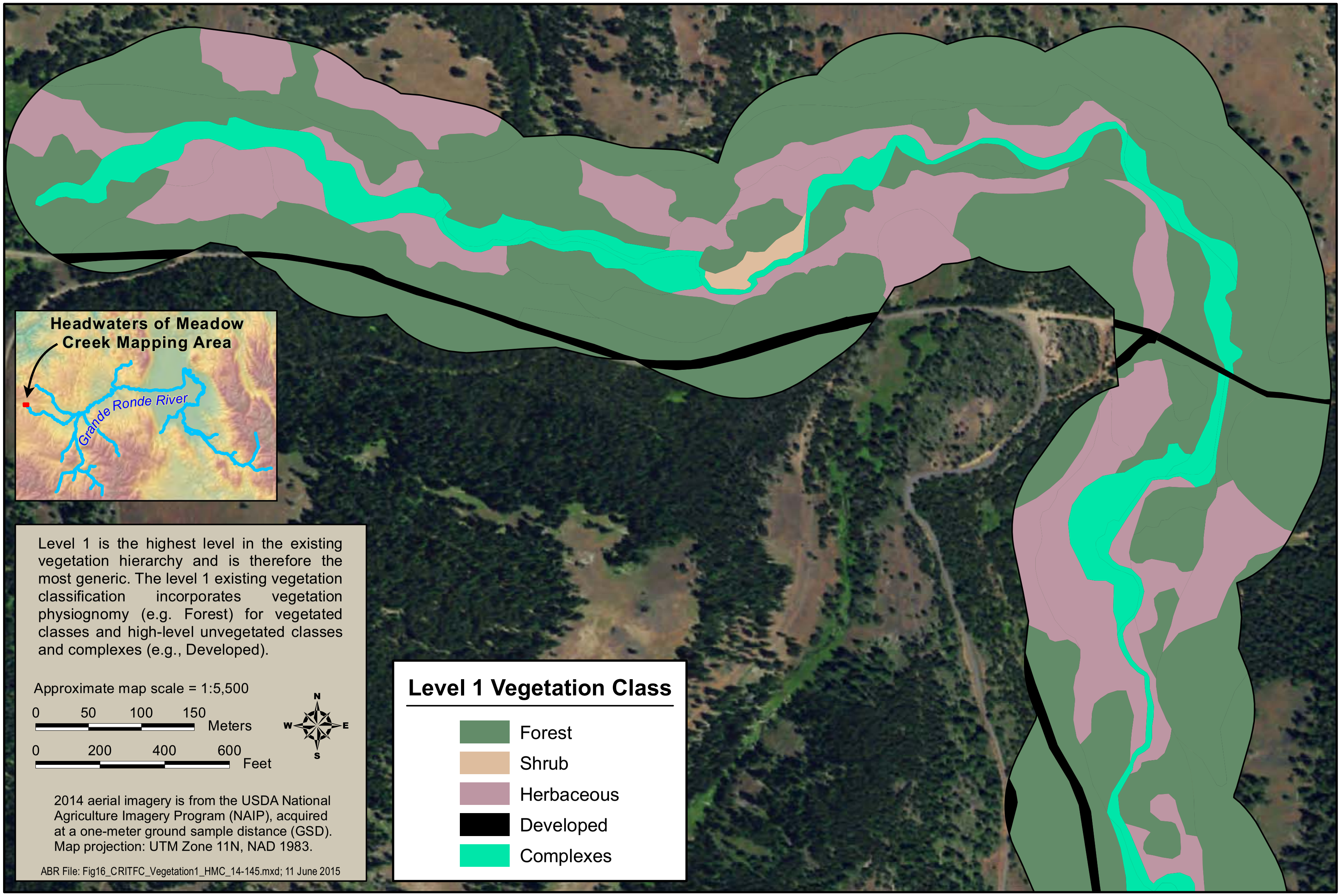


Two existing soil surveys encompass the riparian vegetation mapping study area, including Union County Soil Survey and the Wallowa-Whitman National Forest. A total of 111 soil series from these soil surveys occured within the study area. The generalized soil series were aggregated by reviewing profile descriptions and typical pedons for each of these 111 soil series. The criteria used as the basis for aggregating series included horizon textural classes; horizon coarse fragment content (gravels, cobbles, stones); depth to root restricting layers(e.g. bedrock, duripans, clay) and/or perched water tables; chemical characteristics (e.g., pH); and soil temperature and soil moisture classes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: Fig15_CRITFC_GenSoils_HMC_14-145.mxd; 11 June 2015

Figure 15. Integrated terrain unit mapping depicting generalized soils, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



Level 1 is the highest level in the existing vegetation hierarchy and is therefore the most generic. The level 1 existing vegetation classification incorporates vegetation physiognomy (e.g. Forest) for vegetated classes and high-level unvegetated classes and complexes (e.g., Developed).

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: Fig16_CRITFC_Vegetation1_HMC_14-145.mxd; 11 June 2015

Figure 16. Integrated terrain unit mapping depicting the level 1 existing vegetation classes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

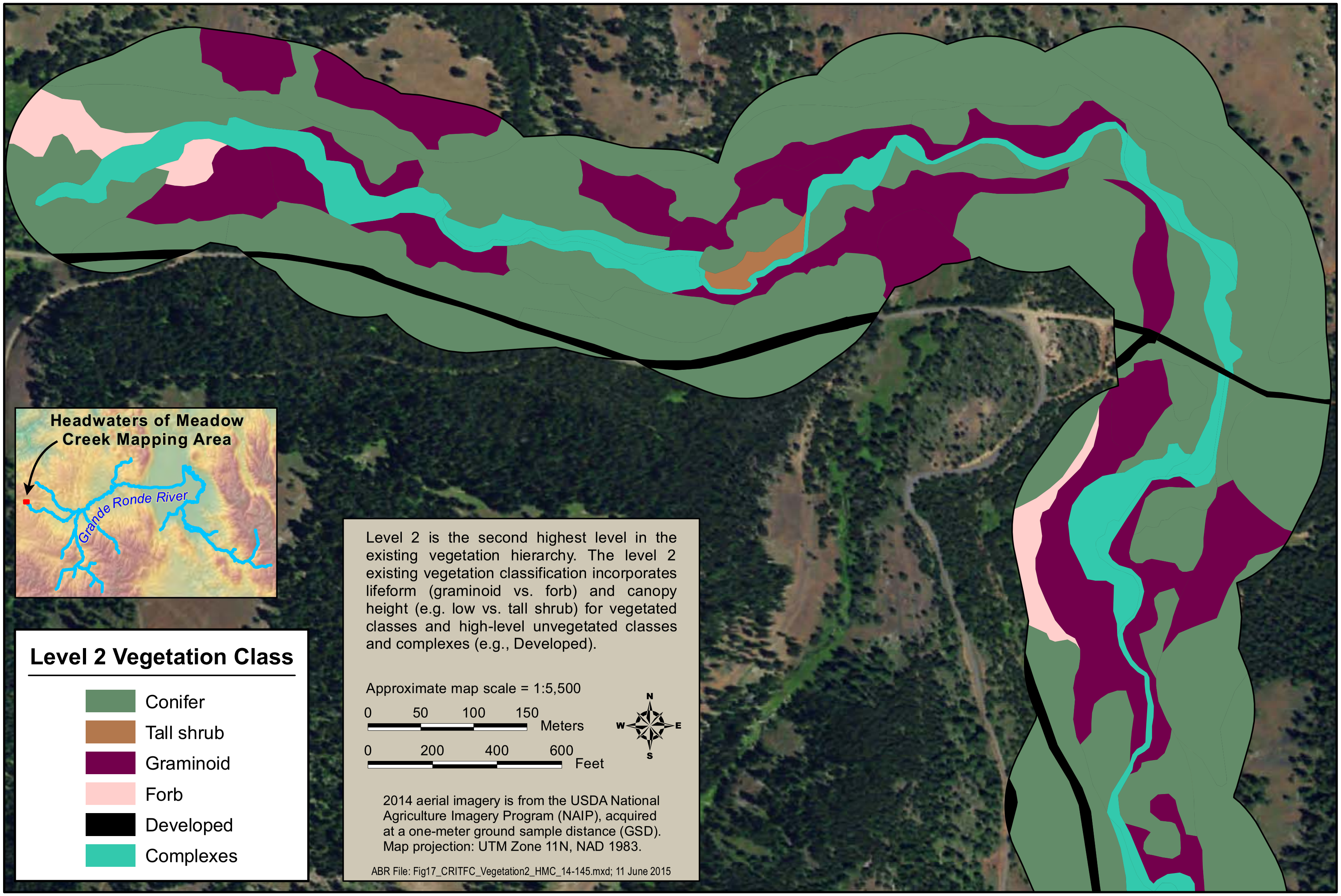


Figure 17. Integrated terrain unit mapping depicting the level 2 existing vegetation classes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

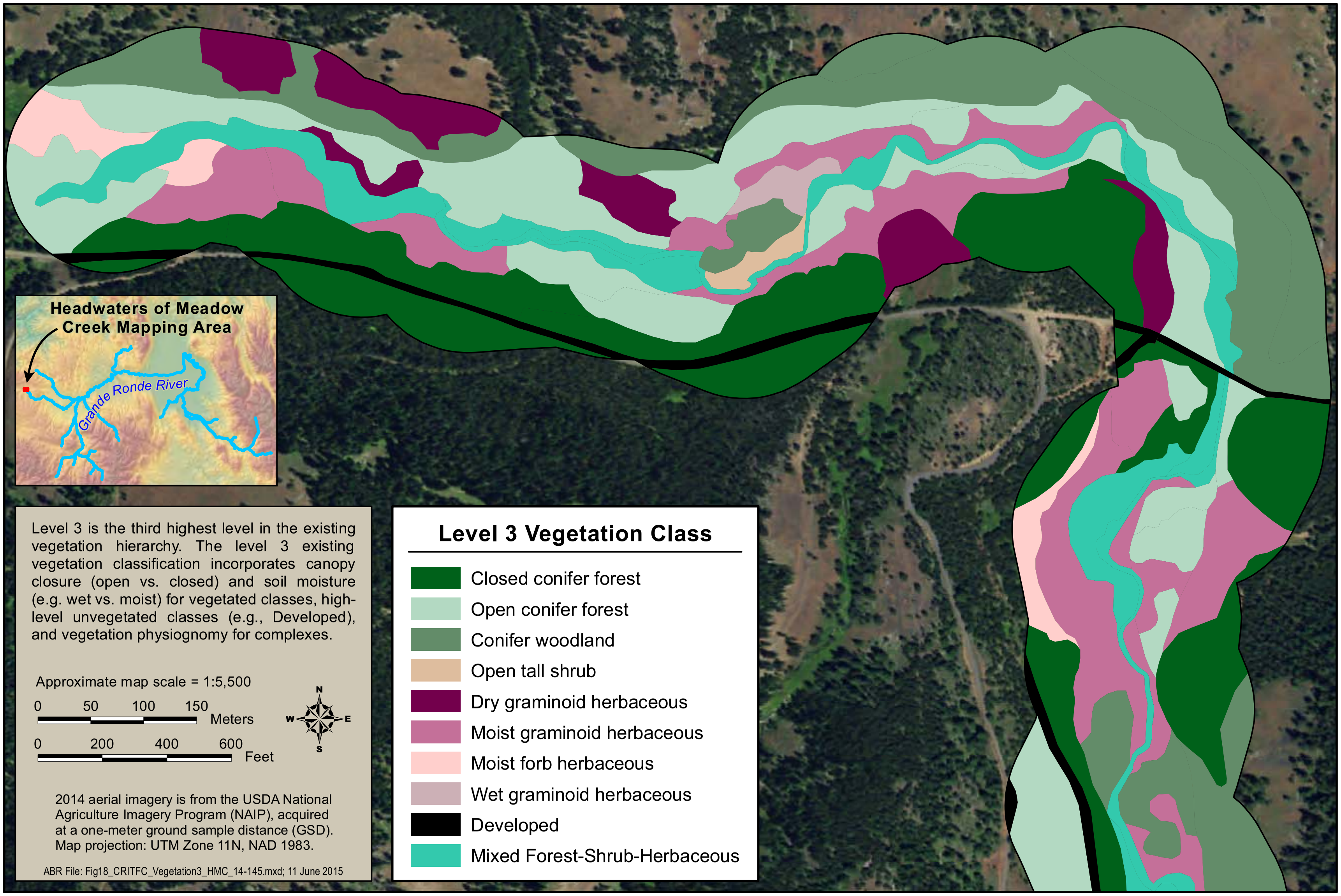


Figure 18. Integrated terrain unit mapping depicting the level 3 existing vegetation classes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

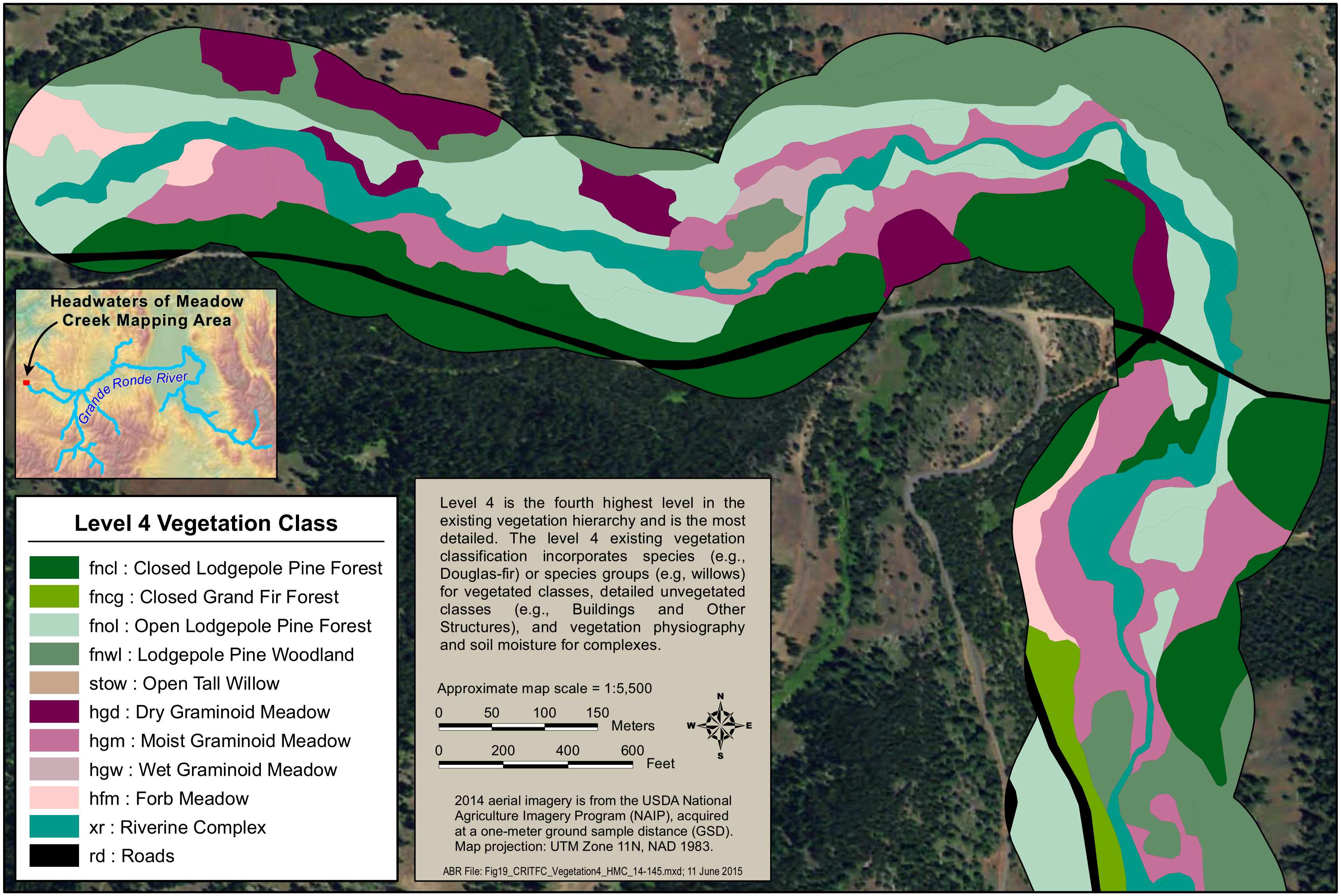
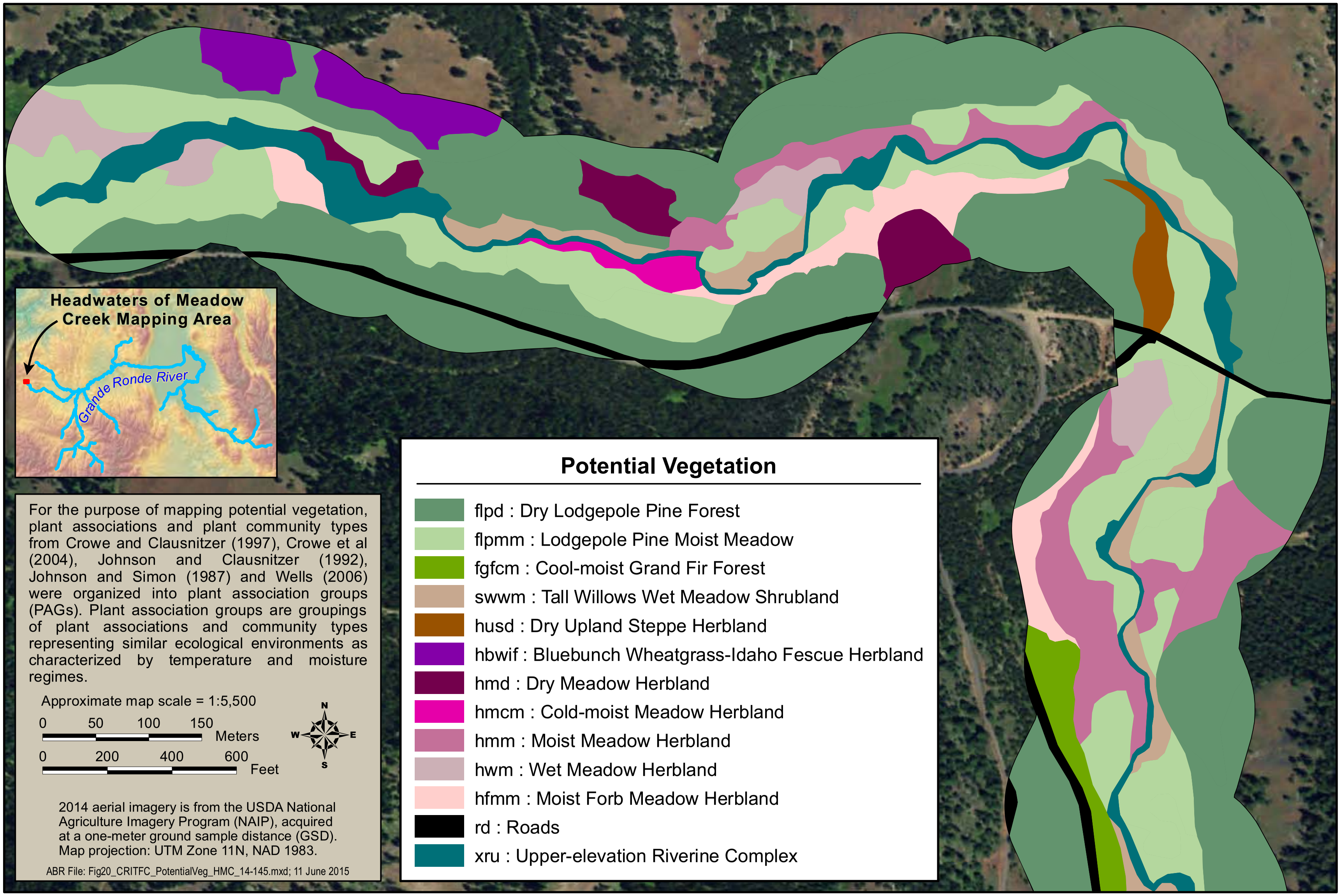


Figure 19. Integrated terrain unit mapping depicting the level 4 existing vegetation classes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



For the purpose of mapping potential vegetation, plant associations and plant community types from Crowe and Clausnitzer (1997), Crowe et al (2004), Johnson and Clausnitzer (1992), Johnson and Simon (1987) and Wells (2006) were organized into plant association groups (PAGs). Plant association groups are groupings of plant associations and community types representing similar ecological environments as characterized by temperature and moisture regimes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: Fig20_CRITFC_PotentialVeg_HMC_14-145.mxd; 11 June 2015

Figure 20. Integrated terrain unit mapping depicting potential vegetation, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

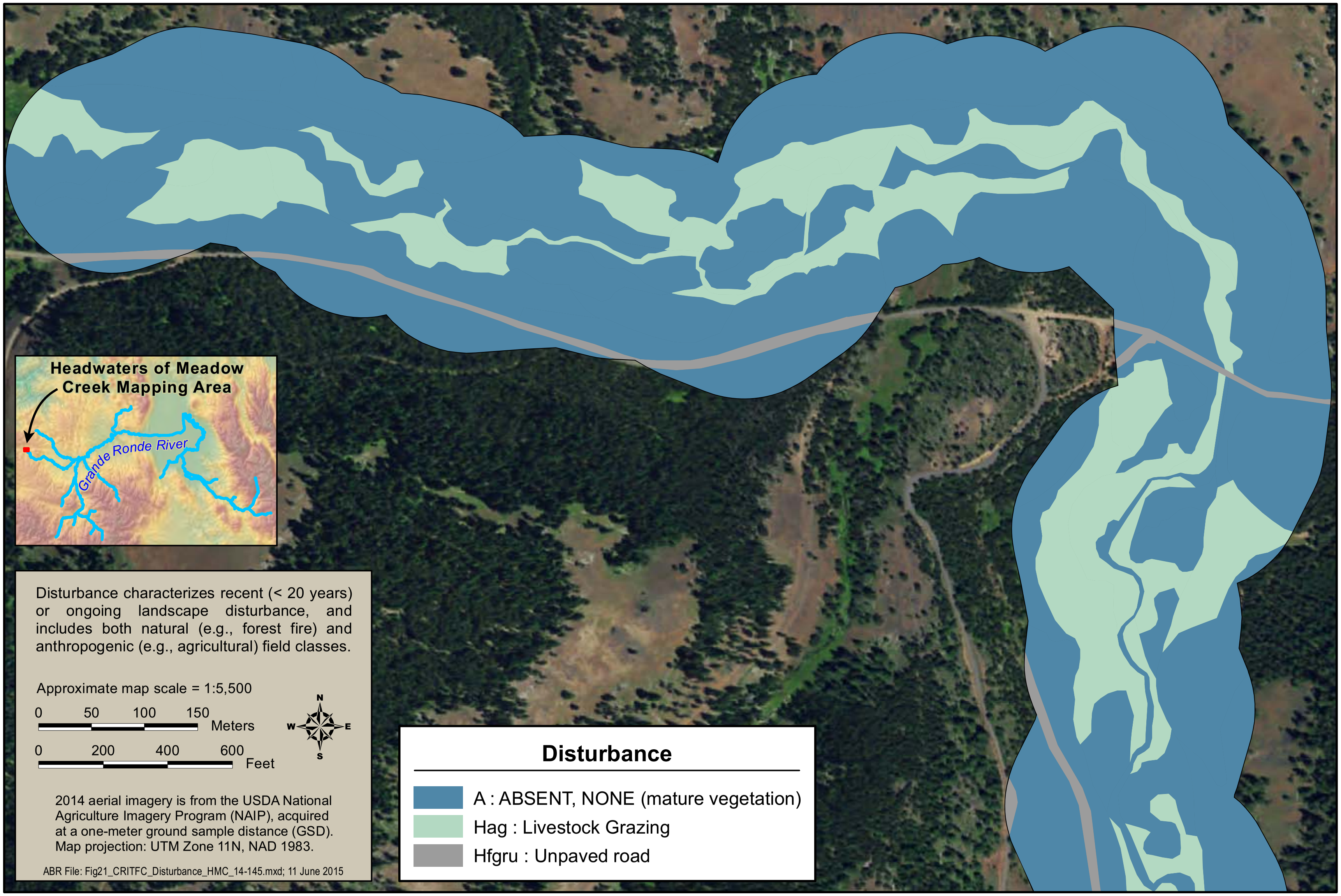


Figure 21. Integrated terrain unit mapping depicting disturbance, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Table 13. Areal extent of physiography and geomorphology classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Code and Title	Hectares	Acres	Percent
PHYSIOGRAPHY			
L : Lowland	2871.6	7095.9	38.8%
R : Riverine	1476.0	3647.2	20.0%
S : Subalpine	153.4	379.1	2.1%
U : Upland	2892.6	7147.9	39.1%
Grand Total	7393.6	18270.1	
GEOMORPHOLOGY			
	Hectares	Area	Percent
Bx : Bedrock - undifferentiated	256.0	632.5	3.5%
ch : Hillside Colluvium	2439.4	6028.0	33.0%
ff : Alluvial Fan	98.0	242.1	1.3%
fmoa : Meander Active Overbank Deposit	441.8	1091.6	6.0%
fmob : Meander Abandoned Overbank Deposit	1749.2	4322.5	23.7%
fmoi : Meander Inactive Overbank Deposit	488.1	1206.1	6.6%
Fmolp : Levee-protected Floodplain	368.9	911.6	5.0%
fmrac : Meander Coarse Active Channel Deposit	391.3	967.0	5.3%
fmri : Meander Inactive Channel Deposit	28.0	69.1	0.4%
Fmrox : Old Oxbow	8.6	21.2	0.1%
fto : Old Alluvial Terrace	136.5	337.3	1.8%
ftr : Recent Alluvial Terrace	332.7	822.1	4.5%
H : Human Modified	454.9	1124.2	6.2%
Of : Organic Fen	8.1	20.0	0.1%
Wh : Human Modified Waterbody	23.5	58.2	0.3%
Wr : Rivers and Streams	168.5	416.4	2.3%
Grand Total	7393.6	18270.1	

Table 14. Areal extent of generalized soil classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

	Hectares	Acres	Percent
AsilovCF : Ashy silt loam over coarse frags	12.0	29.7	0.2%
AsilovL : Ashy silt loam over loam	201.7	498.5	2.7%
AsilovSk : Ashy silt loam over skeletal	412.7	1019.7	5.6%
DpCF : Deep w/coarse fragments	223.6	552.5	3.0%
DpSiCL : Deep - silt to clay loam	11.2	27.7	0.2%
LGr : Loamy-gravelly	225.5	557.1	3.0%
LiShC : Lithic/Shallow to Clay	999.0	2468.5	13.5%
LovSk : Loam over skeletal	829.8	2050.5	11.2%
LSil : Loam/Silt Loam	1581.7	3908.5	21.4%
LSilbr : Loam/Silt Loam - brackish	783.5	1936.1	10.6%
LSilor : Loam/Silt Loam - organic-rich	72.6	179.5	1.0%
MDpCF : Mod. deep w/coarse frags	1034.6	2556.5	14.0%
Roads : Roads	312.5	772.3	4.2%
Rock : Rock Outcrop	22.1	54.5	0.3%
SSkEnt : Sandy-skeletal Entisols	470.9	1163.7	6.4%
StmBkHG : Streambanks - high gradient	5.0	12.3	0.1%
Water : Water	195.2	482.4	2.6%
Grand Total	7393.6	18270.1	

Table 15. Areal extent of level 1 and 2 existing vegetation classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

	Hectares	Acres	Percent
LEVEL 1			
Agricultural	780.1	1927.7	10.6%
Barren	58.6	144.7	0.8%
Complexes	555.0	1371.4	7.5%
Developed	422.6	1044.3	5.7%
Forest	3063.1	7569.0	41.4%
Herbaceous	1823.9	4506.9	24.7%
Shrub	499.1	1233.2	6.7%
Water	191.3	472.8	2.6%
Grand Total	7393.6	18270.1	
LEVEL 2			
Agricultural	780.1	1927.7	10.6%
Barren	58.6	144.7	0.8%
Complexes	555.0	1371.4	7.5%
Conifer	2784.7	6881.1	37.7%
Deciduous/Broadleaf	278.4	688.0	3.8%
Developed	422.6	1044.3	5.7%
Forb	7.1	17.4	0.1%
Graminoid	1816.8	4489.4	24.6%
Tall shrub	499.1	1233.2	6.7%
Water	191.3	472.8	2.6%
Grand Total	7393.6	18270.1	

Table 16. Areal extent of level 3 existing vegetation classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

	Hectares	Acres	Percent
Agricultural	780.1	1927.7	10.6%
Barren	58.6	144.7	0.8%
Closed conifer forest	794.6	1963.6	10.7%
Closed deciduous forest	47.9	118.5	0.6%
Closed tall shrub	240.2	593.6	3.2%
Conifer woodland	632.6	1563.1	8.6%
Deciduous woodland	12.3	30.3	0.2%
Developed	422.6	1044.3	5.7%
Dry graminoid herbaceous	676.4	1671.5	9.1%
Herbaceous	111.9	276.4	1.5%
Mixed Forest-Shrub-Herbaceous	443.1	1095.0	6.0%
Moist forb herbaceous	7.1	17.4	0.1%
Moist graminoid herbaceous	1036.5	2561.4	14.0%
Open conifer forest	1357.5	3354.4	18.4%
Open deciduous forest	218.2	539.2	3.0%
Open tall shrub	258.9	639.6	3.5%
Water	191.3	472.8	2.6%
Wet graminoid herbaceous	103.8	256.6	1.4%
Grand Total	7393.6	18270.1	

Table 17. Areal extent of level 4 existing vegetation classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

	Hectares	Acres	Percent
bbg : Barren	31.4	77.6	0.4%
bpa : barren agricultural	620.2	1532.6	8.4%
bpvh : Barren partially vegetated herbaceous	27.2	67.1	0.4%
fbcc : Closed Black Cottonwood Forest	15.8	39.1	0.2%
fbcs : Open Willow Forest (lower valley)	34.5	85.4	0.5%
fboc : Open Black Cottonwood Forest	138.2	341.4	1.9%
fbos : Closed Willow Forest (lower valley)	27.2	67.2	0.4%
fbwc : Black Cottonwood Woodland	12.3	30.3	0.2%
fmbcdfc : Closed Black Cottonwood-Douglas-fir Forest	4.9	12.2	0.1%
fmbcdfo : Open Black Cottonwood-Douglas-fir Forest	11.2	27.7	0.2%
fmbceso : Open Black Cottonwood-Engelmann Spruce Forest	5.9	14.6	0.1%
fmbcgfo : Open Black Cottonwood-Grand Fir Forest	6.3	15.5	0.1%
fmbcppo : Open Black Cottonwood-Ponderosa Pine Forest	22.1	54.6	0.3%
fncdf : Closed Douglas-fir Forest	199.8	493.8	2.7%
fnces : Closed Engelmann Spruce Forest	5.3	13.1	0.1%
fncg : Closed Grand Fir Forest	336.0	830.3	4.5%
fncl : Closed Lodgepole Pine Forest	145.6	359.8	2.0%
fncpp : Closed Ponderosa Pine Forest	26.7	65.9	0.4%
fndfw : Douglas-fir Woodland	217.8	538.2	2.9%
fngfw : Grand Fir Woodland	99.0	244.7	1.3%
fnodf : Open Douglas-fir Forest	518.5	1281.2	7.0%
fnoes : Open Englemann Spruce Forest	35.4	87.5	0.5%
fnog : Open Grand Fir Forest	478.9	1183.5	6.5%
fnol : Open Lodgepole Pine Forest	200.6	495.8	2.7%
fnopp : Open Ponderosa Pine Forest	108.6	268.3	1.5%
fnscf : Closed Subalpine Fir Forest	81.2	200.7	1.1%
fnsfo : Open Subalpine Fir Forest	15.4	38.1	0.2%
fnsfw : Subalpine Fir Woodland	2.8	6.8	0.0%
fnwl : Lodgepole Pine Woodland	97.9	242.0	1.3%
fnwpp : Ponderosa Pine Woodland	215.0	531.4	2.9%
hca : agricultural croplands	150.7	372.4	2.0%
hfm : Forb Meadow	7.1	17.4	0.1%
hgd : Dry Graminoid Meadow	388.0	958.9	5.2%
hgm : Moist Graminoid Meadow	1036.5	2561.4	14.0%
hgw : Wet Graminoid Meadow	103.8	256.6	1.4%
hgwmcc : Wet-Moist Graminoid Meadow Complex	111.9	276.4	1.5%
hpa : agricultural pasture	1.5	3.8	0.0%

Table 17. Continued.

	Hectares	Acres	Percent
hus : Upland Steppe	288.4	712.6	3.9%
rd : Roads	312.5	772.3	4.2%
smxlc : Closed Low Elevation Mixed Shrubland	105.7	261.2	1.4%
smxlo : Open Low Elevation Mixed Shrubland	100.3	247.9	1.4%
ssa : Sitka Alder	0.9	2.3	0.0%
stcat : Closed Thinleaf Alder	45.5	112.3	0.6%
stcbh : Closed Black Hawthorn	33.2	82.1	0.4%
stcw : Closed Tall Willow	35.8	88.6	0.5%
stoat : Open Thinleaf Alder	56.9	140.7	0.8%
stobh : Open Black Hawthorn	31.7	78.4	0.4%
stow : Open Tall Willow	33.1	81.8	0.4%
suc : Closed Upland Shrubland	19.0	47.0	0.3%
suo : Open Upland Shrubland	36.8	90.9	0.5%
ub : Buildings and Other Structures	41.1	101.7	0.6%
wf : Fresh Water	191.3	472.8	2.6%
xa : agricultural complex	7.6	18.8	0.1%
xd : Urban Complex	68.9	170.3	0.9%
xr : Riverine Complex	443.1	1095.0	6.0%
Grand Total	7393.6	18270.1	

Table 18. Areal extent of potential vegetation classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

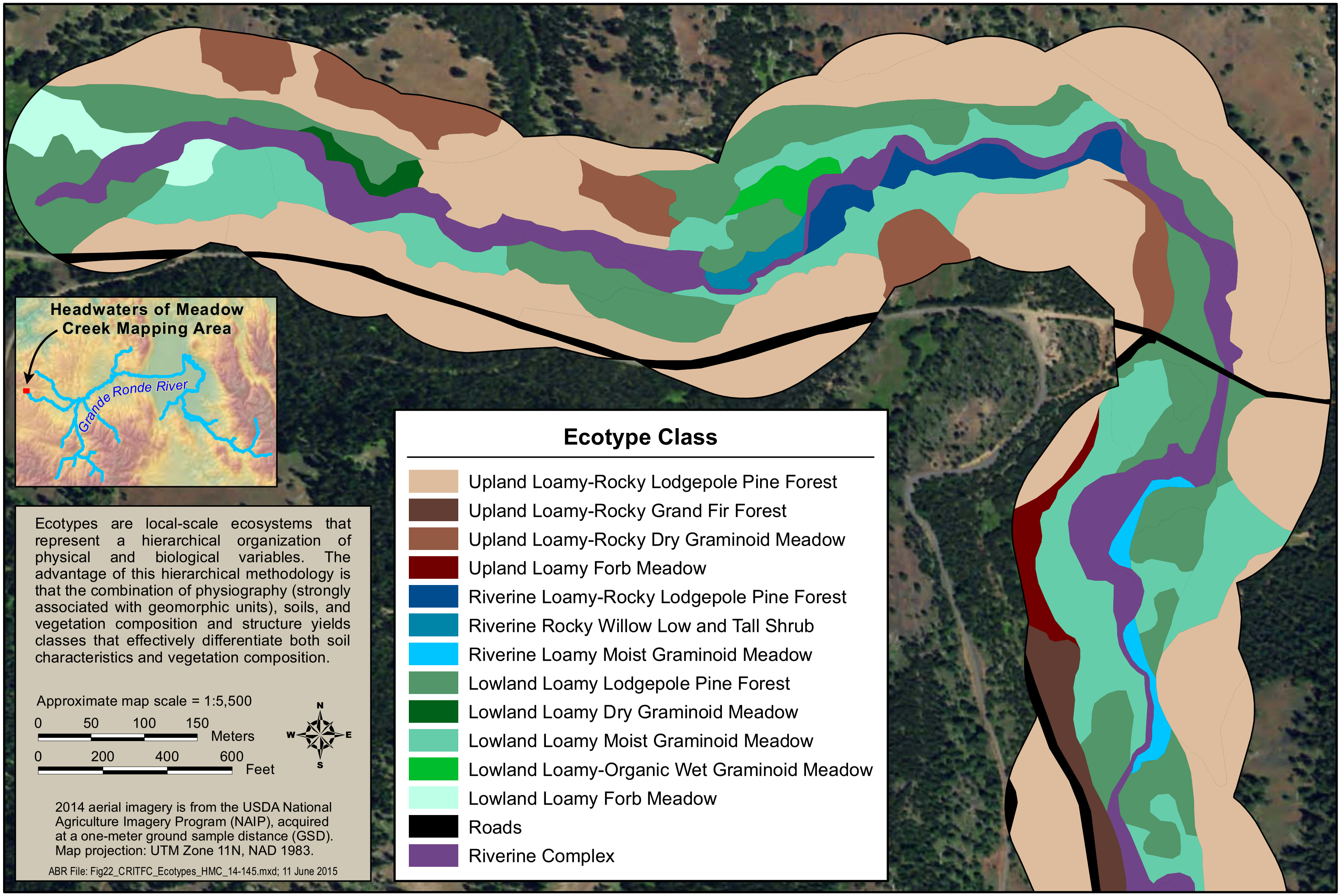
	Hectares	Acres	Percent
a : Agricultural Fields	8.5	21.0	0.1%
bbg : Barren	13.1	32.5	0.2%
fbbcwf : Black Cottonwood/Willows Floodplain Forest	150.6	372.2	2.0%
fbcf : Black Cottonwood Floodplain Forest	48.2	119.2	0.7%
fbclf : Low Elevation Black Cottonwood Floodplain Forest	104.2	257.5	1.4%
fbcmmlfc : Low Elevation Black Cottonwood/Moist Meadow Floodplain Complex	213.2	526.8	2.9%
fbct : Black Cottonwood Terrace Forest	78.4	193.8	1.1%
fbww : White Willow Forest	1.1	2.7	0.0%
fdfd : Dry Douglas-fir Forest	142.8	352.8	1.9%
fdflm : Low Elevation Moist Douglas-fir Forest	15.4	38.0	0.2%
fdfm : Moist Douglas-fir Forest	144.2	356.4	2.0%
fdfmo : Open Moist Douglas-fir Forest	47.2	116.5	0.6%
fdfwm : Warm-moist Douglas-fir Forest	793.0	1959.4	10.7%
fes : Engelmann Spruce Forest	14.5	35.9	0.2%
fgfc : Cold Grand Fir Forest	175.9	434.6	2.4%
fgfcm : Cool-moist Grand Fir Forest	255.3	630.9	3.5%
fgfcmo : Open Cool-moist Grand Fir Forest	207.6	512.9	2.8%
fgfes : Grand fir-Engelmann Spruce Forest	21.6	53.4	0.3%
fgfeso : Open Grand fir-Engelmann Spruce Forest	16.0	39.6	0.2%
fgfwd: Warm-dry Grand Fir Forest	239.4	591.5	3.2%
fgfwdo : Open Warm-dry Grand Fir Forest	75.4	186.3	1.0%
flpd : Dry Lodgepole Pine Forest	203.7	503.3	2.8%
flpmm : Lodgepole Pine Moist Meadow	193.0	476.8	2.6%
flpwm : Lodgepole Pine Wet Meadow	13.9	34.4	0.2%
fppd : Dry Ponderosa Pine Forest	169.1	417.9	2.3%
fppm : Moist Ponderosa Pine Forest	120.6	298.1	1.6%
fppmo : Open Moist Ponderosa Pine Forest	41.2	101.8	0.6%
fsfd : Dry Subalpine Fir Forest	50.3	124.4	0.7%
fsfes : Subalpine Fir-Engelmann Spruce Forest	63.2	156.2	0.9%
fsfeso : Open Subalpine Fir-Engelmann Spruce Forest	6.6	16.3	0.1%
hbwif : Bluebunch Wheatgrass-Idaho Fescue Herbland	337.8	834.6	4.6%
hfmm : Moist Forb Meadow Herbland	3.3	8.1	0.0%
hgfgb : Graminoid-Forb Gravel Bar Herbland	6.4	15.8	0.1%
hgmccwmc:Cold Wet-Moist Meadow Complex Herbland	7.0	17.4	0.1%
hgmcwmc:Wet-Moist Meadow Complex Herbland	111.5	275.6	1.5%
hmcm : Cold-moist Meadow Herbland	3.9	9.8	0.1%

Table 18. Continued.

	Hectares	Acres	Percent
hmd : Dry Meadow Herbland	33.2	82.1	0.4%
hmm : Moist Meadow Herbland	93.4	230.8	1.3%
hss : Subalpine Steppe Herbland	10.3	25.4	0.1%
husd : Dry Upland Steppe Herbland	49.5	122.3	0.7%
husgbwc : Dry Upland Steppe-Moist Great Basin Wildrye Complex	41.4	102.2	0.6%
hwm : Wet Meadow Herbland	47.7	118.0	0.6%
hwmc : Cold Wet Meadow Herbland	0.9	2.3	0.0%
rd : Roads	312.5	772.3	4.2%
ro : Rock	14.6	36.2	0.2%
sbh : Black Hawthorn Shrubland	52.8	130.4	0.7%
scs : Red-osier Dogwood Shrubland	2.2	5.5	0.0%
smaf : Mountain Alder Floodplain Shrubland	68.9	170.4	0.9%
smalf : Low Elevation Mountain Alder Floodplain Shrubland	22.2	54.9	0.3%
smawm : Mountain Alder Wet Meadow Shrubland	43.6	107.8	0.6%
smm : Moist Meadow Shrubland	2.5	6.3	0.0%
smmgrlfc : Low Elevation Moist Shrub/Graminoid Floodplain Complex	44.1	109.0	0.6%
smxl : Low Elevation Mixed Shrubland	199.1	492.1	2.7%
ssa : Sitka Alder Shrubland	0.9	2.3	0.0%
sud : Upland Dry Shrubland	4.2	10.4	0.1%
sum : Upland Moist Shrubland	52.1	128.6	0.7%
swgb : Willows Gravel Bar Shrubland	31.2	77.0	0.4%
swmm : Tall Willows Moist Meadow Shrubland	44.1	109.0	0.6%
swmmgrblfc : Low Elevation Brackish Wet-Moist Shrub/Graminoid Floodplain Complex	61.9	153.0	0.8%
swmmgrlfc : Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex	1227.7	3033.8	16.6%
swwm : Tall Willows Wet Meadow Shrubland	28.8	71.2	0.4%
ub: Buildings and Other Structures	36.2	89.4	0.5%
wf : Fresh Water	190.0	469.4	2.6%
wpps : Ponderosa Pine Steppe Woodland	96.1	237.4	1.3%
xd : Developed Sites	11.0	27.2	0.1%
xrl : Low-elevation Riverine Complex	34.9	86.1	0.5%
xrm : Mid-elevation Riverine Complex	237.0	585.7	3.2%
xru : Upper-elevation Riverine Complex	142.7	352.7	1.9%
xu : Urban Complex	58.6	144.8	0.8%
Grand Total	7393.6	18270.1	

Table 19. Areal extent of disturbance classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

	Hectares	Acres	Percent
A : ABSENT, NONE (mature vegetation)	3108.3	7680.8	42.0%
DC : Disturbance complex	288.2	712.2	3.9%
Ha : Agricultural Field	608.7	1504.2	8.2%
Hac : Crops	150.8	372.5	2.0%
Haf : Feedlot/livestock holding pen	2.6	6.3	0.0%
Hag : Livestock Grazing	1643.8	4062.0	22.2%
Hah : Hayfield	477.8	1180.6	6.5%
Hc : Clearings (Non-agricultural or undifferentiated)	24.7	61.1	0.3%
Hcl : Logged	55.1	136.2	0.7%
Hd : Human Developed Sites (urban complex)	78.1	193.0	1.1%
Hdr : Residential Development	52.4	129.4	0.7%
He : Excavation/Pits (undifferentiated)	4.2	10.4	0.1%
Hf : Fill	32.0	79.0	0.4%
Hfgrp : Paved Road	130.3	321.9	1.8%
Hfgru : Unpaved road	153.4	379.0	2.1%
Hft : Mine Tailings	10.4	25.8	0.1%
Hp : Pasture	8.5	20.9	0.1%
Hrr : Railroad	17.8	44.1	0.2%
Hsb : Building	6.4	15.8	0.1%
Hsisd : Abandoned/historic splash dam	0.5	1.2	0.0%
Hwc : Canal	64.9	160.5	0.9%
Hwd : Ditch	6.6	16.3	0.1%
Hwe : Water-filled excavation	10.5	25.8	0.1%
Hwi : Drainage Impoundment	2.1	5.2	0.0%
Hwl : Levee	48.4	119.7	0.7%
Nf : Fire	156.3	386.1	2.1%
Ngfd : Fluvial Deposition	27.3	67.4	0.4%
Ngfe : Fluvial Erosion/channel migration	223.7	552.7	3.0%
Grand Total	7393.6	18270.1	

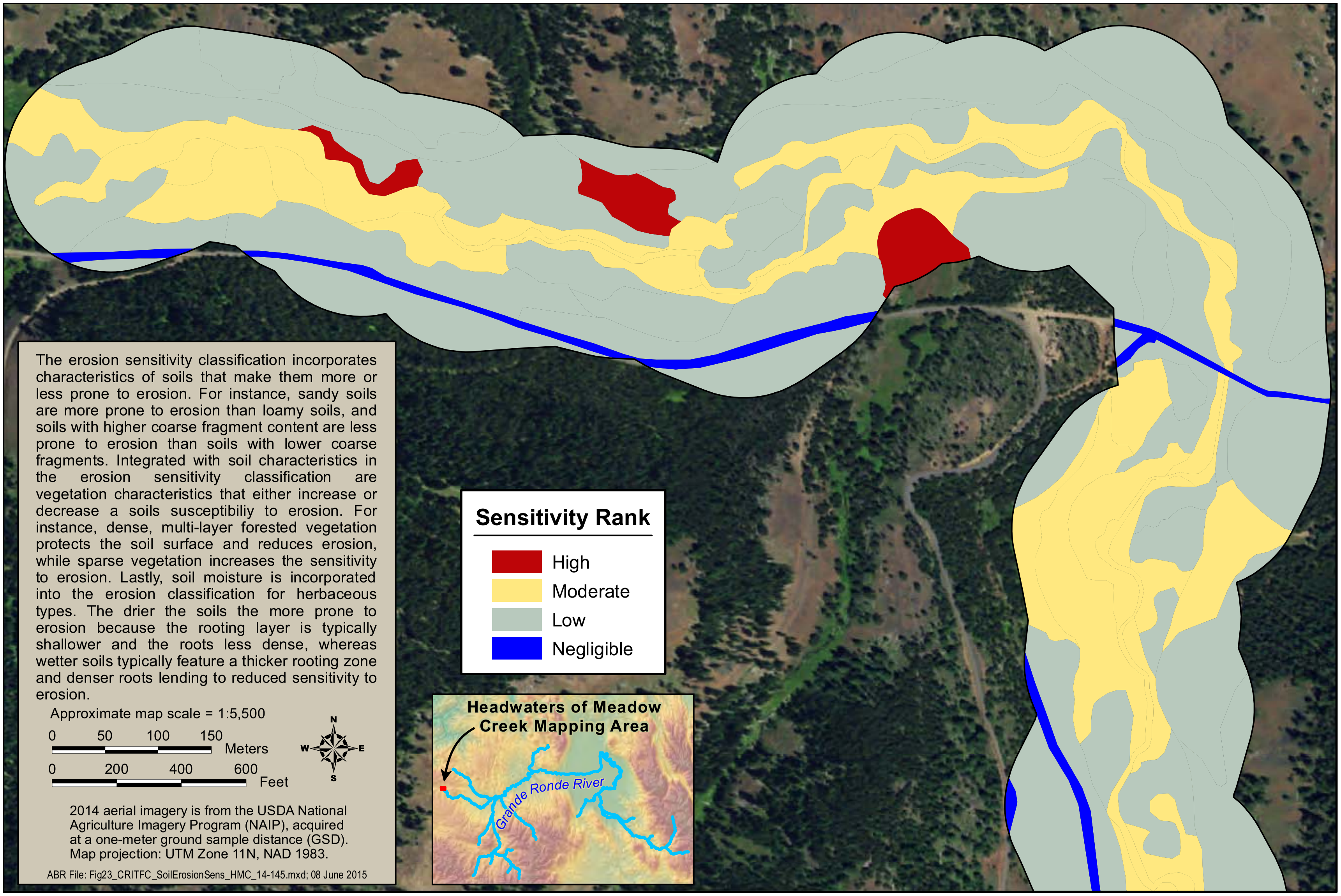


Ecotypes are local-scale ecosystems that represent a hierarchical organization of physical and biological variables. The advantage of this hierarchical methodology is that the combination of physiography (strongly associated with geomorphic units), soils, and vegetation composition and structure yields classes that effectively differentiate both soil characteristics and vegetation composition.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: Fig22_CRITFC_Ecotypes_HMC_14-145.mxd; 11 June 2015

Figure 22. Integrated terrain unit mapping depicting ecotypes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



The erosion sensitivity classification incorporates characteristics of soils that make them more or less prone to erosion. For instance, sandy soils are more prone to erosion than loamy soils, and soils with higher coarse fragment content are less prone to erosion than soils with lower coarse fragments. Integrated with soil characteristics in the erosion sensitivity classification are vegetation characteristics that either increase or decrease a soils susceptibiliy to erosion. For instance, dense, multi-layer forested vegetation protects the soil surface and reduces erosion, while sparse vegetation increases the sensitivity to erosion. Lastly, soil moisture is incorporated into the erosion classification for herbaceous types. The drier the soils the more prone to erosion because the rooting layer is typically shallower and the roots less dense, whereas wetter soils typically feature a thicker rooting zone and denser roots lending to reduced sensitivity to erosion.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983.

ABR File: Fig23_CRITFC_SoilErosionSens_HMC_14-145.mxd; 08 June 2015

Figure 23. Integrated terrain unit mapping depicting soil erosion sensitivity classes, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Table 20. Areal extent of ecotype classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

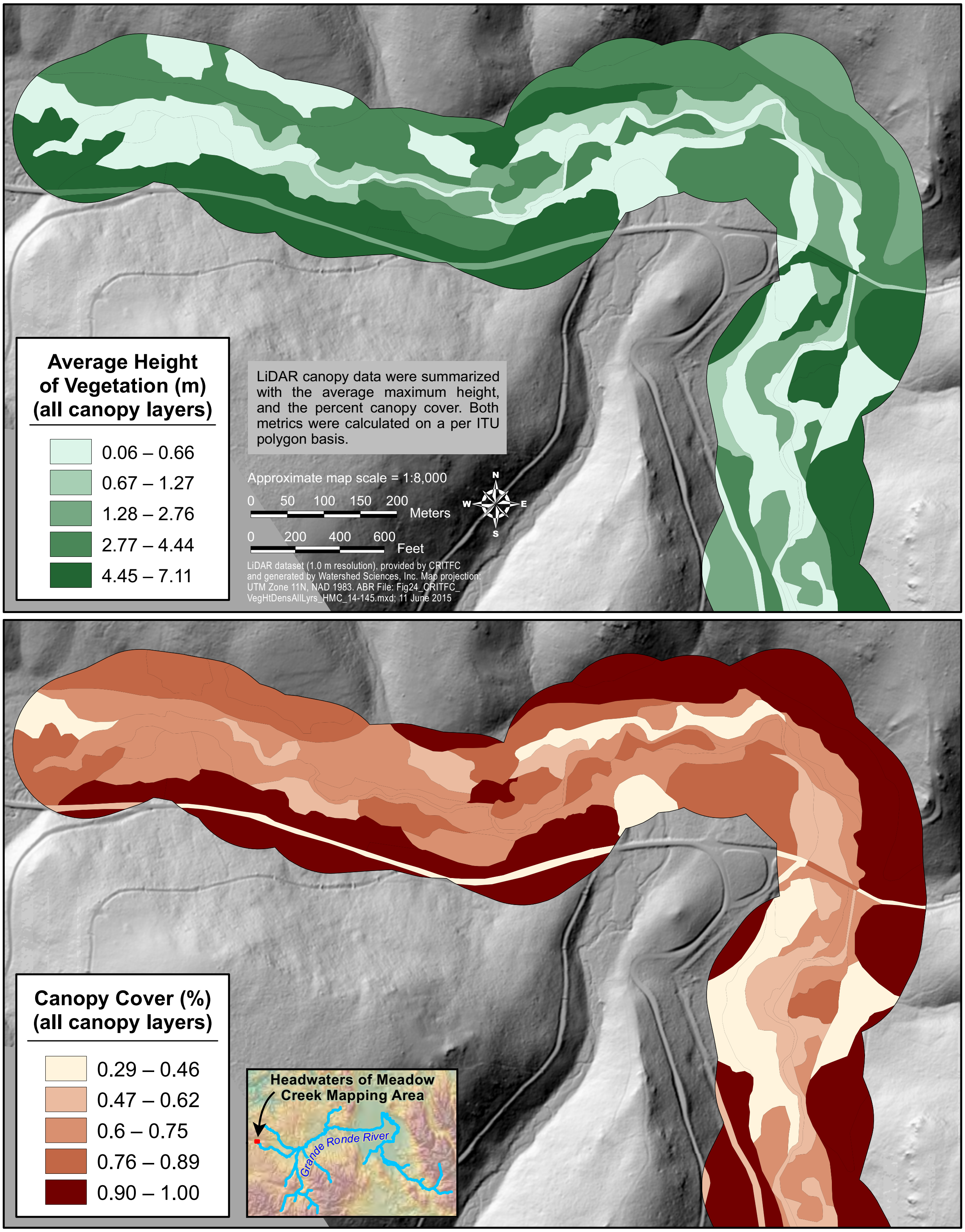
	Hectares	Acres	Percent
Freshwater	191.3	472.8	2.6%
Human Developments	110.1	272.0	1.5%
Loamy Human-modified Barrens and Partially Vegetated	632.5	1563.0	8.6%
Lowland Loamy Agricultural Lands	573.0	1415.9	7.7%
Lowland Loamy Black Cottonwood Forest	67.3	166.4	0.9%
Lowland Loamy Black Hawthorn Tall Shrub	33.9	83.7	0.5%
Lowland Loamy Douglas-fir Forest	83.8	207.2	1.1%
Lowland Loamy Dry Graminoid Meadow	204.1	504.4	2.8%
Lowland Loamy Forb Meadow	6.5	16.0	0.1%
Lowland Loamy Grand-fir Forest	81.9	202.3	1.1%
Lowland Loamy Lodgepole Pine Forest	85.9	212.3	1.2%
Lowland Loamy Low Elevation Mixed Shrubland	11.7	28.8	0.2%
Lowland Loamy Moist Graminoid Meadow	499.8	1235.1	6.8%
Lowland Loamy Ponderosa Pine Forest	66.5	164.4	0.9%
Lowland Loamy Spruce Forest	30.4	75.1	0.4%
Lowland Loamy Subalpine Fir Forest	6.4	15.8	0.1%
Lowland Loamy Thinleaf Alder Tall Shrub	16.5	40.8	0.2%
Lowland Loamy Willow Forest	14.8	36.5	0.2%
Lowland Loamy Willow Low and Tall Shrub	26.6	65.6	0.4%
Lowland Loamy-Organic Wet Graminoid Meadow	176.1	435.2	2.4%
Lowland Rocky Dry Graminoid Meadow	33.6	83.0	0.5%
Lowland Rocky Moist Graminoid Meadow	12.4	30.7	0.2%
Riverine Complex	441.1	1090.1	6.0%
Riverine Loamy Black Cottonwood Forest	101.2	250.0	1.4%
Riverine Loamy Douglas-fir Forest	48.8	120.5	0.7%
Riverine Loamy Forb Meadow	0.2	0.5	0.0%
Riverine Loamy Low Elevation Mixed Shrubland	193.7	478.5	2.6%
Riverine Loamy Moist Graminoid Meadow	66.0	163.2	0.9%
Riverine Loamy Ponderosa Pine Forest	15.8	39.1	0.2%
Riverine Loamy Spruce Forest	10.3	25.5	0.1%
Riverine Loamy Subalpine Fir Forest	3.9	9.7	0.1%
Riverine Loamy Willow Forest	47.0	116.1	0.6%
Riverine Loamy-Organic Wet Graminoid Meadow	9.1	22.6	0.1%
Riverine Loamy-Rocky Dry Graminoid Meadow	7.7	19.0	0.1%
Riverine Loamy-Rocky Grand Fir Forest	45.0	111.2	0.6%
Riverine Loamy-Rocky Hawthorn Tall Shrub	29.3	72.4	0.4%
Riverine Loamy-Rocky Lodgepole Pine Forest	20.5	50.6	0.3%
Riverine Loamy-Rocky Wet Graminoid Meadow	11.9	29.5	0.2%

Table 20. Continued.

	Hectares	Acres	Percent
Riverine Rocky Barrens and Partially Vegetated	23.1	57.1	0.3%
Riverine Rocky Black Cottonwood Forest	45.2	111.8	0.6%
Riverine Rocky Moist Graminoid Meadow	47.3	116.9	0.6%
Riverine Rocky Thinleaf Alder Tall Shrub	83.9	207.3	1.1%
Riverine Rocky Willow Low and Tall Shrub	42.0	103.8	0.6%
Roads	312.5	772.3	4.2%
Rocky Sitka Alder Tall Shrub	0.9	2.3	0.0%
Subalpine Loamy-Rocky Grand Fir Forest	50.3	124.4	0.7%
Subalpine Loamy-Rocky Lodgepole Pine Forest	28.3	70.0	0.4%
Subalpine Loamy-Rocky Subalpine Fir Forest	67.0	165.5	0.9%
Subalpine Organic-rich Wet Graminoid Meadow	0.2	0.6	0.0%
Subalpine Rocky Dry Graminoid Meadow	2.8	7.0	0.0%
Upland Loamy Forb Meadow	0.4	0.9	0.0%
Upland Loamy-Rocky Douglas-fir Forest	807.5	1995.3	10.9%
Upland Loamy-Rocky Dry Graminoid Meadow	428.2	1058.2	5.8%
Upland Loamy-Rocky Grand Fir Forest	736.7	1820.5	10.0%
Upland Loamy-Rocky Lodgepole Pine Forest	309.5	764.7	4.2%
Upland Loamy-Rocky Low Elevation Mixed Shrubland	0.7	1.8	0.0%
Upland Loamy-Rocky Moist Graminoid Meadow	16.2	40.0	0.2%
Upland Loamy-Rocky Ponderosa Pine Forest	268.0	662.1	3.6%
Upland Loamy-Rocky Subalpine Fir Forest	22.1	54.7	0.3%
Upland Loamy-Rocky Thinleaf Alder Tall Shrub	2.0	5.0	0.0%
Upland Rocky Barrens and Partially Vegetated	18.8	46.4	0.3%
Upland Rocky Black Cottonwood Forest	0.9	2.3	0.0%
Upland Rocky Black Hawthorn Tall Shrub	1.8	4.4	0.0%
Upland Rocky Human-modified Barrens and Partially Vegetated	4.3	10.7	0.1%
Upland Rocky Willow Tall Shrub	0.4	0.9	0.0%
Upland Rocky-Loamy Undiffentiated Shrubland	55.8	137.9	0.8%
Grand Total	7393.6	18270.1	

Table 21. Areal extent of erosion sensitivity classes mapped in the riparian mapping study area. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

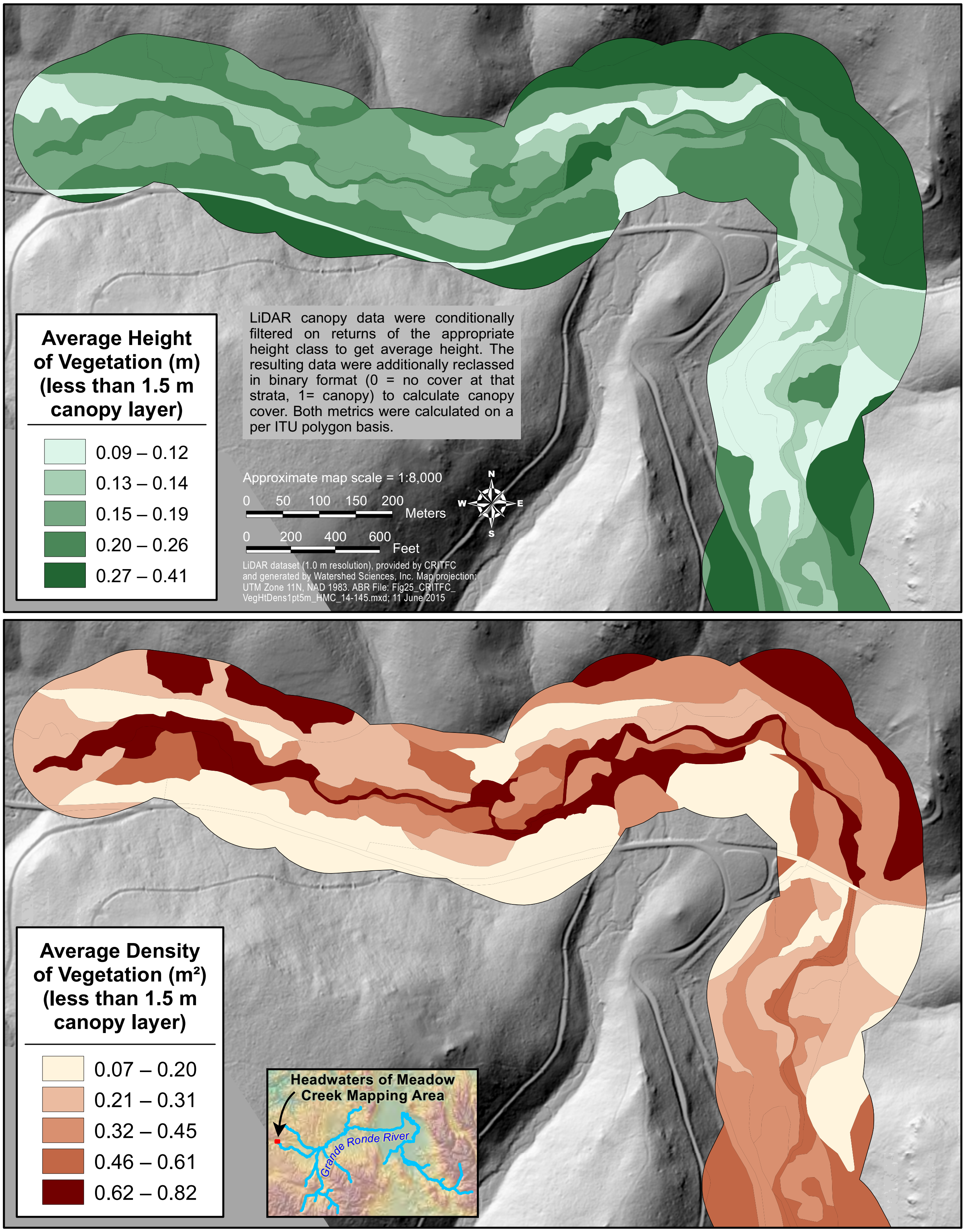
	Hectares	Area	Percent
High	1534.0	3790.6	20.7%
Low	3848.6	9510.1	52.1%
Moderate	1397.0	3452.2	18.9%
Negligible	614.0	1517.2	8.3%
Grand Total	7393.6	18270.1	



LiDAR canopy data were summarized with the average maximum height, and the percent canopy cover. Both metrics were calculated on a per ITU polygon basis.

LiDAR dataset (1.0 m resolution), provided by CRITFC and generated by Watershed Sciences, Inc. Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig24_CRITFC_VegHtDensAllLyrs_HMC_14-145.mxd; 11 June 2015

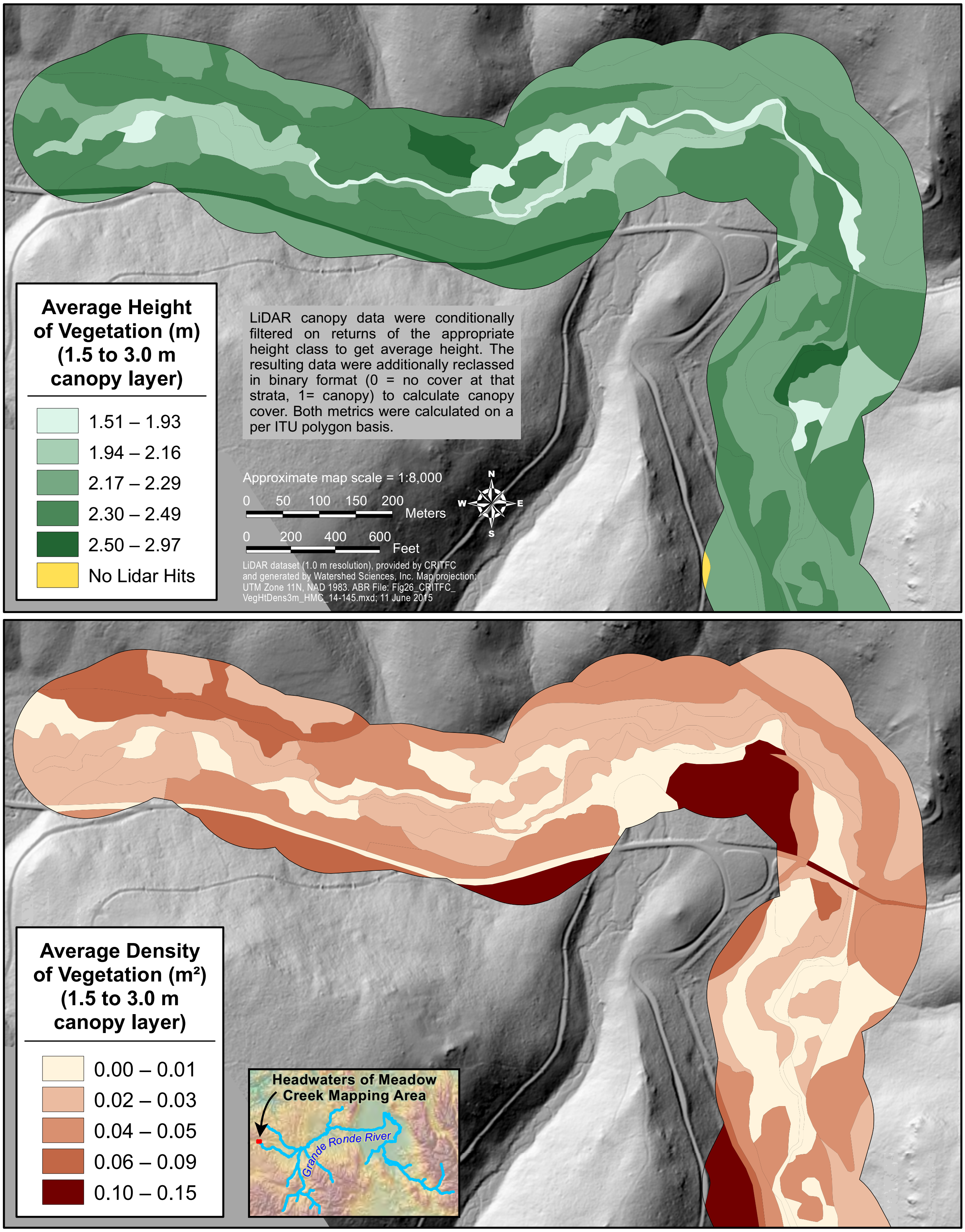
Figure 24. Maps of average height (upper) and density (lower) of existing vegetation across all canopy layers by map polygon as summarized from LiDAR data, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



LiDAR canopy data were conditionally filtered on returns of the appropriate height class to get average height. The resulting data were additionally reclassed in binary format (0 = no cover at that strata, 1= canopy) to calculate canopy cover. Both metrics were calculated on a per ITU polygon basis.

LiDAR dataset (1.0 m resolution), provided by CRITFC and generated by Watershed Sciences, Inc. Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig25_CRITFC_VegHtDens1pt5m_HMC_14-145.mxd; 11 June 2015

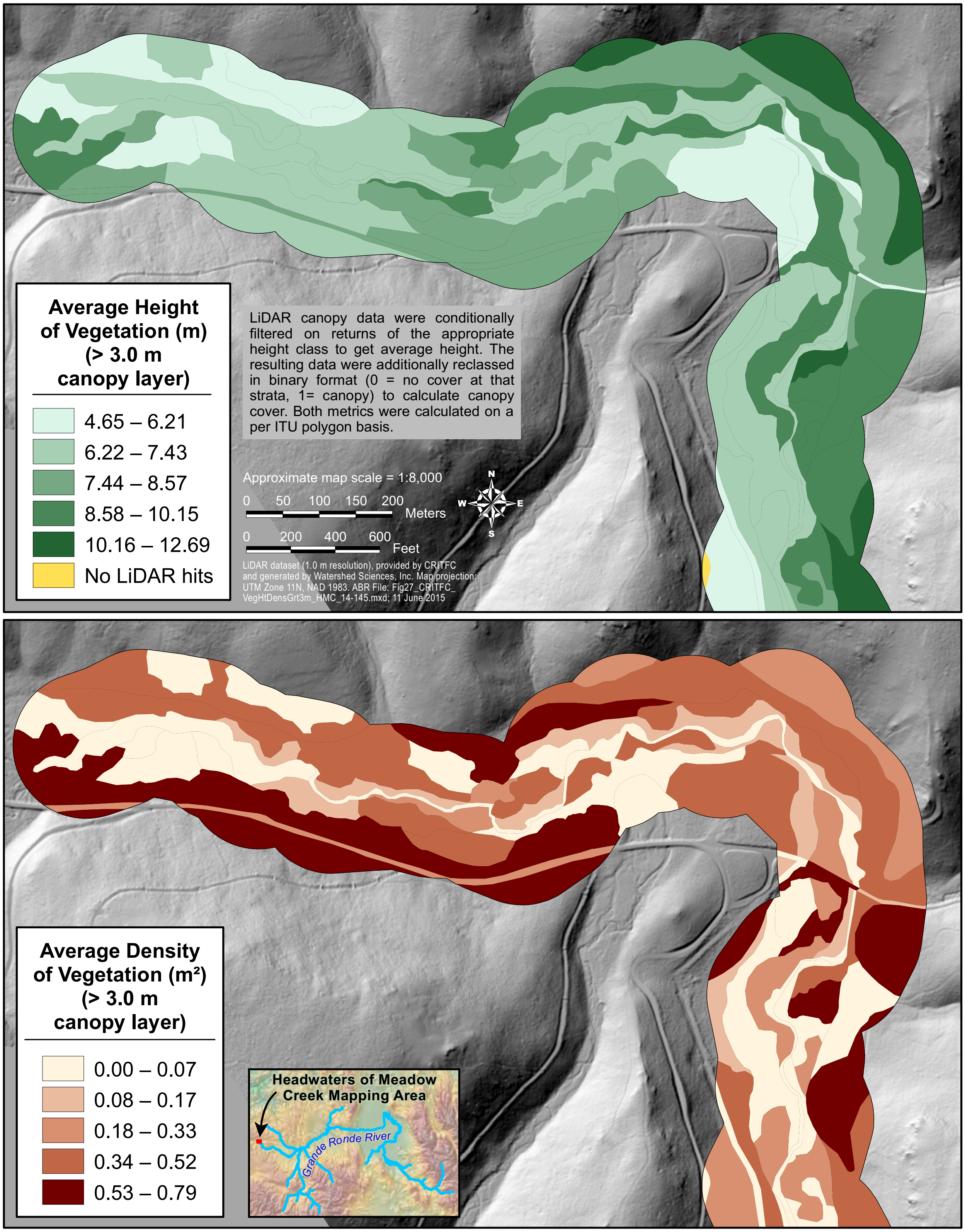
Figure 25. Maps of average height (upper) and density (lower) of existing vegetation for the less than 1.5 meter canopy layer by map polygon as summarized from LiDAR data, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



LiDAR canopy data were conditionally filtered on returns of the appropriate height class to get average height. The resulting data were additionally reclassed in binary format (0 = no cover at that strata, 1= canopy) to calculate canopy cover. Both metrics were calculated on a per ITU polygon basis.

LiDAR dataset (1.0 m resolution), provided by CRITFC and generated by Watershed Sciences, Inc. Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig26_CRITFC_VegHtDens3m_HMC_14-145.mxd; 11 June 2015

Figure 26. Maps of average height (upper) and density (lower) of existing vegetation for the 1.5 to 3.0 meter canopy layer by map polygon as summarized from LiDAR data, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



LiDAR canopy data were conditionally filtered on returns of the appropriate height class to get average height. The resulting data were additionally reclassed in binary format (0 = no cover at that strata, 1= canopy) to calculate canopy cover. Both metrics were calculated on a per ITU polygon basis.

LiDAR dataset (1.0 m resolution), provided by CRITFC and generated by Watershed Sciences, Inc. Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig27_CRITFC_VegHtDensGrt3m_HMC_14-145.mxd; 11 June 2015

Figure 27. Maps of average height (upper) and density (lower) of existing vegetation for the >3.0 meter canopy layer by map polygon as summarized from LiDAR data, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

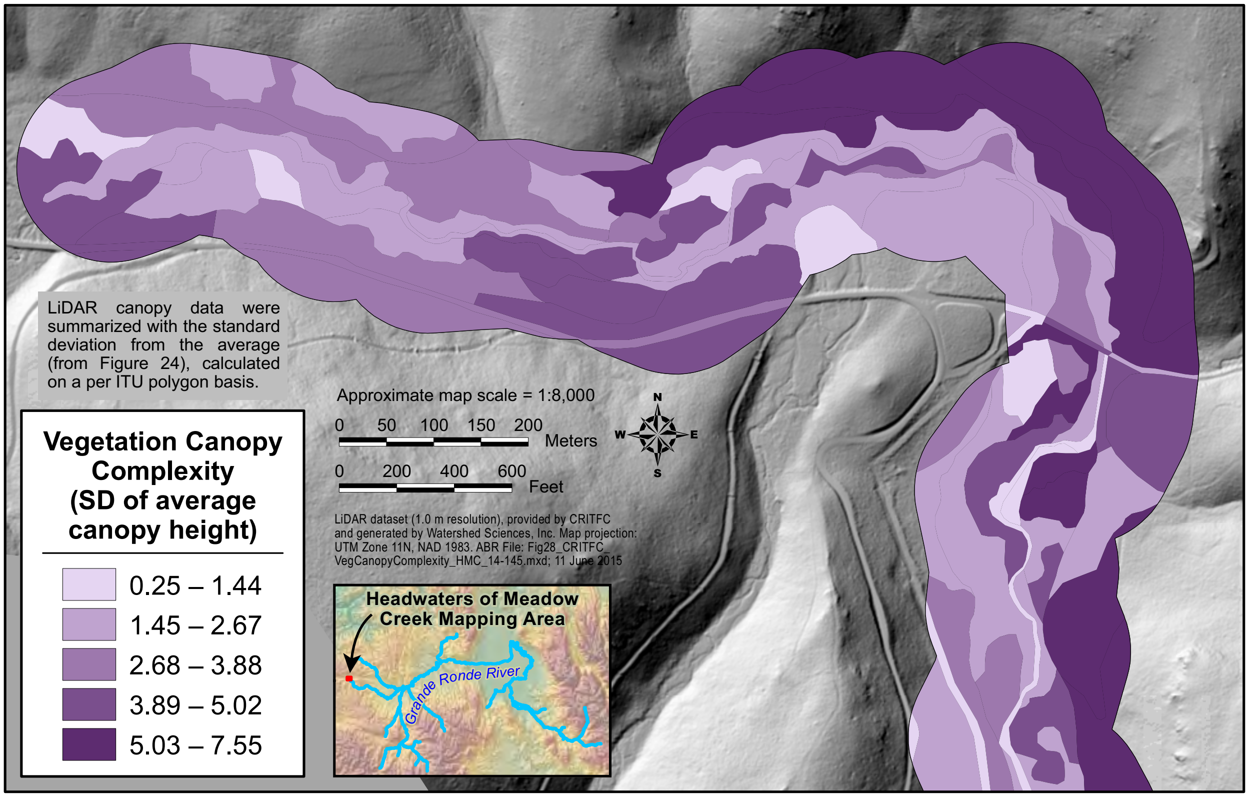
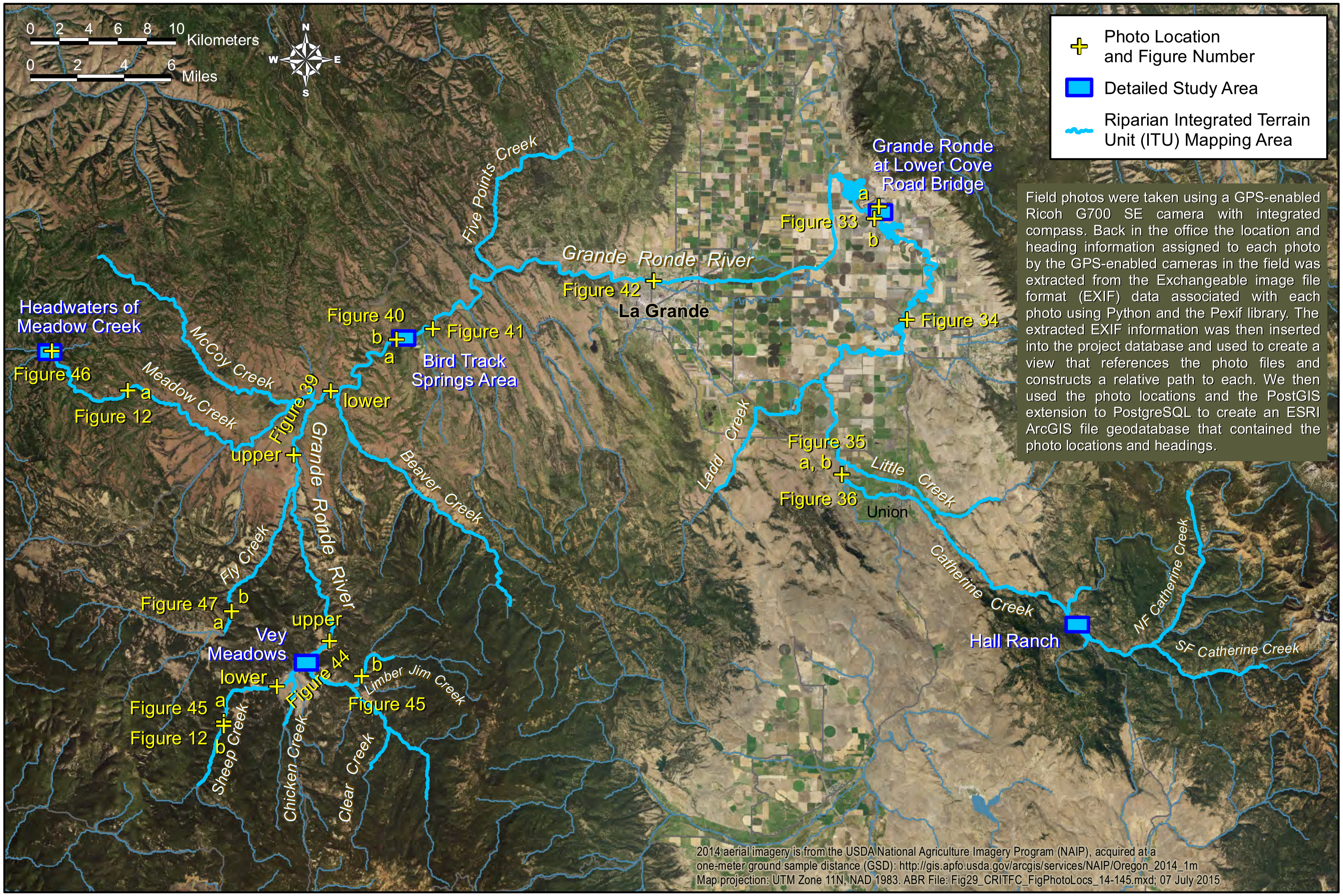


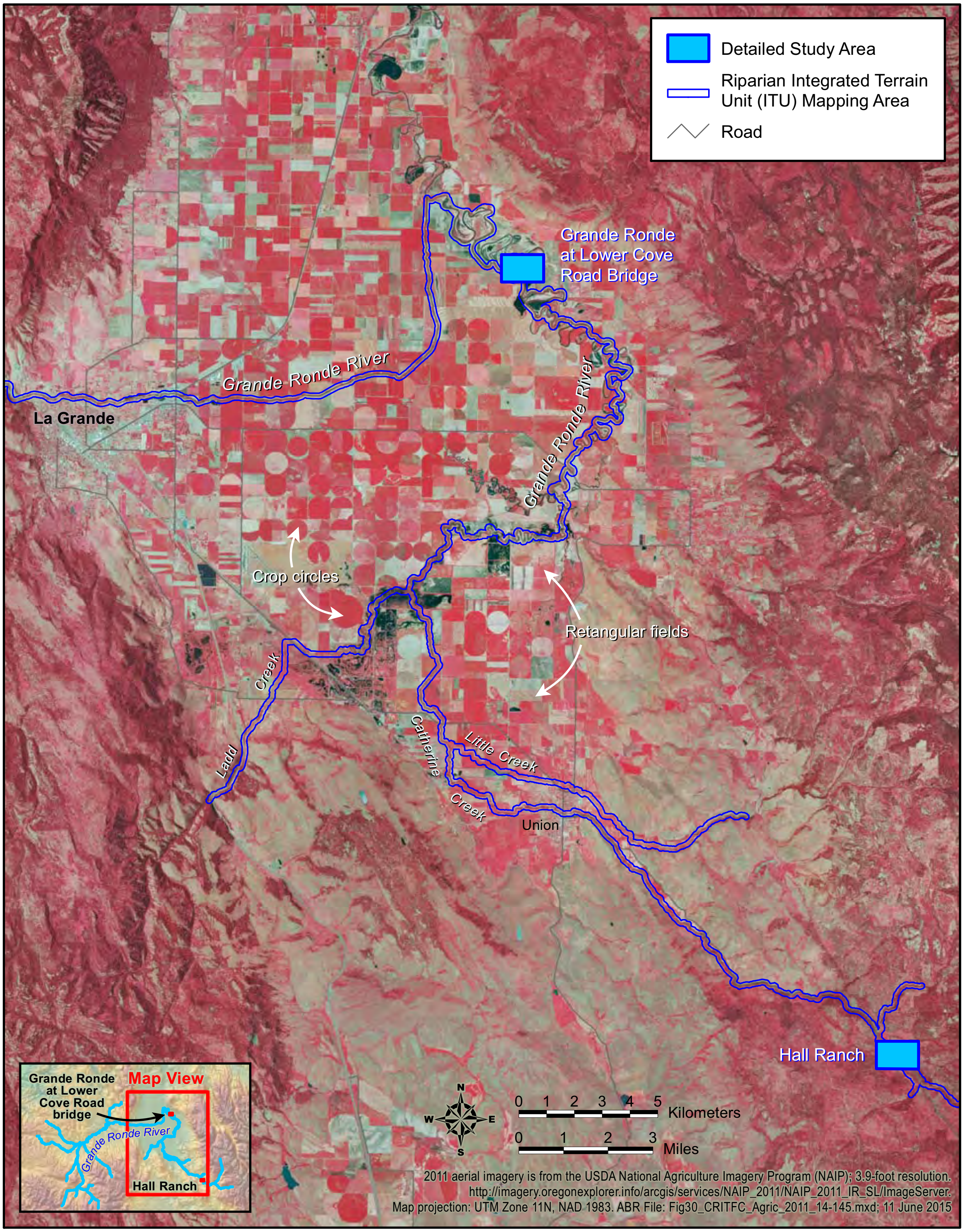
Figure 28. Vegetation canopy complexity as expressed by the standard deviation of average canopy height across all canopy layers as summarized from LiDAR data, headwaters of Meadow Creek. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



Field photos were taken using a GPS-enabled Ricoh G700 SE camera with integrated compass. Back in the office the location and heading information assigned to each photo by the GPS-enabled cameras in the field was extracted from the Exchangeable image file format (EXIF) data associated with each photo using Python and the Pexif library. The extracted EXIF information was then inserted into the project database and used to create a view that references the photo files and constructs a relative path to each. We then used the photo locations and the PostGIS extension to PostgreSQL to create an ESRI ArcGIS file geodatabase that contained the photo locations and headings.

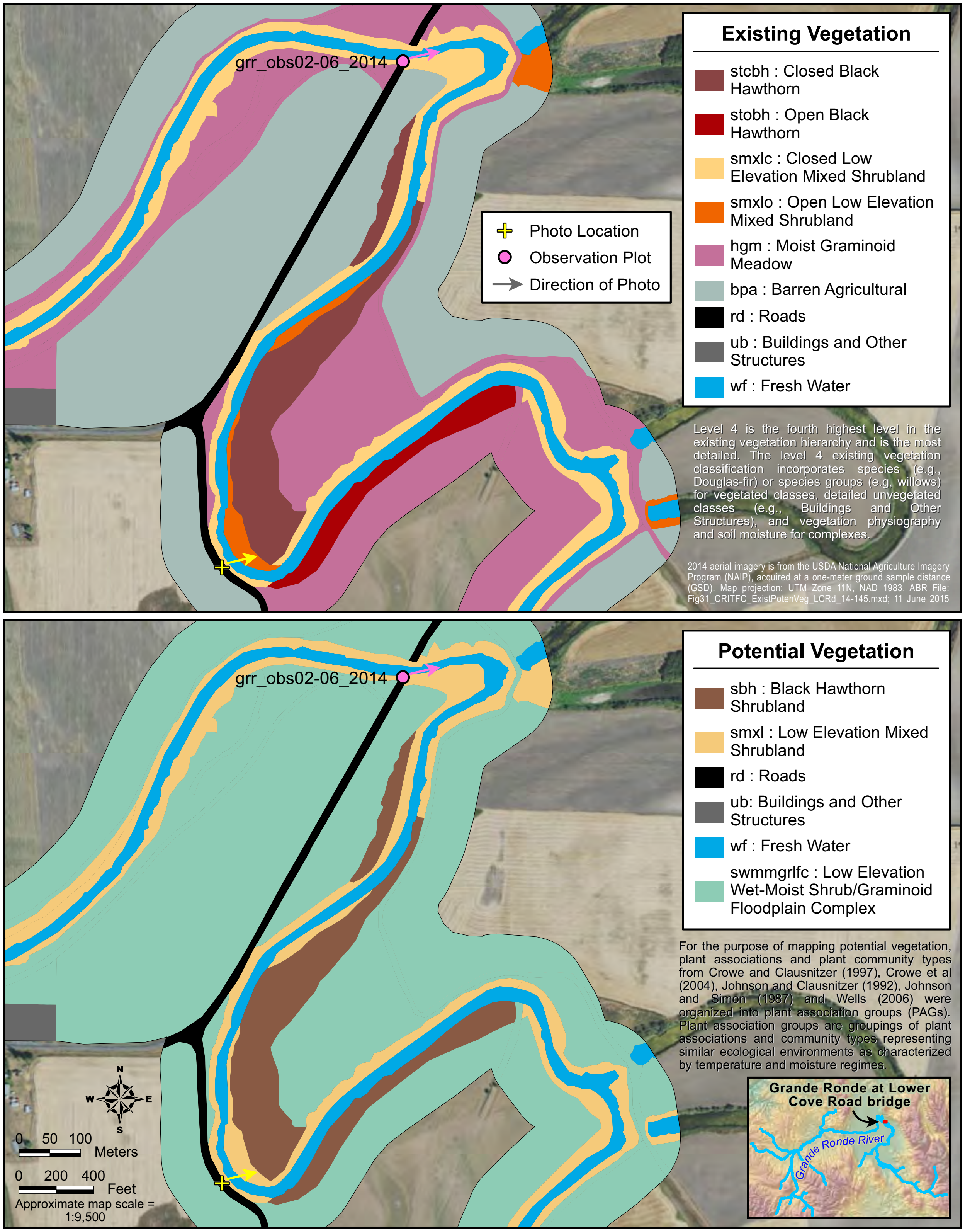
2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD): http://gis.apfo.usda.gov/arcgis/services/NAIP/Oregon_2014_1m
Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig29_CRITFC_FigPhotoLocs_14-145.mxd; 07 July 2015

Figure 29. Map of study area showing location of photos presented in subsequent figures. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



2011 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP); 3.9-foot resolution. http://imagery.oregonexplorer.info/arcgis/services/NAIP_2011/NAIP_2011_IR_SL/ImageServer. Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig30_CRITFC_Agric_2011_14-145.mxd; 11 June 2015

Figure 30. Aerial image of the Grande Ronde Valley from the 2011 NAIP IR imagery showing the extent of agricultural lands (crop circles and rectangular fields) in the valley as of 2011. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

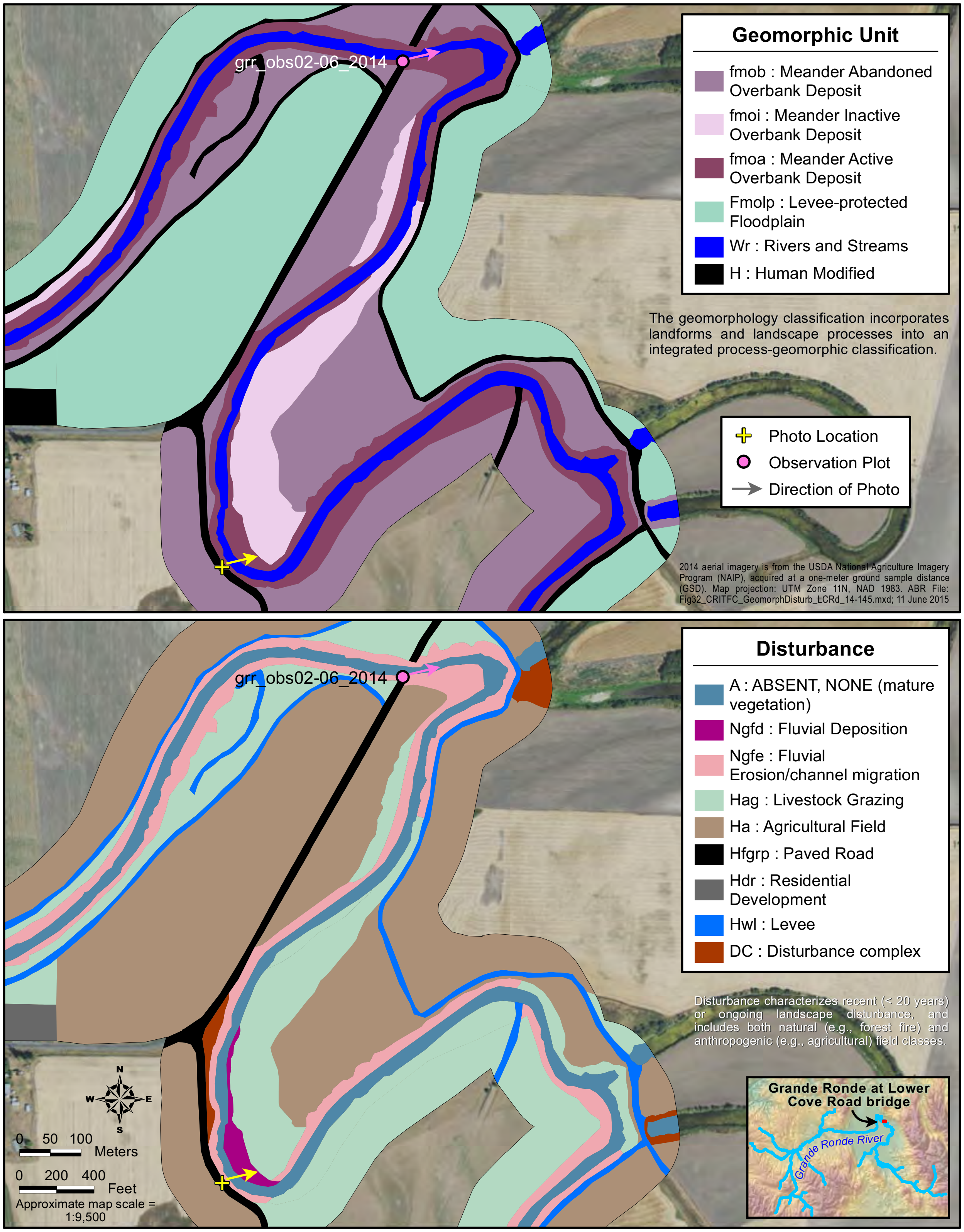


Level 4 is the fourth highest level in the existing vegetation hierarchy and is the most detailed. The level 4 existing vegetation classification incorporates species (e.g., Douglas-fir) or species groups (e.g, willows) for vegetated classes, detailed unvegetated classes (e.g., Buildings and Other Structures), and vegetation physiography and soil moisture for complexes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig31_CRITFC_ExistPotenVeg_LCRd_14-145.mxd; 11 June 2015

For the purpose of mapping potential vegetation, plant associations and plant community types from Crowe and Clausnitzer (1997), Crowe et al (2004), Johnson and Clausnitzer (1992), Johnson and Simon (1987) and Wells (2006) were organized into plant association groups (PAGs). Plant association groups are groupings of plant associations and community types representing similar ecological environments as characterized by temperature and moisture regimes.

Figure 31. Grande Ronde at Lower Cove Road bridge detailed study area showing maps of existing (upper) and potential (lower) vegetation, and field plot and photo locations. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



The geomorphology classification incorporates landforms and landscape processes into an integrated process-geomorphic classification.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig32_CRITFC_GeomorphDisturb_LCRd_14-145.mxd; 11 June 2015

Disturbance characterizes recent (< 20 years) or ongoing landscape disturbance, and includes both natural (e.g., forest fire) and anthropogenic (e.g., agricultural) field classes.

Figure 32. Grande Ronde at Lower Cove Road bridge detailed study area showing maps of geomorphology (upper) and disturbance (lower), and field plot and photo locations. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 33. Field photos from the Lower Cove Road bridge detailed study area showing existing vegetation including a photo from plot grr_obs02-06_2014 (a) and a nearby unnamed photo point (b). Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 34. Field photo from plot grr_obs02-05_2014 at Highway 82 bridge between Cove and Island City, Oregon, showing agricultural lands extending directly to the river channel. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Field observations in the Grande Ronde Valley revealed a low cover of shrub and forested vegetation on active floodplains. Historical records from pre-European settlement indicate that the floodplains (active, inactive and abandoned) of the Grande Ronde River and Catherine Creek in the Valley were extensive, and much of the valley was wet and “swampy” and covered by graminoid-dominated vegetation (Gildemeister 1998). The historical accounts also suggest that black cottonwood (*Populus trichocarpa* ssp. *balsamerifera*), willows (*Salix* spp.) and other hardwood shrubs were generally restricted to streambanks and active floodplains immediately adjacent to stream channels in the Grande Ronde Valley (U.S. Bureau of Reclamation 2012b). In 2014, small, relic stands of large cottonwood forest were observed in several locations through-out the Grande Ronde Valley, and in some cases catkins were observed (Figure 35). These stands could serve as a seed source for cottonwood establishment in the lower study area. However, younger cottonwood stands (sapling and pole-sized) were not observed in the lower study area, reflecting a noteworthy gap in cottonwood age structure. Along with a seed source, natural recruitment of cottonwood is dependent on moist, sandy bedding surfaces without competition from dense herbaceous vegetation, and an appropriate flow regime (Scott et al. 1997). A lack of appropriate bedding surfaces and flow regime are likely a contributing factor to the lack cottonwood regeneration in the lower study area. Another obstacle along many kilometers of lower Catherine Creek and the Grande Ronde River in the valley is ubiquitous cover of streambanks and floodplains

Figure 35. Field photo showing a relic poplar stand (a), including close up showing catkins in seed (b), in lower Grande Ronde Valley. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

by reed canarygrass (*Phalaris arundinacea*), which grows in a dense, nearly monocultural, rhizomatous stand 0.6–2 m tall (Waggy 2010). This "carpet" of reed canary grass can compete aggressively with cottonwood and other hardwood seedlings depriving them of light, moisture and nutrients (Tu 2004, Wisconsin Reed Canary Grass Working Group 2009).

In the Lower Cove Road bridge detailed study area, much of the potential vegetation is mapped as Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex. Restoration of the floodplain vegetation in the lower study area to potential vegetation, such as that mapped in the Lower Cove Road bridge detailed study area would require restoring the natural flow regime to the floodplain and oxbows. This might be accomplished by raising the water table and removing levees, but widespread irrigation (which lowers the water table) and channelization along the main stem of the Grande Ronde in the lower study area make these approaches to floodplain restoration challenging. An alternative approach to restoring native vegetation to the floodplain is described in Hall et al. (2011). They planted dormant pole cuttings of black cottonwood and willows along incised channels of Bridge Creek within John Day Fossil Beds National Monument in eastern Oregon. The cuttings were established successfully by planting them upwards of 2 meters in depth, such that they were in contact with the water table, and were covered with vented plastic tree covers.

Stands of white willow (*Salix alba* var. *vitellina*), an introduced, tree-sized willow, were observed more commonly than cottonwood stands in the lower study area (Figure 36). These forest stands are mapped as Closed and Open Willow Forest in the level 4 existing vegetation mapping. White willow may be a suitable surrogate for cottonwood on floodplains in the lower study area, contributing shade and large woody debris to the river channel. We mapped potential vegetation for polygons on active floodplains with existing white willow (and sometimes scattered black cottonwood

Figure 36. Field photo of a white willow (*Salix alba var. vitellina*) stand in lower river Grande Ronde Valley. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

trees) as Black Cottonwood/Willows Floodplain Forest. These sites may be Low Elevation Black Cottonwood Floodplain Forest or Low Elevation Tall Willows Floodplain Shrubland.

Four potential vegetation complexes were mapped along the Grande Ronde River from La Grande to its present-day confluence with Catherine Creek confluence; along Catherine Creek throughout the Catherine Creek Tributary Assessment's Reaches 1 and 2 and through portions of Reaches 3–7 (U.S. Bureau of Reclamation 2012a); along most of Little Creek; and along Ladd Creek from the former extent of Tule Lake and its associated wetlands downstream to its confluence with Catherine Creek. Complexes were assigned to polygons according to the generalized soil mapping unit attributed to each polygon. The morphology of the floodplain soil series within each generalized soil mapping unit reflects long-term depositional system dynamics, such as flooding frequency, sediment load, sediment size, and rate of lateral stream channel migration (Leopold et al 1964); these characteristics help predict the types of vegetation communities most likely to have developed on these soils. In addition, vegetation reported to occur on the soil series was described in the Union County Soil Survey (Dyksterhuis and High 1985); the Official Soil Series Descriptions (USDA, NRCS, Soil Survey Division_b 2013); and the Ecological Site Descriptions (USDA, NRCS, Ecological Sciences Division 2014), corresponding to the soil map units. Using soil morphology, vegetation descriptions, general historical accounts of vegetation in the Grande Ronde Valley, and the hydraulics that were de- scribed for the lower reaches of Catherine Creek (U.S. Bureau of Reclamation 2012b), potential vegetation complexes were mapped using best professional judgement.

The Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex was mapped on the lower section of the Grande Ronde River near the confluence with Wright Slough down to the confluence with Catherine Creek and on Catherine Creek in Reach 1 and in portions of Reach 2 (U.S. Bureau of Reclamation 2012a). This complex of potential vegetation would be characterized by shrubby vegetation types, and possibly some white willow stands, along active stream channel banks and the banks of younger oxbows. Inactive channels, oxbow channels and lower floodplain surfaces (i.e. areas of long-term soil saturation throughout the growing season) would be occupied by wet meadows and some remnant stands of low elevation mixed shrubland or low elevation tall willow communities, which would no longer be expanding in size or self-perpetuating. Slightly elevated inactive and abandoned floodplains would be occupied by moist meadows with possibly some scattered white willows and small remnant patches of shrubs. Black hawthorn (*Crataegus douglasii*) stands may also occur on drier surfaces. This potential vegetation was mapped predominantly on the Loam/Silt Loam generalized soil mapping unit. The fine textures of these soils indicate that flooding episodes are gentle and the sediment load is fine-textured. The hydraulics of Reaches 1 and 2 are "indicative of an ephemeral lake or estuary" (U.S. Bureau of Reclamation 2012b). In Reach 1 the valley gradient averages 0.03% and the stream gradient 0.01%, and in Reach 2 the valley gradient averages 0.04% and the stream gradient averages 0.03% (U.S. Bureau of Reclamation 2012b). Sinuosity in Reach 1 is 2.4 and is described as meandering to tortuous. Shear stresses in Reach 1 are so low that only fine-grained sediments are transported and there is little bank erosion potential (U.S. Bureau of Reclamation 2012b). In addition, channel bed materials are loose fine sands, silts and clayey silts (U.S. Bureau of Reclamation 2012b). The vegetation reported to occur on the soil series where this complex was mapped is sedges (*Carex* spp.) and rushes (*Juncus* spp.) on the wet meadows; tufted hairgrass (*Deschampsia cespitosa*) with some sedges and rushes on the moist meadows; and Great Basin wildrye (*Elymus cinereus*), threadleaf sedge (*Carex filifolia*) and bluebunch wheatgrass (*Agropyron spicatum*) on the driest of the moist meadow sites. Streambank vegetation, i.e., shrub stands, were probably not included because of the mapping scale of the Union County Soil Survey (Dyksterhuis and High 1985).

The Low Elevation Moist Shrub/Graminoid Floodplain Complex was mapped on a section of the lower reach of the Grande Ronde River and in a few locations on the lower section of Reach 1 of Catherine Creek. The generalized soil mapping unit is Loam/Silt Loam. The soil series in these sections were drier soils supporting primarily Great Basin wildrye (*Elymus cinereus*), threadleaf sedge (*Carex filifolia*), and bluebunch wheatgrass (*Agropyron spicatum*). Shrub communities would occur along active stream channel banks and oxbow banks. Black hawthorn stands may also occur on inactive and abandoned floodplains.

The Low Elevation Brackish Wet-Moist Shrub/Graminoid Complex was mapped on sections of lower Ladd Creek in the historic location of Tule Lake and its associated wetlands and along a few sections of Catherine Creek in Reach 2. This complex was mapped on the Loam/Silt Loam–brackish generalized soil mapping unit. These soils are similar to those in the Loam/Silt Loam generalized soil mapping unit but have high concentrations of sodium, to which particular grasses and shrub dominant species are tolerant. Low elevation mixed shrubland and low elevation tall willows floodplain shrublands would occur on streambanks and active floodplains. In addition, greasewood (*Sarcobatus vermiculatus*)/Great Basin wildrye communities would occur on active and inactive floodplains. Basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*)/Great Basin wildrye communities would occur on abandoned floodplains and recent terraces. These three complexes are unlikely to support abundant (if any) cottonwood stands because of the high water tables in the fine-textured floodplain soils and slower flows and more stable discharge in the channels. This situation would be exacerbated by the introduction of natural or artificial beaver dams. Cottonwoods are much less tolerant of long-term inundation and saturated soils than willow species (Amlin and Rood 2001). Cottonwood seedlings (and even saplings) that may be established during one spring runoff can be completely killed in one season of inundation of as little as 5 cm (Amlin and Rood 2001, Noble 1979).

The Low Elevation Black Cottonwood/Moist Meadow Floodplain Complex was mapped along reaches of the Grande Ronde River from La Grande downstream to the confluence with Wright Slough, along lower Little Creek, and along Catherine Creek in small sections of Reaches 2 and 5 and in larger sections of Reaches 4 and 6 (Hall Ranch) (U.S. Bureau of Reclamation 2012a). This complex was mapped where riparian vegetation has been removed or highly altered and it was not possible to map the potential vegetation as Low Elevation Black Cottonwood Forest or Moist Meadow in individual polygons. The complex occurs primarily on the Loam over Skeletal generalized soil mapping unit with some units on the Loam/Silt Loam mapping unit. The Loam over Skeletal soils are associated with channel deposits and active and recently inactive floodplains and would support the mountain alder (*Alnus incana*) and black cottonwood plant association groups. Moist meadows and moist ponderosa pine (*Pinus ponderosa*) forest would occur on the Loam/Silt loam soils on recent alluvial terraces.

MIDDLE STUDY AREA

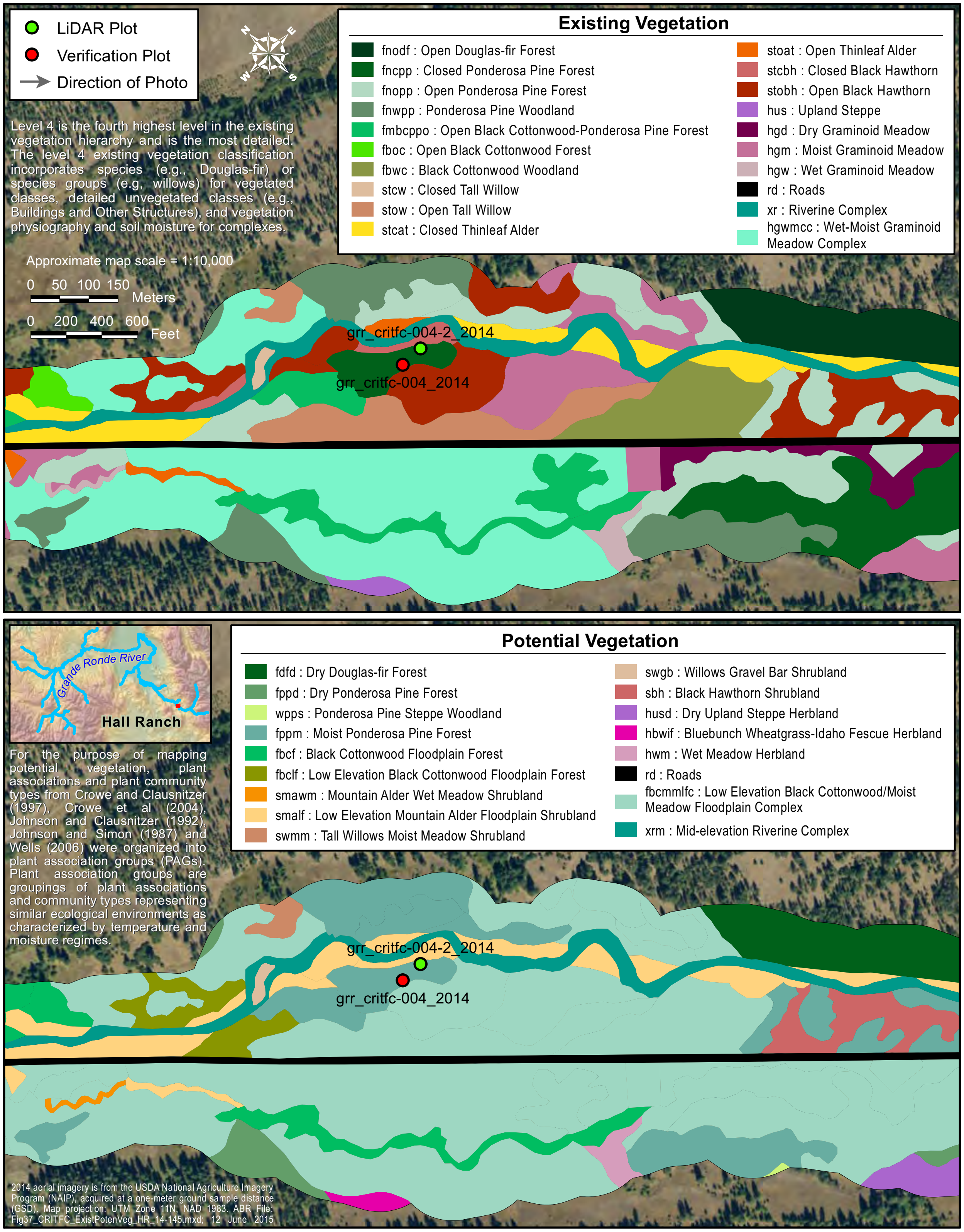
The Grande Ronde River and Catherine Creek in the middle study area are montane rivers characterized by sections of broader, unconstrained reaches with gentle to moderate gradients, and narrower, moderately constrained reaches with moderately high gradients. The middle study area is a patchwork of private lands and National Forest lands managed by the Wallowa-Whitman National Forest. Cattle grazing and logging, including splash dam logging in the early 19th century, are important land uses that have affected riparian areas in the Grande Ronde watershed, including the middle study area, beginning in the early- to mid-nineteenth century, and in the case of cattle grazing, continuing today (Wissmar et al. 1994). Field studies using grazing exclosures have demonstrated that cattle grazing in riparian areas in the Grande Ronde and Catherine Creek riparian areas affected the height and density of woody vegetation, including willows and cottonwoods (Green and Kauffman 1995, Case and Kauffman 1997).

Splash dam logging is a type of logging that uses instream structures to temporarily impound water that is later used to float harvested logs down river in “log drives”. While the technique was an efficient means of moving a large quantity of harvested timber downstream, it resulted in alterations to the geomorphology of stream and river channels (Phelps 2011). Geomorphic alterations (increased bed scour and bank erosion) were related to the physical impacts of the flooding and tons of large wood coursing through aquatic ecosystems resulting in massive bed scour and erosion. Prior to blowing the splash dams in-channel large woody debris was removed and large boulders and beaver dams were dynamited. The net result of these impacts were changes to the natural flow regime, stream channel entrenchment, and reductions in fine sediment resulting from increased flows and removal of large wood.

Figures 37 and 38 display selected attributes of the ITU mapping for representative areas of middle Catherine Creek and the Grande Ronde River, respectively. Figure 37 displays the existing and potential vegetation near Hall Ranch along Catherine Creek. The existing vegetation in this area is characterized by scattered Closed and Open Mountain Alder stands directly adjacent to the active river channel. The total cover of Mountain Alder is much lower than the potential along this reach of Catherine Creek and some stands have been replaced by Black Hawthorn, likely as a result of historic livestock over-grazing. Closed and Open Ponderosa Pine Forest and Ponderosa Pine Woodland occur on the lower floodplain. Moist and wet graminoid meadow characterize much of the upper floodplain and terraces. Black cottonwood existing vegetation types occur in relatively small, isolated stands in the Hall Ranch detailed study area. However, a large proportion of the potential vegetation in this area is mapped as various types of black cottonwood forest, including Black Cottonwood Floodplain Forest, Low Elevation Black Cottonwood Floodplain Forest, and Low Elevation Black Cottonwood/Moist Meadow Floodplain Complex. This complex comprises Low Elevation Mountain Alder Floodplain along streambanks and active overbank deposit surfaces; Low Elevation Black Cottonwood Floodplain Forest along streambanks and on active and inactive overbank deposit surfaces; Moist Ponderosa Pine on inactive to abandoned floodplains; Moist Meadows on slightly drier sections of backwater areas; and Wet Meadows on backwater areas where water ponds following flooding. The Hall Ranch area likely had a high beaver population historically, which would have resulted in a very complex system of vegetation types across the valley. The riverine complex along Catherine Creek from just above the North Fork-South Fork confluence to approximately 130 meters below the confluence with Little Catherine Creek is a Low-elevation Riverine Complex.

Hall Ranch corresponds to Reach 6 in the Catherine Creek Tributary Assessment (U.S. Bureau of Reclamation 2012b). Reach 4 in this assessment is a similarly unconfined reach and the historical assemblage of vegetation communities was probably similar to Reach 6. Restoration of both of these reaches would likely result in similar riparian systems.

Black cottonwood stands in the lower study area were observed infrequently during field surveys, particularly the younger, smaller size classes, including seedling, sapling, and pole-sized stands. Cobble bars throughout the middle river were commonly observed to have little to no regeneration of woody species, including willows and black cottonwood, and also lacked fine sediments to serve as seed beds (Figure 39). Sapling- and pole-sized poplar stands were observed at Bird Track Springs Interpretive Site on the Wallowa-Whitman National Forest (Figures 38 and 40). However, these instances of younger aged poplar were rare, and we more commonly observed older, larger aged poplar stands (Figure 41) or a complete lack of cottonwood forests altogether. An age-structure more typical of successful naturally regenerating populations of poplar is a combination of these size/age classes along a given river reach as was observed on the alluvial bars and banks in the Grande Ronde River near Riverside Park in La Grande (Figure 42). The limited extent of younger aged poplar in the middle study area is likely related to a combination of changes in channel morphology due to splash dam logging and physical removal of seedlings and saplings due to browsing by cattle and wild ungulates. Restoration of black cottonwood in the middle study area would require a combination of the following: cottonwood live stakes and live pole plantings installed into the floodplain surfaces down to within proximity of the the low summer flow groundwater capillary fringe, building grazing exclosures around the plantings, and installing engineered log jams (Abbe et al. 2003) to create mid-channel islands and lateral floodplains that will trap bedload and fine sediments. The fine sediment will serve as future seed beds and seedling safe sites (Polzin and Rood 2006) to enhance natural regeneration.

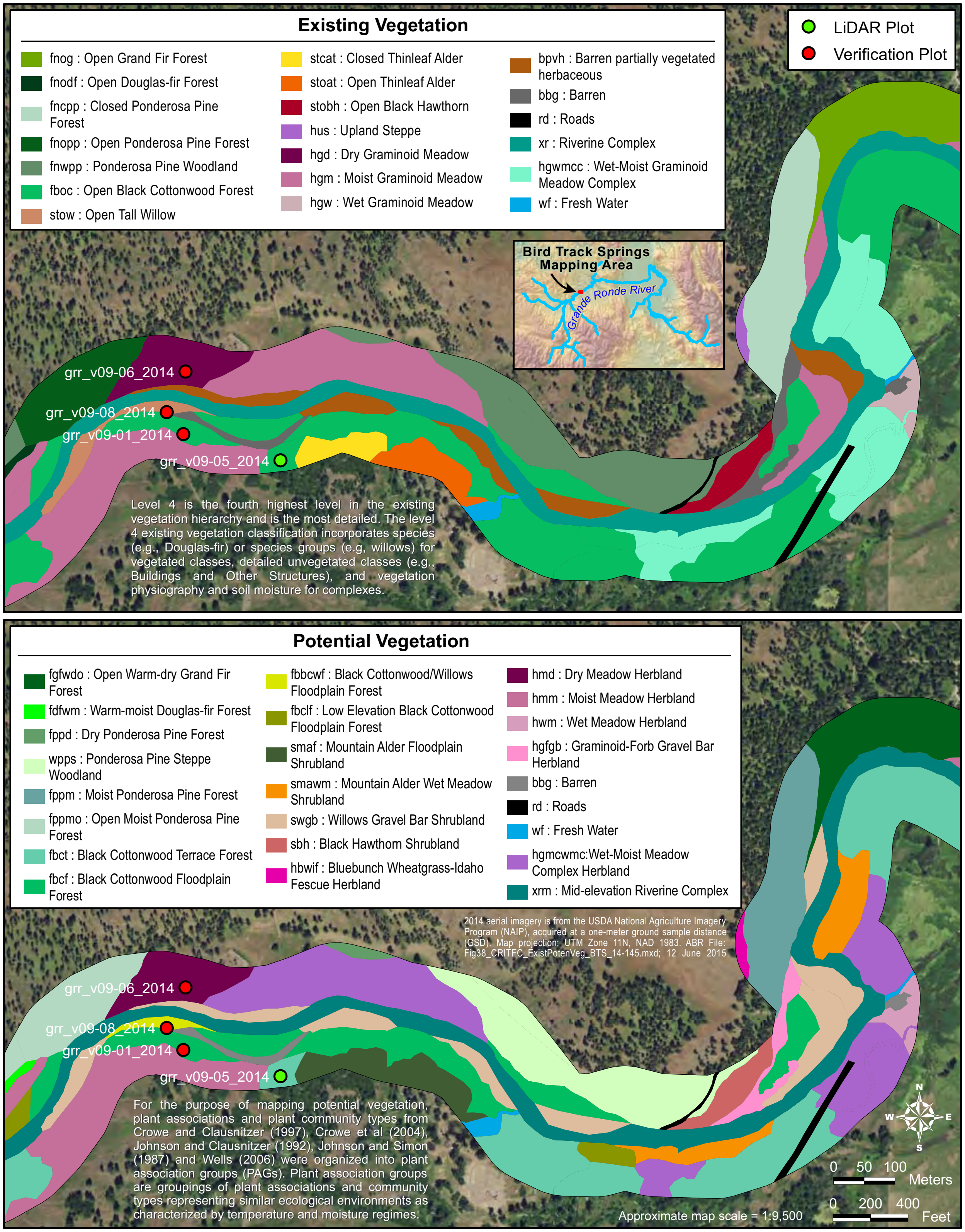


Level 4 is the fourth highest level in the existing vegetation hierarchy and is the most detailed. The level 4 existing vegetation classification incorporates species (e.g., Douglas-fir) or species groups (e.g, willows) for vegetated classes, detailed unvegetated classes (e.g., Buildings and Other Structures), and vegetation physiography and soil moisture for complexes.

For the purpose of mapping potential vegetation, plant associations and plant community types from Crowe and Clausnitzer (1997), Crowe et al (2004), Johnson and Clausnitzer (1992), Johnson and Simon (1987) and Wells (2006) were organized into plant association groups (PAGs). Plant association groups are groupings of plant associations and community types representing similar ecological environments as characterized by temperature and moisture regimes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig37_CRITFC_ExistPotenVeg_HR_14-145.mxd; 12 June 2015

Figure 37. Hall Ranch detailed study area showing maps of existing (upper) and potential (lower) vegetation, and field plot and photo locations. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.



Level 4 is the fourth highest level in the existing vegetation hierarchy and is the most detailed. The level 4 existing vegetation classification incorporates species (e.g., Douglas-fir) or species groups (e.g, willows) for vegetated classes, detailed unvegetated classes (e.g., Buildings and Other Structures), and vegetation physiography and soil moisture for complexes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig38_CRITFC_ExistPotenVeg_BTS_14-145.mxd; 12 June 2015

For the purpose of mapping potential vegetation, plant associations and plant community types from Crowe and Clausnitzer (1997), Crowe et al (2004), Johnson and Clausnitzer (1992), Johnson and Simon (1987) and Wells (2006) were organized into plant association groups (PAGs). Plant association groups are groupings of plant associations and community types representing similar ecological environments as characterized by temperature and moisture regimes.

Approximate map scale = 1:9,500

Figure 38. Bird track springs detailed study area showing maps of existing (upper) and potential (lower) vegetation, including plot locations. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 39. Photos showing examples of barren cobble bars with little to no woody vegetation regeneration on main stem of Grande Ronde River. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 40. Field photos of pole-sized cottonwood at plot grr_09-01_2014 (a) and sapling-sized poplar and willow at plot grr_09-08_2014 (b), Bird Track Springs Interpretive Site, Wallowa-Whitman National Forest. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 41. Photo of large, mature cottonwood stand (highlighted in red) on the main stem of the Grande Ronde River. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 42. Panoramic field photo of mature black cottonwood *(Populus trichocarpa)* along the river banks (dashed yellow outline) and black cottonwood saplings and willows on a cobble bar (solid red outline) at Riverside Park in La Grande. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

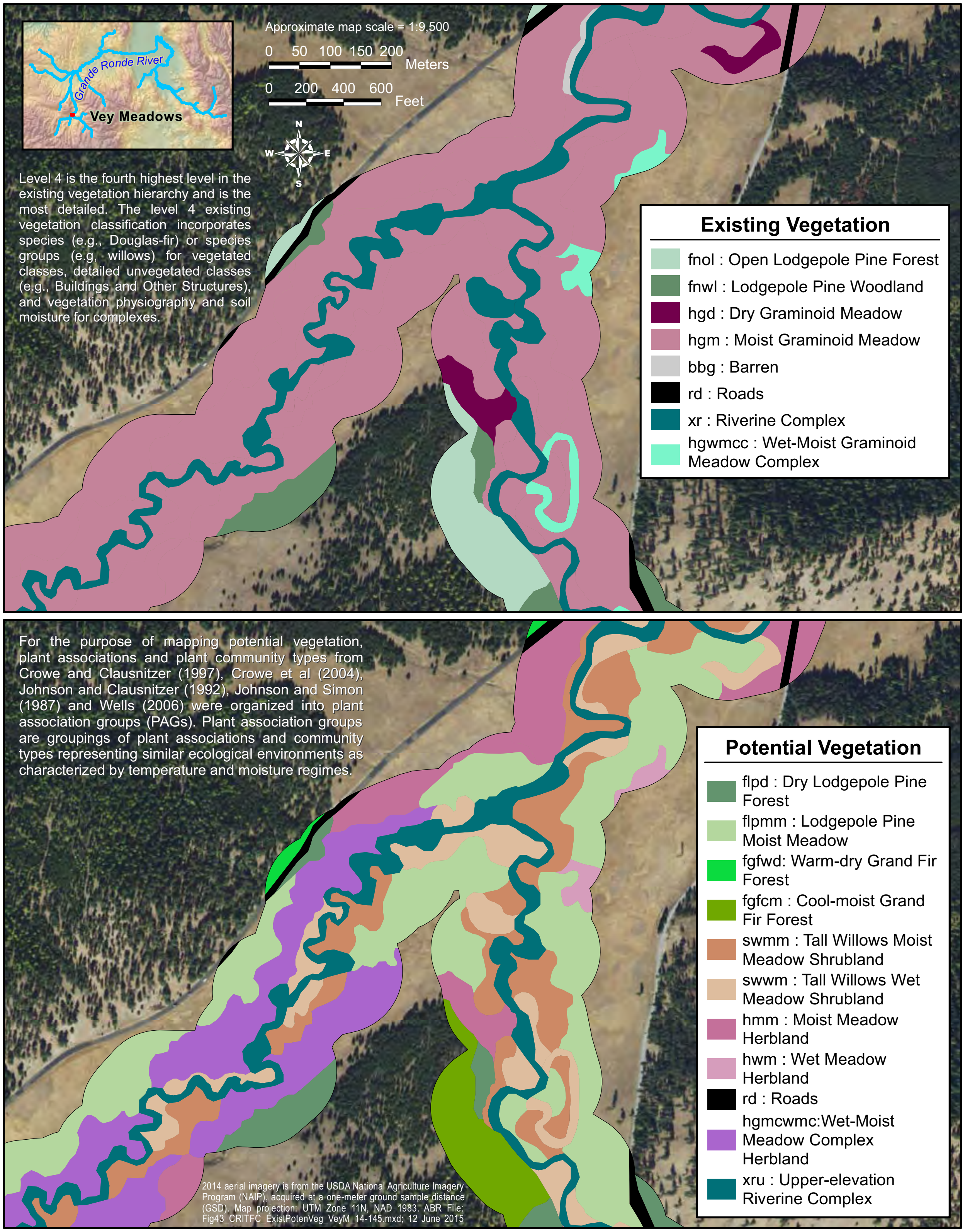
Low elevation shrub communities along Little Catherine Creek starting at approximately one km upstream from the confluence with Catherine Creek were observed to be in excellent ecological condition. The shrub layer was diverse and the shrubs had grown to their full height potential. The herbaceous understory was composed almost entirely of native plant species, an extremely rare occurrence in low elevation shrub communities in the Blue Mountains.

The section of Five Points Creek within the mapping buffer has a narrow to moderately-wide valley bottom. Within the upper 1500 m of the mapping buffer the potential vegetation is a High-elevation Riverine complex surrounded by Grand Fir Forest. This section in currently not within a livestock grazing allotment. Below this section downstream to approximately 500 m above the confluence with Pelican Creek the valley bottom is dominated throughout most of its length by Warm-moist Douglas-fir Forests and Mountain Alder Floodplain Shrublands with scattered Black Hawthorn and Black Cottonwood stands. There may have been more Black Cottonwood in this drainage historically. Remnants of a historic unpaved road that ran from side to side up the Five Points Creek valley bottom were mapped. Over time the road has been obliterated in a piecemeal fashion by erosion as the stream has changed course. There are many remnant channels and abundant down wood evident in the LiDAR imagery indicating that the stream channels moves laterally within the valley bottom on a relatively frequent basis. From 500 m above the Pelican Creek confluence down to the Grande Ronde River to the city of La Grande is a Low-elevation Riverine Complex characterized by abundant Black Cottonwood.

UPPER STUDY AREA

Vey Meadows

The upper study area includes the headwaters of the numerous 3rd and 4th order streams and rivers that form the Grande Ronde River and Catherine Creek (Figure 1). The upper study area is characterized by broad, low-gradient meadows and steep, constrained forested reaches. Vey Meadows, a private inholding located at the confluence of the mainstem of the Grande Ronde River with Sheep Creek, is one of the more prominent meadows in the upper study area. Figure 43 displays the existing and potential vegetation map for a portion of Vey Meadows. The existing vegetation for large areas of Vey Meadows is Moist Graminoid Meadow. Active channel deposits and areas of the floodplain directly adjacent to the active river channel are mapped as Riverine Complex, which includes barren river bars, small patches of moist and wet meadow, and small stands of lodgepole pine. Field observations made from the road in 2014 revealed a general lack of woody vegetation throughout Vey Meadows, namely willows on active channel deposits and lower floodplain surfaces and lodgepole pine on upper floodplain surfaces and terraces (Figure 44). The potential vegetation in Vey Meadows as presented in the ITU mapping is somewhat more complex, and prominently features woody vegetation (Figure 43). In addition to woody vegetation, the potential vegetation features a mosaic of moist and wet meadows. The potential vegetation in Vey Meadows in large part reflects field observations and mapping of existing vegetation in similar meadows in the study area, namely the upper portions of Meadow Creek (Figure 19) that are part of the Starkey Experimental Forest. The Starkey Experimental Forest is enclosed by a game-proof fence (installed in 1987) for much of its 28,000 acres and was established to study population dynamics of native ungulates and responses of vegetation to varying levels of grazing and browsing. The existing vegetation at the headwaters of Meadow Creek features a mosaic of woody vegetation, including stands of lodgepole pine and willows, and herbaceous vegetation, including wet and moist graminoid meadows and moist forb meadows. The key difference affecting existing vegetation between Vey Meadows and the section of Meadow Creek displayed in Figure 19 is the reduction in grazing intensity along Meadow Creek for the last 18 years. Field studies from the Starkey Experimental Forest have demonstrated that cattle grazing in riparian areas in the Grande Ronde and Catherine Creek riparian areas affected the height and density of woody vegetation, including willows (Case and Kauffman 1997). Figure 45 illustrates this, showing field observations from 2014 of browsed willows in an unenclosed area along upper Sheep Creek and



Level 4 is the fourth highest level in the existing vegetation hierarchy and is the most detailed. The level 4 existing vegetation classification incorporates species (e.g., Douglas-fir) or species groups (e.g, willows) for vegetated classes, detailed unvegetated classes (e.g., Buildings and Other Structures), and vegetation physiography and soil moisture for complexes.

For the purpose of mapping potential vegetation, plant associations and plant community types from Crowe and Clausnitzer (1997), Crowe et al (2004), Johnson and Clausnitzer (1992), Johnson and Simon (1987) and Wells (2006) were organized into plant association groups (PAGs). Plant association groups are groupings of plant associations and community types representing similar ecological environments as characterized by temperature and moisture regimes.

2014 aerial imagery is from the USDA National Agriculture Imagery Program (NAIP), acquired at a one-meter ground sample distance (GSD). Map projection: UTM Zone 11N, NAD 1983. ABR File: Fig43_CRITFC_ExistPotenVeg_VeyM_14-145.mxd; 12 June 2015

Figure 43. Vey Meadows detailed study area showing maps of existing (upper) and potential (lower) vegetation. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 44. Photos of Vey Meadows taken from Forest Road 5160 showing the lack of woody vegetation on the floodplain. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

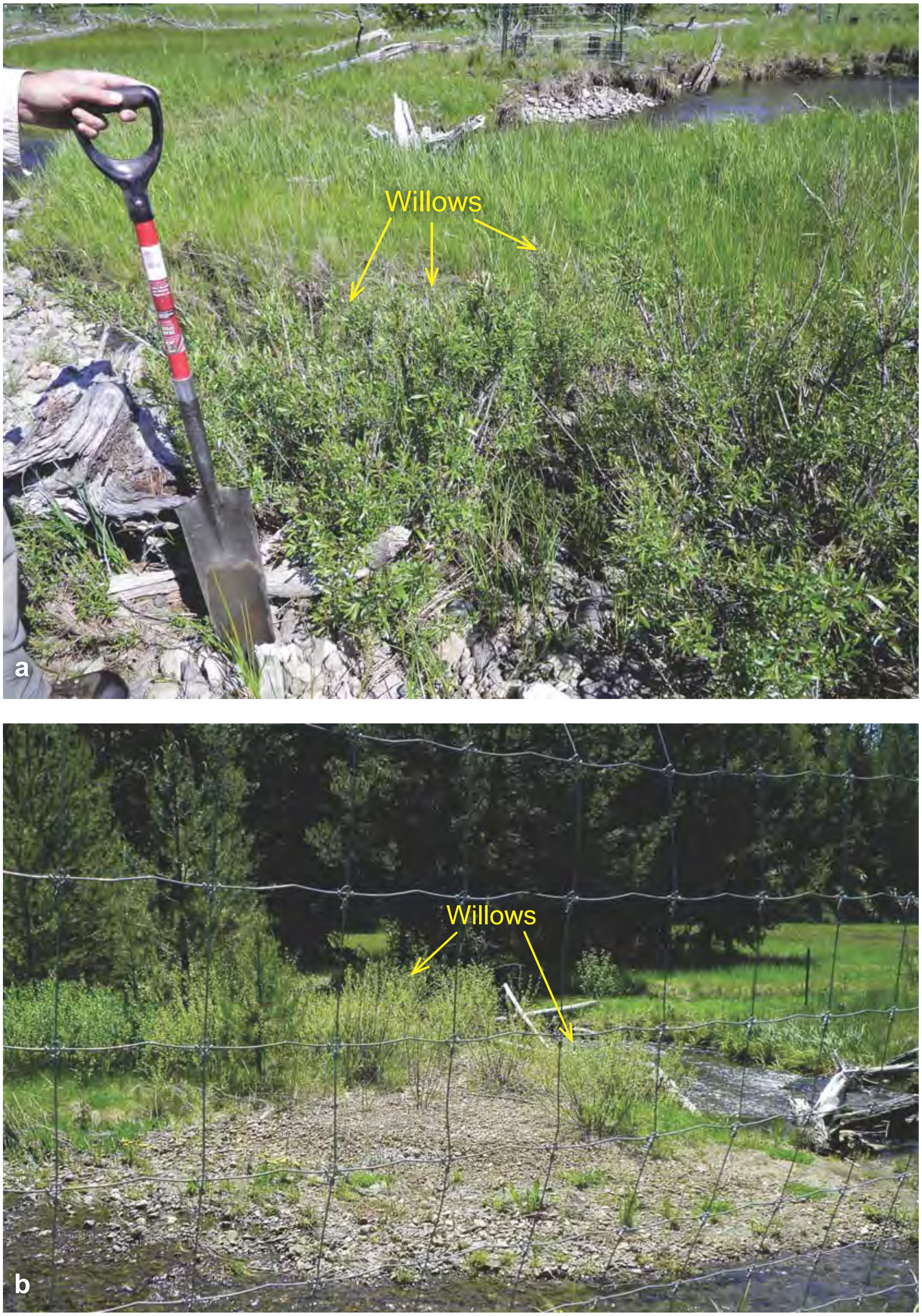


Figure 45. Field photos showing examples of browsed willows in an unfenced area in upper Sheep Creek (a) and unbrowsed willows in a fenced area along Limber Jim Creek (b). For scale, shovel in upper photo is approximately 1.1 meters tall, and willows in lower photos are 1.0–1.5 meters tall. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

unbrowsed willows in a small enclosure along Limber Jim Creek.

Beaver Creek

Through most of the Beaver Creek drainage, the valley bottom is narrow. The potential vegetation (and most existing vegetation) in the upper part of the drainage is cool, moist habitat with Grand Fir-Engelmann Spruce Forest and Mountain Alder Floodplain Shrublands intermixed with open wet meadows and Lodgepole Pine transitioning to Cool-moist Grand Fir Forest and pockets of Cold Grand Fir Forest. Within the National Forest boundary there is no livestock grazing, so the riparian vegetation is in relatively good condition with potential or nearly potential canopy cover. The riverine complex that occurs from about 2 km downstream of confluence with Dry Beaver Creek to the upper end of the mapping buffer is a High Elevation Riparian Complex. Below the confluence with Dry Beaver Creek, the valley bottom transitions to the Low Elevation Riverine Complex and is dominated by scattered stands of Warm-moist Douglas Fir Forest, Black Cottonwood stands, Low Elevation Mountain Alder Floodplain Shrublands (with higher occurrence and canopy cover of tall willows) and Moist Meadows, probably comprising primarily introduced grass species. Below the National Forest Boundary is private land grazed by livestock and canopy cover of shrubs and herbaceous plants is significantly lower than potential. The riverine complex that occurs from the confluence with Grande Ronde River to about 2 km downstream of confluence with Dry Beaver Creek is a Mid Elevation Riparian Complex.

Catherine Creek

The North Fork of Catherine Creek is a narrow drainage that has cut through old terraces formed by Pleistocene glacial deposits from the upper end of the mapping buffer to approximately 500 m downstream from the confluence with Boot Hill Creek (USDA, Forest Service, Wallowa-Whitman National Forest 2002). The valley bottom vegetation comprises primarily Dry Subalpine Fir Forest on the old terraces and wet meadows in the upstream end of the mapping buffer and Subalpine Fir-Englemann Spruce Forest on moister sideslopes downstream. From the Jim Creek confluence downstream to the Middle Fork Catherine Creek confluence, more Open Cool-moist Grand Fir Forest, Engelmann Spruce Forest, and Mountain Alder Floodplain Shrublands on actively flooded fluvial surfaces occurs. Between the Middle Fork Catherine Creek confluence and the South Fork Catherine Creek confluence, Mountain Alder Floodplain Shrublands occurs on streambanks, alluvial bars, active floodplains, and in side channels. There are occasional Black Cottonwood Floodplain Forest stands on active floodplains. Engelmann Spruce Forest occurs on inactive floodplains and Cool-moist Grand Fir Forests occur on Inactive and abandoned floodplains on the east side of the creek. Open Warm-dry Grand Fir Forest and perhaps scattered Warm-moist Douglas Fir Forest occur on some inactive floodplains on the west side of the creek. The riverine complex from the upper end of the mapping boundary to approximately one km upstream from confluence with South Fork Catherine Creek is an Upper-elevation Riverine Complex.

The South Fork of Catherine Creek flows generally from east to west and accordingly, the south-facing sideslopes comprise warmer and drier vegetation types. These include a mix of Dry Douglas-fir Forest and Bluebunch Wheatgrass-Idaho Fescue grasslands with scattered Ponderosa Pine Steppe Woodlands and Warm-moist Douglas-fir Forest. The north-facing side-slopes and valley bottom are dominated by Cool-moist Grand Fir Forest and Open Cool-moist Grand Fir Forests. Mountain Alder Floodplain Shrubland occurs on banks and small active overbank deposits. From 1220 m elevation (approximate 4.3 km upstream of the confluence with North Fork Catherine Creek), the valley bottom is wider and more Engelmann Spruce occurs in the Cool-moist Grand Fir Forests.

Riparian restoration in the upper study area

In meadows in the upper study area, woody vegetation is unlikely to establish naturally without the aid of grazing exclosures in riparian (i.e., riverine) areas. Optimally, the exclosures would use controlled access points (USDA NRCS 2007), whereby long sections of the riparian area are enclosed using game proof fencing with short period breaks in the fencing, or access points. The breaks allow cattle and native ungulates access to the stream for drinking water. Ideally, streambanks and the streambed would be armored with gravel at access points to reduce erosion.

Using grazing exclosures in meadows throughout the study area, particularly in Vey Meadows, would greatly improve the likelihood of woody vegetation regeneration in riverine areas and promote the vegetative potential in these meadows. However, another challenge to promoting the development of potential vegetation in meadows in the study area is the decoupling of the floodplain and river discharge, including ground water and high water flood events. Down-cutting of streams and the resulting channel incisement is an important factor limiting floodplain-ground water-high water interactions. Channel incisement has also been identified as a primary factor of habitat degradation limiting Chinook and steelhead in the Grande Ronde Subbasin (NPCC 2004, Pollock et al. 2014).

The North America beaver (*Castor canadensis*) has been considered a keystone species by some (Naiman et al. 1986) and an "ecosystem engineer" by others, due to the variety of ways that beavers alter and enhance stream and riparian ecosystems, including geomorphology (Pollock et al. 2007), plant species richness (Wright et al. 2002), and water chemistry (Smith et al. 1989). Historically, beavers have undoubtedly played an important role in shaping the geomorphology and potential vegetation in meadows throughout the study area. Trapping records from the Hudson Bay Company report large yields of beaver pelts from the Grande Ronde and Wallowa Basins in the early 1800's (Grant 2010), suggesting a large population of beavers at that time. However by the late 1830's, yields were down and presently, the beaver population in the Grande Ronde basin is considered to be extremely low; availability of suitable habitat being one of the more important factors limiting the possibility of a population resurgence. The decimation of the beaver populations in Grande Ronde basin have contributed in part to the degradation of stream and riparian habitats since European settlement. This is because beaver dams act as obstructions in stream channels, thereby reducing the stream power and velocity, which in turn reduces the erosive potential of floodwaters and allows sediment to accumulate. Beaver dams or beaver dam analogues can be used to restore incised stream channels (Pollock et al. 2014). This is illustrated in Figure 46, which shows a beaver dam along upper Meadow Creek and the aggraded channel, a small pool, and willow stand upstream of the dam. The beaver dam is contributing to a higher soil water table upstream on the floodplain, encouraging willows along this section of the stream. Beaver dam analogues, also termed artificial beaver dams, are ideal for situations where beaver populations are low and the success of reintroducing beavers uncertain due to existing habitat limitations, as is the case in the Grande Ronde Basin. One approach to implementing stream and riparian restoration to enhance potential vegetation in meadows in the study area would be to use flow-choke structures, a type of artificial beaver dam, similar to DeVries et al. (2012) study on Benewah Creek in north-western Idaho. This study showed positive results one to two years after installing flow-choke structures, including more persistent natural beaver dams being built close to the artificial structures and increased flooding upstream of flow-choke structures as designed (K.L. Fetherston, personal communications).

In steeper, confined stream reaches natural or artificial beaver dams may be less effective due to the increased stream power that would readily destroy beaver dams. Instead, large woody debris plays a more important role here. For instance, in upper Fly Creek, the channel steepens and narrows downstream from Fly Creek Meadows. In 2014, a log jam was observed along upper Fly Creek (Figure 47) that was composed largely of logs with clean cut ends suggesting that the logs had been added to the stream in an attempt to restore large woody debris to the channel. However, the log jam itself appeared to have developed naturally, likely during a flood event that forced the logs downstream, where they eventually lodged into place forming the jam. Upstream of the jam, the river bed was aggraded approximately 0.5 m above the river bed on the downstream side of the dam. Additionally, a side channel has formed upstream of the jam. During high water events, floodwaters are forced down the side channel (as evidenced by flotsam observed on the floodplain and along the side channel) and onto the floodplain; thus, enhancing riparian habitat and stimulating

Figure 46. Beaver dam along upper Meadow Creek showing the aggraded channel and small pool upstream of the dam, with a willow stand (dashed red outline) in the background. For scale, shovel in upper photo is approximately 1.1 meters tall. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Figure 47. Field photos of a log jam on upper Fly Creek, including a photo from downstream of the log jam looking upstream (a), and a panoramic photo from upstream of the jam looking downstream (b). Note in the upper photo that many of the logs were likely placed in the stream as large woody as evidenced by the clean cut ends. These logs were then pushed downstream during large spring flood events forming the jam. For scale, the biologist in the photo is approximate 1.7 meters tall. The lower photo shows the aggraded river bed on the upstream side of the jam. Field observations indicate that the jam is redirecting flood waters into a lateral channel during high flow events thus reconnecting the river with the floodplain. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

increased floodplain-floodwater interactions. Along steeper stream reaches in the upper study area, natural or engineered log jams may be a useful restoration tool for entrenched channels along steep, constrained stream reaches.

LIDAR FIELD VERIFICATION

Figure 48 displays the paired bar charts comparing mean and SD of tree heights measured in the field (Mean Tree Height) at LiDAR plots against the mean and SD of canopy hit heights in the >3 m strata layer (Mean LiDAR Tree Canopy Height). The chart indicates that in most cases, the mean tree heights measured in the field for the map polygon were greater than the mean canopy hit heights estimated from LiDAR data for that polygon.This is related to methods used for measuring tree heights in the field as opposed to how the LiDAR canopy height data were summarized. In the field, tree height was measured from the ground level to the very top of the tree, thereby accounting for the total height of the tree. The LiDAR data summarizes the mean height of canopy hits greater than 3 m in height. Hence, the mean height of canopy hits in the LiDAR data includes hits of canopy below the top of tree, resulting in an overall lower mean height. However, in many of these cases the SD of mean heights overlaps, indicating that the mean canopy hit height as estimated from the LiDAR data falls within the variability of the tree heights measured in the field. Other sources of error include differences between the tree heights in the plot as compared to tree heights in the map polygon, which represents a larger spatial area than the plot. Errors and glitches in the LiDAR data, as described in the Methods section, also are factors.

Figure 49 displays the paired bar charts comparing the hit density (%) of trees (>3 m) and tall shrubs (1.5–3.0 m) as estimated in the field (Canopy Density) against the hit density for the map polygon associated with each plotas summarized in the LiDAR data (Canopy Hit Density). Compared to the height data summaries, which showed a clear trend of higher heights based on the field measurements, the density data is somewhat less clear. In some cases, the plot data matches reasonably well with the LiDAR canopy hit density data (e.g., grr_critfc-013_2014), but in others the canopy density estimates are off substantially in one, or the other, direction (e.g., grr_critfc-001_2014, grr_v40-01_2014). In the case of field plot data having reasonable alignment with the LiDAR canopy hit density data, the canopy density in the field plot, which in most cases is circular with a 10 m radius, is representative of the canopy density in the map polygon. In contrast, plots that are misaligned with the LiDAR canopy hit data for the polygon have the opposite situation; the canopy density in the plot is not representative of the broader map polygon in which it is located. For instance, the canopy density as estimated in the field at plot grr_critfc-001_2014 is lower than the canopy hit density in the map polygon. The vegetation at the plot is Ponderosa Pine Woodland, and features few, large, widely spaced ponderosa pine. The plot dimensions were not large enough to capture the wide spacing of the trees in this polygon. The opposite was true for plot grr_v40-01_2014, which was located in a small Closed Tall Thin Alder stand. In this instance, the canopy density estimated in the field was higher than the canopy hit density in the map polygon, which includes a broader area and is mapped as Douglas-fir Woodland. The closed alder stand where the plot is located is an inclusion within the map unit and has a higher canopy density than the broader polygon. Based on these results, we recommend that the protocols for the LiDAR field plots be modified to encompass a larger area within each polygon. Perhaps several transects that extend across the entire polygon could be included and spaced to ensure that height and density measurements more fully capture the polygon.

SUMMARY

The Columbia River Inter-Tribal Fish Commission (CRITFC) seeks to develop a spatially-based system for modeling abundance, productivity, and growth rate for spring Chinook salmon in the upper Grande Ronde watershed in northeastern Oregon. ABR, Inc.—Environmental Research & Services (ABR) and Elizabeth Crowe worked collaboratively to create a map of existing and potential natural vegetation throughout the extent of the spring Chinook spawning and rearing zone in the upper Grande Ronde watershed. The study area encompasses approximate 7,300 hectares (ha) of the Grande Ronde River watershed in northeast Oregon. The study area is defined by a 100 m buffer along each side of the center of active river channels, including the mainstem of the Grande Ronde River and Catherine Creek and major tributaries. Field surveys were conducted 3–11 June 2015 by two field crews to collect data on vegetation and soils for map verification. Field crews were based in La Grande, Oregon and traveled to the field each day via pickup truck. A total of 82 plots were sampled across the study area, including 57 verification plots, 12 observation plots, 11 LiDAR plots, and 2 photo plots.

We classified and mapped several ecosystem components in the study area using standardized classification and coding systems developed for northeastern Oregon. Map polygon delineation was completed on-screen in a Geographic Information System (GIS) by photo-interpretation of aerial imagery. A LiDAR dataset was also used to assist the mapping effort and to estimate height and density of existing vegetation within map polygons. Individual ecological components were mapped simultaneously as compound codes called Integrated Terrain Units (ITUs). Integrated Terrain Units comprise five parameters assigned to each map polygon describing physiography, geomorphology, generalized soils, existing vegetation, potential vegetation, and disturbance. Individual ecological components for each polygon in the ITU mapping were concatenated to create ITU code combinations. The ITU code combinations were aggregated based on physiography, and similarities in soils and existing vegetation into ecological types and erosion sensitivity classes. Potential vegetation height and density were estimated using canopy cover averages for trees and shrubs in each Plant Association Group (PAG), the data for which were taken from datasets used in developing local vegetation classifications. The potential vegetation heights were then assigned to each map polygon based on the PAG.

The long, narrow study area, combined with the large mapping scale (1:5,000) precluded displaying the mapping for the entire study area in this report. Instead, 5 detailed study areas representing a range of representative environmental conditions were selected for which the ITU mapping is displayed. Field observations and ITU mapping examples are presented for discussion purposes for 3 subareas of the study area, including 1) the lower study area, 2) the middle study area, and 3) the upper study area.

In the lower study area, agriculture has been an important land use in the Grande Ronde Valley since post-European settlement, and as such, agricultural development covers much of the present-day valley. The Catherine Creek channel in much of the the Grande Ronde Valley is deeply incised with a narrow floodplain. Many portions of floodplains and former oxbows in the lower study area are cut-off from annual flooding by levees. In other sections of the lower study area, floodplain agricultural lands abut the river channel.

The Grande Ronde River and Catherine Creek in the middle study area are montane rivers characterized by sections of broader, unconstrained reaches with gentle to moderate gradients, and narrower, moderately constrained reaches with moderately high gradients. Cattle grazing and logging, including splash dam logging in the early 19th century, are important land uses that have affected riparian areas in the Grande Ronde watershed, including the middle study area, beginning in the early- to mid-nineteenth century, and in the case of cattle grazing, continuing today. Field studies using grazing exclosures have demonstrated that cattle grazing in riparian areas in the Grande Ronde and Catherine Creek riparian areas affected the height and density of woody vegetation, including willows and cottonwoods. Black cottonwood stands in the lower study area were observed infrequently during field surveys, particularly the younger, smaller size classes, including seedling, sapling, and pole-sized stands. Cobble bars throughout the middle river were commonly observed to have little to no regeneration of woody species, including willows and black cottonwood, and also lacked fine sediments to serve as seed beds. Restoration of black cottonwood in the middle study area would require a combination of planting cuttings on floodplain surfaces down to the water table; building grazing exclosures around the plantings; and installing engineered log jams. The log jams would create mid-channel and lateral bars with fine

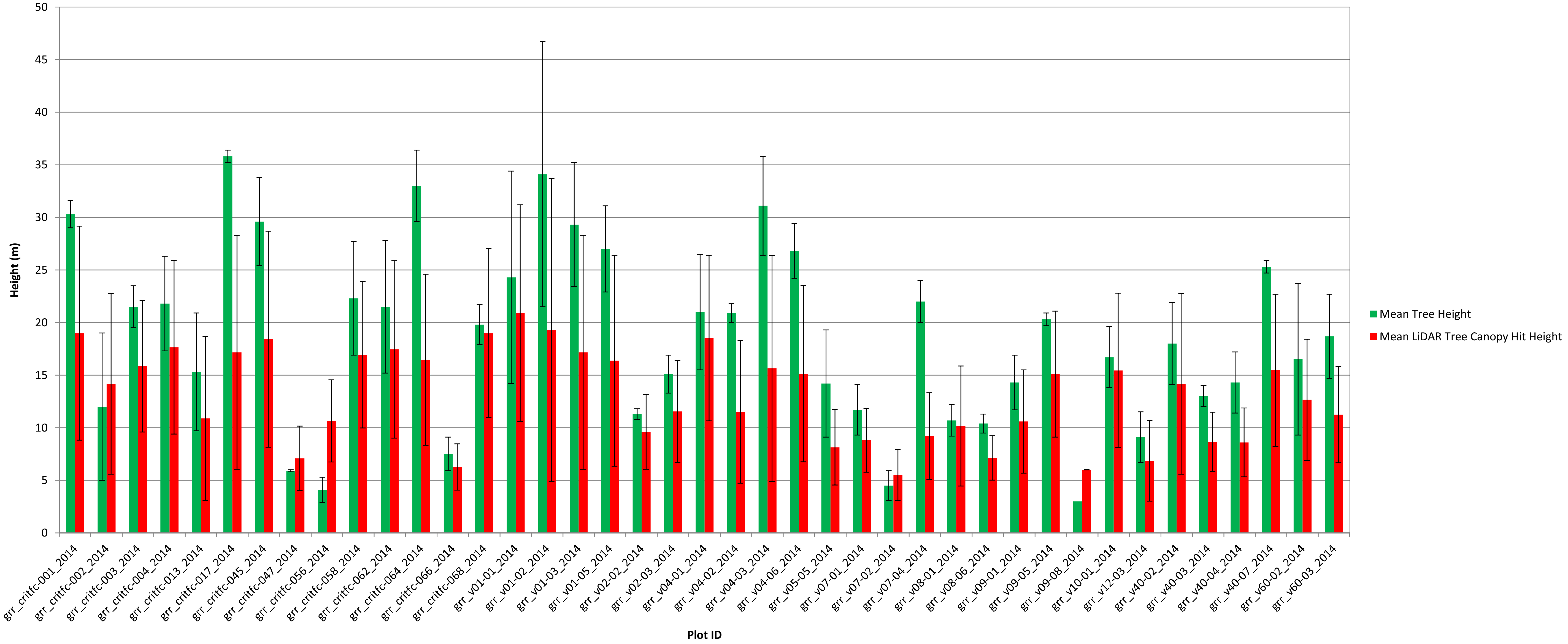


Figure 48. Paired bar chart showing the average tree height and standard deviation as measured at LiDAR plots in the field versus the average height and standard deviation of LiDAR canopy hits in the >3 m strata in the ITU map polygon within which each plot is located.

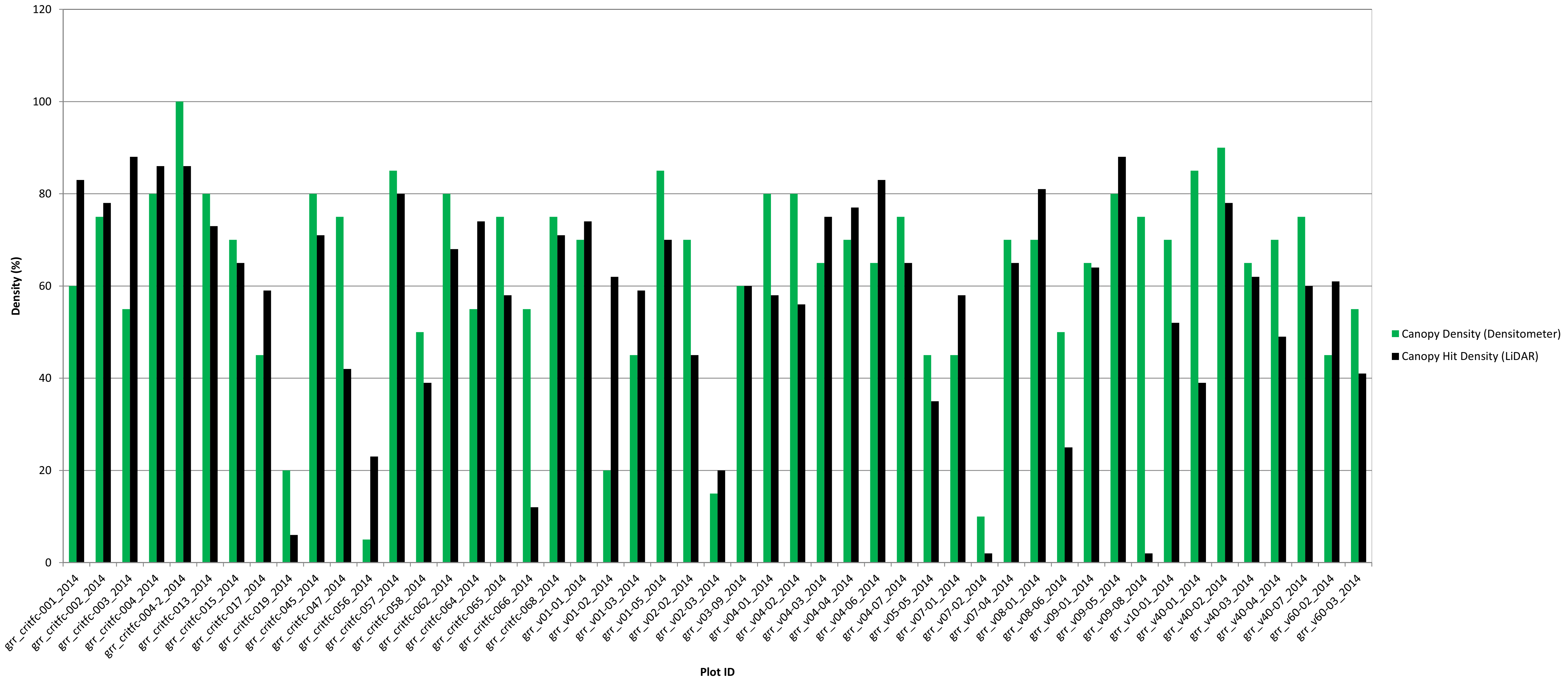


Figure 49. Paired bar chart showing the average canopy density as estimated in the field at LiDAR plots versus the percent density of LiDAR canopy hits in the >1.5 m strata in the ITU map polygon within which each plot is located.

sediments to serve as seed beds and seedling safe sites to enhance natural regeneration.

The upper study area includes the headwaters of the numerous 3rd and 4th order streams and rivers that form the Grande Ronde River and Catherine Creek. The upper study area is characterized by broad, low-gradient meadows and steep, constrained forested reaches. Vey Meadows, a private inholding located at the confluence of the mainstem of the Grande Ronde River with Sheep Creek, is one of the more prominent meadows in the upper study area. The existing vegetation for large areas of Vey Meadows is Moist Graminoid Meadow. Active channel deposits and areas of the floodplain directly adjacent to the active river channel are mapped as Riverine Complex, which includes barren river bars, small patches of moist and wet meadow, and small stands of lodgepole pine. Field observations made from the road in 2014 revealed a general lack of woody vegetation throughout Vey Meadows. In meadows in the upper study area, woody vegetation is unlikely to establish naturally without the aid of grazing exclosures in riparian (i.e., riverine) areas. Additionally, artificial beaver dams can be used to restore incised stream channels and raise the water table in the floodplain to encourage establishment of woody species. In steeper, confined stream reaches natural or artificial beaver dams may be less effective due to the increased power of floodwater that would readily destroy beaver dams. Instead natural or engineered log jams may be a useful restoration tool for entrenched channels along steep, constrained stream reaches.

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Appendix 1. Data attributes measured or estimated and recorded in the field, including the data type, the name of the database table within with the data attribute is stored, and the name and a brief description of the data attribute. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Data Type	Table Name	Data Attribute Name	Data Attribute Description
General Environment	els	aspect_declin_degrees	Declination setting of the compass used to record aspect in degrees. East is negative, west is positive, zero is magnetic north.
General Environment	els	aspect_degrees	Slope aspect at the plot, recorded in degrees.
General Environment	els	disturbance_class_code	Disturbance class, either natural or human induced.
General Environment	els	macrotopography_code	Mesoscale descriptor of surface form, evaluated over a broad area (tens of meters to hundreds of meters).
General Environment	els	microtopography_code	Microscale descriptor of surface form, evaluated in immediate vicinity of plot (meters to tens of meters).
General Environment	els	physiography_code	General description of landscape unit and depositional process.
General Environment	els	slope_degrees	Slope gradient at the plot, recorded in degrees.
General Environment	els	surface_terrain_code	Terrain unit code describing the present geomorphic deposition and form.
LiDAR	vpi_hit	hit_id	Identifier for a hit at a vegetation point-intercept point. Generally sequential and corresponding to hit order from highest to lowest, starting with the highest hit as hit_id=1.
LiDAR	vpi_hit	line_id	Identifier for a sampling line at a vegetation point-intercept plot.
LiDAR	vpi_hit	point_id	Identifier for a sampling point on a vegetation point-intercept line. Generally sequential from the start of the line to the end, with the first point on the line as point_id=1.
LiDAR	vpi_hit	veg_field_taxonomy_code	The species code recorded in the field.
LiDAR	woody_height	veg_field_taxonomy_code	The species code recorded in the field.
LiDAR	woody_height	woody_height_meters	The height in meters of a tree or shrubs species as measured in the field using a laser range finder.
Plot	els	els_plot_type_code	Single letter code to identify the type of plot.

Appendix 1. Continued.

Data Type	Table Name	Data Attribute Name	Data Attribute Description
Plot	els	env_field_start_timestamp	Timestamp recorded when the environmental data collection form is initialized at the plot.
Plot	els	env_observer_code	Initials of the field environmental observer.
Plot	all tables	plot_id	Unique code identifying the field plot.
Plot	els	plot_radius_code	The area evaluated for an individual plot.
Soil	els	soil_dominant_mineral_code_40cm	Most abundant mineral soil type in the upper 40 cm of the profile.
Soil	els	soil_dominant_texture_code_40cm	Most abundant soil material, mineral or organic, in the upper 40 cm of the profile.
Soil	els	soil_moisture_code	A measure of the representative soil moisture within the upper 40 cm of the soil profile.
Soil	els	soil_rock_depth_probe_cm	Depth in centimeters from soil surface to the upper depth of a horizon with >15% rock fragments.
Soil	els	soil_surface_organic_thick_cm	The total thickness in centimeters of uninterrupted surface organic material from the soil surface
Soil	els	water_depth_cm	The depth from the soil surface to the water table. Recorded as a negative value if water table is below the soil surface, and positive if above the soil surface.
Vegetation	els	veg_structure_ecotype_code	Simplified vegetation structure code, which is a component of the field ecotype calculated field.
Vegetation	veg	bare_soil_cover	Total % cover of all bare mineral soil (< 2 mm). This does not include rock fragments, moss/lichens, or litter.
Vegetation	veg	bedrock_cover	Total % cover of all exposed bedrock.
Vegetation	veg	broadleaf_tree_cover	Total % cover of all broadleaf tree species, including seedlings, but excluding dwarfed trees, see below.
Vegetation	veg	broadleaf_tree_crown_code	Typical position of broadleaf trees in the canopy.
Vegetation	veg	broadleaf_tree_size_code	Typical size class of broadleaf trees.
Vegetation	veg	cladonia_cladina_cover	Total % cover of all species of cladonia and cladina.

Appendix 1. Continued.

Data Type	Table Name	Data Attribute Name	Data Attribute Description
Vegetation	veg	dwarf_broadleaf_tree_cover	Total % cover of broadleaf trees growing in a dwarfed condition (~3-4m max ht) due to environmental constraints, typically high wind or persistent drought.
Vegetation	veg	dwarf_needleleaf_tree_cover	Total % cover of needleleaf trees growing in a dwarfed condition (~3-4m max ht) due to environmental constraints, e.g. high elevation, shallow active layer.
Vegetation	veg	dwarf_shrub_cover	Total % cover of all species of dwarf (<0.2 m) shrubs.
Vegetation	veg	feathermoss_cover	Total % cover of all feather mosses (e.g. hylspl, tomnit, pticri, plesch). Leave blank if unsure.
Vegetation	veg	forbs_cover	Total % cover of all forb species (includes club mosses, equisetum).
Vegetation	veg	graminoids_cover	Total % cover of all live gramminoids (exclude standing litter unless current year growth).
Vegetation	veg	litter_alone_cover	Total % cover of litter with no canopy above, litter exposed directly to the sky (i.e., no overtopping vegetation). This is typically a small number.
Vegetation	veg	litter_cover	Total % cover of all litter on plot. Typically this is a large number.
Vegetation	veg	low_shrub_cover	Total % cover of all species of low (0.2--1.5 m) shrubs.
Vegetation	veg	needleleaf_tree_cover	Total % cover of all needleleaf tree species, including seedlings, but excluding dwarfed trees, see below.
Vegetation	veg	needleleaf_tree_crown_code	Typical position of needleleaf trees in the canopy.
Vegetation	veg	needleleaf_tree_size_code	Typical size class of needleleaf trees.
Vegetation	veg	other_cover	Total % cover of abiotic ground cover types not already described.
Vegetation	veg	sphagnum_cover	Total % cover of all sphagnum moss species.
Vegetation	veg	standing_dead_cover	Total % cover of all standing dead trees.
Vegetation	veg	surface_fragment_cover	Total percent cover of all exposed coarse fragments (> 2 mm), e.g., gravels, cobbles, stones, boulders.
Vegetation	veg	tall_shrub_cover	Total % cover of all species of tall (>1.5 m) shrubs.
Vegetation	veg	total_lichens_cover	Total % cover of all lichens, including crustose lichens.
Vegetation	veg	total_mosses_cover	Total % cover of all mosses.

Appendix 1. Continued.

Data Type	Table Name	Data Attribute Name	Data Attribute Description
Vegetation	veg	veg_completeness_code	Degree of intensity in vegetation sampling. Typically T plots are complete (c), V plots are partial (p) or dominants are (d).
Vegetation	veg	veg_cutpoint_viereck_4_code	If vegetation is on the cusp between two veg_class4 classes, an alternative vegetation class is selected. If vegetation is not on the cusp then the cutpoint will be the same as veg_viereck_4_code.
Vegetation	veg	veg_observer_code	Initials of the field botanist.
Vegetation	veg	veg_viereck_4_code	The vegetation class from the Level IV of the Alaska Vegetation Classifcation (Viereck) after changes made during during data quality control/quality assurance review.
Vegetation	veg	water_cover	Total % cover of standing water above the soil surface.
Vegetation	veg	whole_tussocks_cover	Total % cover of whole tussocks mounds.
Vegetation	veg_cover	cover_percent	Percent cover of the species within the plot area, based on ocular estimation.
Vegetation	veg_cover	veg_field_taxonomy_code	The species code recorded in the field.

Appendix 2. Listing of all species encountered during field surveys, including the structure class and USDA Plants code. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Structure Class	Scientific Name	USDA Plants Species Code
Deciduous Tree	*Acer negundo*	acne2
Deciduous Tree	*Larix occidentalis*	laoc
Deciduous Tree	*Populus trichocarpa*	potr15
Deciduous Tree	*Salix alba var. vitellina*	saalv
Dwarf Shrub	*Arctostaphylos uva-ursi*	aruv
Dwarf Shrub	*Berberis repens*	bere
Dwarf Shrub	*Pachistima myrsinites*	pamy
Dwarf Shrub	*Vaccinium scoparium*	vasc
Evergreen Tree	*Abies grandis*	abgr
Evergreen Tree	*Abies lasiocarpa*	abla
Evergreen Tree	*Picea engelmannii*	pien
Evergreen Tree	*Pinus contorta*	pico
Evergreen Tree	*Pinus ponderosa*	pipo
Evergreen Tree	*Pseudotsuga menziesii*	psme
Forbs	*Achillea millefolium*	acmi2
Forbs	*Aconitum columbianum*	acco4
Forbs	*Agoseris glauca*	aggl
Forbs	*Allium validum*	alva
Forbs	*Anemone piperi*	anpi
Forbs	*Angelica arguta*	anar3
Forbs	*Arctium minus*	armi2
Forbs	*Arnica chamissonis*	arch3
Forbs	*Arnica cordifolia*	arco9
Forbs	*Artemisia ludoviciana*	arlu
Forbs	*Aster occidentalis*	asoc
Forbs	*Athyrium filix-femina*	atfi
Forbs	*Besseya rubra*	beru
Forbs	*Camassia cusickii*	cacu2
Forbs	*Camassia quamash*	caqu2
Forbs	*Chimaphila umbellata*	chum
Forbs	*Chrysanthemum leucanthemum*	chle80
Forbs	*Circaea alpina*	cial
Forbs	*Clintonia uniflora*	clun2
Forbs	*Corallorhiza trifida*	cotr3
Forbs	*Cynoglossum officinale*	cyof
Forbs	*Delphinium occidentale*	deoc

Appendix 2. Continued.

Structure Class	Scientific Name	USDA Plants Species Code
Forbs	*Epilobium angustifolium*	epan2
Forbs	*Equisetum arvense*	eqar
Forbs	*Equisetum hyemale*	eqhy
Forbs	*Eriogonum heracleoides*	erhe2
Forbs	*Euphorbia esula*	eues
Forbs	*Fragaria vesca*	frve
Forbs	*Fragaria virginiana*	frvi
Forbs	*Frasera speciosa*	frsp
Forbs	*Galium aparine*	gaap2
Forbs	*Galium boreale*	gabo2
Forbs	*Galium triflorum*	gatr3
Forbs	*Geum macrophyllum*	gema4
Forbs	*Geum triflorum*	getr
Forbs	*Gymnocarpium dryopteris*	gydr
Forbs	*Habenaria dilatata*	hadi7
Forbs	*Heracleum lanatum*	hela4
Forbs	*Hypericum perforatum*	hype
Forbs	*Iris missouriensis*	irmi
Forbs	*Ligusticum canbyi*	lica2
Forbs	*Linnaea borealis*	libo3
Forbs	*Lithospermum ruderale*	liru4
Forbs	*Lupinus polyphyllus*	lupo2
Forbs	*Menyanthes trifoliata*	metr3
Forbs	*Mertensia ciliata*	meci3
Forbs	*Montia perfoliata*	mope3
Forbs	*Pedicularis groenlandica*	pegr2
Forbs	*Penstemon procerus*	pepr2
Forbs	*Penstemon rydbergii*	pery
Forbs	*Polemonium occidentale*	pooc2
Forbs	*Polemonium viscosum*	povi
Forbs	*Potentilla gracilis*	pogr9
Forbs	*Pterospora andromedea*	ptan2
Forbs	*Pyrola asarifolia*	pyas
Forbs	*Ranunculus acris*	raac3
Forbs	*Ranunculus occidentalis*	raoc
Forbs	*Ranunculus repens*	rare3
Forbs	*Ranunculus uncinatus*	raun
Forbs	*Rudbeckia occidentalis*	ruoc2
Forbs	*Rumex occidentalis*	ruoc3
Forbs	*Sanguisorba occidentalis*	saoc2

Appendix 2. Continued.

Structure Class	Scientific Name	USDA Plants Species Code
Forbs	*Sanguisorba sitchensis*	sasi10
Forbs	*Sedum lanceolatum*	sela
Forbs	*Senecio foetidus*	sefo
Forbs	*Senecio integerrimus*	sein
Forbs	*Senecio pseudaureus*	seps2
Forbs	*Senecio serra*	sese2
Forbs	*Senecio triangularis*	setr
Forbs	*Sidalcea oregana*	sior
Forbs	*Smilacina racemosa*	smra
Forbs	*Smilacina stellata*	smst
Forbs	*Taraxacum officinale*	taof
Forbs	*Thalictrum fendleri*	thfe
Forbs	*Thalictrum occidentale*	thoc
Forbs	*Thalictrum venulosum*	thve
Forbs	*Thermopsis montana*	thmo6
Forbs	*Trautvetteria caroliniensis*	trca
Forbs	*Trifolium longipes*	trlo
Forbs	*Trifolium pratense*	trpr2
Forbs	*Trifolium repens*	trre3
Forbs	*Trillium petiolatum*	trpe3
Forbs	*Urtica dioica*	urdi
Forbs	*Valeriana sitchensis*	vasi
Forbs	*Veratrum californicum*	veca2
Forbs	*Veratrum viride*	vevi
Forbs	*Viola adunca*	viad
Forbs	*Viola glabella*	vigl
Grasses	*Alopecurus pratensis*	alpr3
Grasses	*Arrhenatherum elatius*	arel3
Grasses	*Bromus carinatus*	brca5
Grasses	*Bromus inermis*	brin2
Grasses	*Bromus pumpellianus*	brpu3
Grasses	*Bromus tectorum*	brte
Grasses	*Bromus vulgaris*	brvu
Grasses	*Calamagrostis canadensis*	caca4
Grasses	*Calamagrostis rubescens*	caru
Grasses	*Catabrosa aquatica*	caaq3
Grasses	*Cinna latifolia*	cila2
Grasses	*Dactylis glomerata*	dagl
Grasses	*Deschampsia atropurpurea*	deat2
Grasses	*Deschampsia cespitosa*	dece

Appendix 2. Continued.

Structure Class	Scientific Name	USDA Plants Species Code
Grasses	*Elymus cinereus*	elci2
Grasses	*Elymus glaucus*	elgl
Grasses	*Festuca arundinacea*	fear3
Grasses	*Festuca idahoensis*	feid
Grasses	*Festuca rubra*	feru2
Grasses	*Festuca subulata*	fesu
Grasses	*Glyceria striata*	glst
Grasses	*Koeleria cristata*	kocr
Grasses	*Melica subulata*	mesu
Grasses	*Phalaris arundinacea*	phar3
Grasses	*Phleum pratense*	phpr3
Grasses	*Poa bulbosa*	pobu
Grasses	*Poa nemoralis L.*	pone
Grasses	*Poa nervosa*	pone2
Grasses	*Poa nevadensis*	pone3
Grasses	*Poa pratensis*	popr
Grasses	*Poa sandbergii*	posa12
Grasses	*Poa trivialis*	potr2
Grasses	*Stipa lettermanii*	stle4
Grasses	*Ventenata dubia*	vedu
Low Shrub	*Clematis ligusticifolia*	clli2
Low Shrub	*Lonicera involucrata*	loin5
Low Shrub	*Lonicera utahensis*	lout2
Low Shrub	*Ribes aureum*	riau
Low Shrub	*Ribes cereum*	rice
Low Shrub	*Ribes hudsonianum*	rihu
Low Shrub	*Ribes lacustre*	rila
Low Shrub	*Rosa gymnocarpa*	rogy
Low Shrub	*Rosa woodsii*	rowo
Low Shrub	*Rubus idaeus*	ruid
Low Shrub	*Rubus parviflorus*	rupa
Low Shrub	*Salix boothii*	sabo2
Low Shrub	*Salix commutata*	saco2
Low Shrub	*Salix wolfii*	sawo
Low Shrub	*Sambucus cerulea*	sace3
Low Shrub	*Shepherdia canadensis*	shca
Low Shrub	*Spiraea betulifolia*	spbe2
Low Shrub	*Symphoricarpos albus*	syal
Low Shrub	*Vaccinium membranaceum*	vame

Appendix 2. Continued.

Structure Class	Scientific Name	USDA Plants Species Code
Sedges and Rushes	*Carex aquatilis*	caaq
Sedges and Rushes	*Carex brunnescens*	cabr15
Sedges and Rushes	*Carex deweyana*	cade9
Sedges and Rushes	*Carex filifolia*	cafi
Sedges and Rushes	*Carex geyeri*	cage2
Sedges and Rushes	*Carex hoodii*	caho5
Sedges and Rushes	*Carex laeviculmis*	cala13
Sedges and Rushes	*Carex lanuginosa*	cala30
Sedges and Rushes	*Carex microptera*	cami7
Sedges and Rushes	*Carex praegracilis*	capr5
Sedges and Rushes	*Carex praticola*	capr7
Sedges and Rushes	*Carex rossii*	caro5
Sedges and Rushes	*Carex rostrata*	caro6
Sedges and Rushes	*Carex sheldonii*	cash
Sedges and Rushes	*Juncus balticus*	juba
Sedges and Rushes	*Scirpus microcarpus*	scmi2
Tall Shrub	*Acer glabrum*	acgl
Tall Shrub	*Alnus incana*	alin2
Tall Shrub	*Alnus sinuata*	alsi3
Tall Shrub	*Amelanchier alnifolia*	amal2
Tall Shrub	*Betula occidentalis*	beoc2
Tall Shrub	*Cornus stolonifera*	cost4
Tall Shrub	*Crataegus douglasii*	crdo2
Tall Shrub	*Holodiscus discolor*	hodi
Tall Shrub	*Physocarpus malvaceus*	phma5
Tall Shrub	*Prunus virginiana*	prvi
Tall Shrub	*Salix amygdaloides*	saam2
Tall Shrub	*Salix bebbiana*	sabe2
Tall Shrub	*Salix exigua*	saex
Tall Shrub	*Salix geyeriana*	sage2
Tall Shrub	*Salix lasiandra*	sala5
Tall Shrub	*Salix lemmonii*	sale
Tall Shrub	*Salix rigida*	sari2
Tall Shrub	*Salix scouleriana*	sasc
Tall Shrub	*Salix sitchensis*	sasi2

Appendix 3. Cross-reference table showing relationship between generalized soil classes, soil series, physiography, landforms, and soil taxonomic classes. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
Ashy silt loam over coarse frags (AsilovCF)	U/L	Terraces	Bigwall ashy silt loam	Ashy Typic Vitrixerands
			Collegecreek ashy loam	Ashy over loamy Typic Vitrixerands
			Digit ashy silt loam	Ashy over loamy Typic Vitricryands
			Tamara ashy silt loam	Ashy over loamy Alfic Udivitrands
Ashy silt loam over loam (AsilovL)	U/L	Terraces	Bigbouldercreek ashy silt loam	Ashy Typic Udivitrands
			Tolo ashy silt loam	Ashy over loamy Alfic Vitrixerands
			Wolot silt loam	Ashy over loamy Alfic Vitrixerands
		Toeslopes/Footslopes	Collegecreek ashy loam	Ashy over loamy Typic Vitrixerands
			Peaviner gravelly ashy sandy clay loam	Fine, smectitic Vertic Palexerolls
Ashy silt loam over skeletal (AsilovSk)	U/L	Ridgetops and sideslopes	Syrupcreek ashy silt loam	Ashy over loamy-skeletal Alfic Udivitrands
		Sideslopes/Terraces	Limberjim ashy silt loam	Ashy over loamy-skeletal Alfic Udivitrands
		Terraces	Bucketlake stony ashy silt loam	Ashy over loamy-skeletal Typic Vitricryands
			Bullroar ashy silt loam	Ashy over loamy-skeletal Alfic Udivitrands
			Icedee ashy silt loam	Ashy over loamy Alfic Vitricryands
			Rebarrow ashy silt loam	Ashy over loamy Alfic Udivitrands
			Tertoo cobbly, ashy silt loam	Ashy over loamy-skeletal Typic Vitrixerands

Appendix 3. Continued.

Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
Deep w/coarse fragments (DpCF)	U	back slopes; toeslopes; footslopes	Emily ashy silt loam	Loamy-skeletal Vitrandic Haploxerolls
		mountain slopes	Bulgar cobbly ashy silt loam	Ashy over loamy-skeletal Typic Udivitrands
			Dunstan ashy silt loam	Clayey-skeletal, smectitic Vitrandic Haploxeralfs
			Fourthcreek ashy silt loam	Ashy over loamy Typic Vitrixerands
			Gutridge gravelly ashy silt loam	Ashy over loamy-skeletal Typic Udivitrands
			Lakefork gravelly ashy silt loam	Ashy-skeletal Typic Udivitrands
			Marblepoint stony ashy silt loam	Loamy-skeletal Andic Haplocryepts
			Pasturecreek gravelly ashy silt loam	Loamy-skeletal Andic Eutrudepts
			Warfield gravelly ashy sandy loam	Loamy-skeletal Vitrandic Haploxerepts
		mountain slopes; plateaus	Bigcow gravelly ashy silt loam	Loamy-skeletal Andic Haploxerepts
			Getaway stony ashy silt loam	Loamy-skeletal Vitrandic Argixerolls
			Harl very gravelly ashy silt loam	Ashy-skeletal Typic Udivitrands
			Klickson ashy silt loam	Loamy-skeletal Vitrandic Argixerolls
			MountEmily ashy silt loam	Ashy over loamy-skeletal Typic Vitricryands
			Pinuscreek ashy silt loam	Loamy-skeletal Andic Haploxeralfs
Deep - silt to clay loam (DpSiCL)	U	hillslopes	McMurdie silt loam, bedrock substratum	fine, smectitic Calcic Pachic Argixerolls
			Palouse silt loam	fine-silty Pachic Ultic Haploxerolls
		mountain slopes	Geisercreek ashy silt loam	Ashy over clayey Alfic Udivitrands
			Gorhamgulch ashy silt loam	Ashy over loamy Typic Udivitrands
		mountain slopes; plateaus	Nibolob ashy silt loam	Fine-loamy Vitrandic Argixerolls

Appendix 3. Continued.

Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
Lithic/Shallow to Clay (LiShC)	U	hillslopes	Gwinly very cobbly silt loam	Clayey-skeletal, smectitic Lithic Argixerolls
			Ramo silty clay loam	Fine, smectitic Typic Argixerolls
			Rockly very gravelly loam	Loamy-skeletal Lithic Haploxerolls
			Starkey very stony silt loam	Clayey-skeletal, smectitic Typic Argixerolls
			Ukiah silty clay loam	Fine, smectitic Vertic Argixerolls
		mountain slopes	Btree ashy slit loam	Ashy over clayey-skeletal Alfic Udivitrands
			Cowsley very stony silt loam	fine, smectitic Xeric Argialbolls
			Flyvalley ashy silt loam	Ashy Lithic Udivitrands
			Powderriver gravelly ashy sandy loam	Loamy-skeletal Lithic Haploxerepts
			Unitylake ashy silt	Fine, smectitic Vertic Palexeralfs
		mountain slopes; plateaus	Anatone very cobbly silt loam	Loamy-skeletal Lithic Haploxerolls
			Bocker very cobbly silt loam	Loamy-skeletal Lithic Haploxerolls
			Burgerbutte extremely cobbly ashy sandy loam	Loamy-skeletal Lithic Humicryepts
			Fivebeaver gravelly ashy silt loam	Loamy-skeletal Lithic Ultic Haploxerolls
			Fivebit extremely stony loam	Loamy-skeletal Lithic Ultic Haploxerolls
			Harlow very stony clay loam	Clayey-skeletal Lithic Argixerolls
			Lowerbluff ashy silt loam	Ashy Lithic Vitrixerands
			Roostercomb extremely gravelly clay loam	Clayey-skeletal Typic Argixerolls
Loam over skeletal (LovSk)	R	Low Floodplains	Dardry loam	Loamy-skeletal Cumulic Ultic Haploxerolls
			Melloe loam	Loamy-skeletal Typic Endoaquolls
			Mugwump sandy loam	Loamy-skeletal Cumulic Hapludolls
			Terlough gravelly silt loam	Loamy-skeletal Aquic Hapludolls
			Voats fine sandy loam	Sandy-skeletal Fluventic Haploxerolls

Appendix 3. Continued.

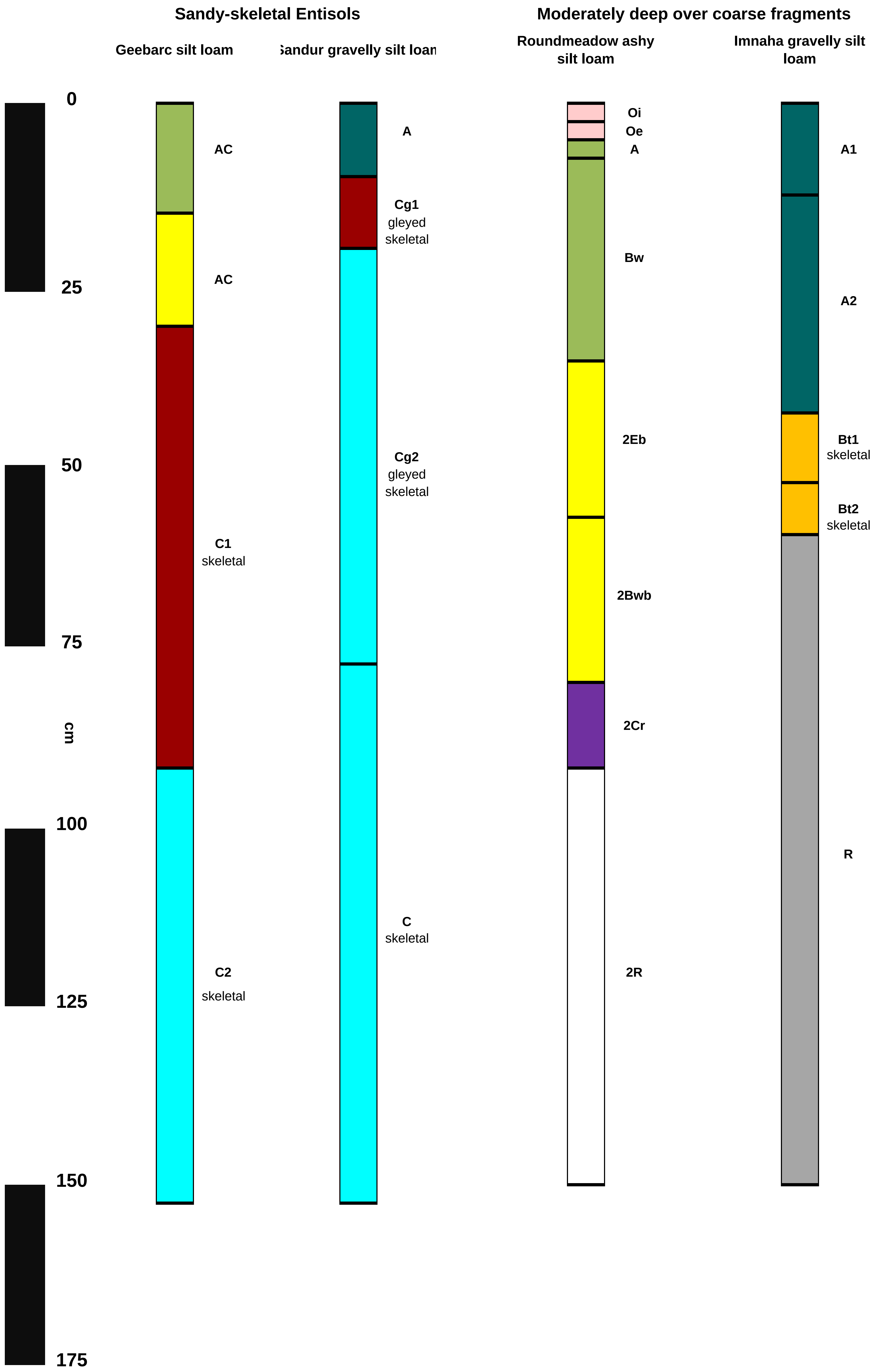
Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
Loam/Silt Loam - brackish (LSilbr)	R/L	Higher Floodplains	Bandarrow silt loam	Coarse-loamy Typic Cryaquolls
			Broady	Loamy Aquic Haplocryolls
			Catherine silt	Fine-silty Cumulic Endoaquolls
			Catherine silty clay loam	Fine-silty Cumulic Endoaquolls
			Terrodd silt loam	Fine-loamy Aquic Cumulic Hapludolls
			Typic Cryaquolls	Typic Cryaquolls
			Veazie loam	Coarse-loamy over sandy or sandy-skeletal Cumulic Haploxerolls
	U/L	Terraces	Alicel fine sandy loam/loam/silt loam	fine-loamy Pachic Haploxerolls
			Bodale loam	Coarse-loamy Cumulic Haplocryolls
			Hutchinson variant silt loam	fine, smectitic Argic Durixerolls
			Imbler fine sandy loam	coarse-loamy Pachic Haploxerolls
			Jett silt loam	fine-silty Cumulic Haploxerolls
			La Grande silt/silty clay loam	fine-silty Pachic Haploxerolls
			Tovame silt loam	Coarse-loamy Cumulic Hapludolls
			Ultic Haploxerolls	Sandy-skeletal Ultic Haploxerolls
			Verdeplane	Fine-loamy Pachic Hapludolls
			Witknee very fine sandy loam	Coarse-loamy Aquic Hapludolls
Loam/Silt Loam - organic-rich (LSilor)	L	Lake Basins/Salty Soils	Hooly ash silt loam	medial over loamy Typic Endoaquands
			Hoopal fine sandy loam	coarse-loamy Typic Duraquolls
			Hot Lake ashy silt loam	medial over loamy Aquic Haploxerands
			Umapine silt loam	coarse-silty Typic Halaquepts
Loam/Silt Loam (LSil)	R/L	Meadows	Bandarrow silt loam	Coarse-loamy Typic Cryaquolls
			Melloe loam	Loamy-skeletal Typic Cryaquolls
			Tovame silt loam	Coarse-loamy Pachic Hapludolls
			Typic Cryaquolls	Typic Cryaquolls
			Typic Haplosaprists	Coarse-loamy Typic Haplosaprists

Appendix 3. Continued.

Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
Loamy-gravelly (LGr)			Peaviner gravelly ashy sandy clay loam	Fine, smectitic Vertic Palexerolls
	U	Alluvial Fans	Collegecreek ashy loam	Ashy over loamy Typic Vitrixerands
			La Grande silt/silty clay loam	fine-silty Pachic Haploxerolls
			Phys (gravelly) silt loam	loamy-skeletal Typic Argixerolls
			Riceton	Coarse-loamy Ultic Haploxerolls
Mod. deep w/coarse frags (MDpCF)	U	glacial valley floors; cirque basins	Mudlakebasin ashy silt loam	Ashy over loamy-skeletal Typic Vitricryands
		hillslopes	Klicker stony silt loam (40-65% slopes)-north/south slopes	Loamy-skeletal Vitrandic Argixerolls
			Lookingglass silt loam/very stony silt loam	fine, smectitic Xeric Argialbolls
			Royst very stony silt loam	Clayey-skeletal, smectitic Pachic Argixerolls
			Watama silt loam	fine-loamy Pachic Haploxerolls
		mountain slopes	Angelbasin ashy silt loam	Loamy-skeletal Andic Dystrocryepts
			Bler ashy silt loam	Clayey-skeletal, smectitic Vitrandic Palexerolls
			Endcreek ashy silt loam	Ashy over loamy-skeletal Typic Vitrixerands
			Flycreek ashy silt loam	Ashy over clayey Alfic Udivitrands
			Hall Ranch stony loam	Fine-loamy Ultic Haploxerolls
			Olot silt loam	Ashy over loamy-skeletal Typic Vitrixerands
			Peaviner gravelly ashy sandy clay loam	Loamy-skeletal Vitrandic Argixerolls
			Roundmeadow ashy silt loam	Coarse-loamy Andic Haploxerepts
			Threecent ashy silt loam	Ashy over clayey Alfic Udivitrands
		mountain slopes; plateaus	Bennettcreek ashy silt loam	Loamy-skeletal Vitrandic Haploxeralfs
			Bolony ashy silt loam	Fine-loamy Vitrandic Argixerolls
			Bunchpoint ashy silt loam	Coarse-loamy Vitrandic Haploxerolls
			Deardorf stony ashy loam	Ashy over loamy-skeletal Typic Udivitrands
			Downeygulch gravelly ashy silt loam	Coarse-loamy Vitrandic Haploxerepts

Appendix 3. Continued.

Generalized Soil Series Title (Code)	Physiography	Characteristic Landforms	Soil Series	Soil Taxonomic Class
			Kamela stony ashy silt loam	Loamy-skeletal Vitrandic Haploxerepts
			Klicker stony (ashy) silt loam	Loamy-skeletal Vitrandic Argixerolls
			Larabee ashy loam	Loamy-skeletal Vitrandic Argixerolls
			McCartycreek cobbly ashy silt loam	Loamy-skeletal Vitrandic Haploxerolls
			Snell very stony loam	Clayey-skeletal Pachic Argixerolls
			Troutmeadows ashy silt loam	Ashy over loamy-skeletal Typic Vitricryands
			Webbgulch very gravelly ashy loam	Loamy-skeletal Vitrandic Haploxerepts
			Wonder stony ashy silt loam	Loamy-skeletal Andic Haploxerepts
Sandy-skeletal Entisols (SSkEnt)	R	Gravel bars/Incipient floodplains	Caulditch	Sandy-skeletal Typic Cryaquents
			Geebarc silt loam	Sandy-skeletal Oxyaquic Cryorthents
			Gulliford very gravelly loamy sand	Sandy-skeletal Oxyaquic Udorthents
			Sandur gravelly silt loam	Sandy-skeletal Aeric Endoaquents
Streambanks - high gradient (StmBkHG)	R	Streambanks	Aquic Vitricryands	Ashy over loamy Aquic Vitricryands
Roads (Roads)	various	Human modified	not applicable	not applicable
Rock Outcrop (Rock)	U	cliffs and rock outcrops	not applicable	not applicable
Urban Complex (Urban)	various	Human modified	not applicable	not applicable
Water (Water)	R	River, stream, lake or pond	not applicable	not applicable



Appendix 4. Block diagrams depicting typical soil texture, rock fragments, and soil horizons for soil series within generalized soil classes. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Appendix 5. Cross-reference table showing the relationship between level 1, 2, 3, and 4 existing vegetation classes. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Level I	Level II	Level III	Level IV Existing Vegetation Domain Code
Forest	Conifer	Closed conifer forest	fnscf : Closed Subalpine Fir Forest
(trees >3m tall and canopy cover 10%+)	(75%+ cover by conifers)	(60–100% tree canopy cover)	fncl : Closed Lodgepole Pine Forest
			fncg : Closed Grand Fir Forest
			fnces : Closed Engelmann Spruce Forest
			fncdf : Closed Douglas-fir Forest
			fncpp : Closed Ponderosa Pine Forest
		Open conifer forest	fnsfo : Open Subalpine Fir Forest
		(11–59% tree canopy cover)	fnog : Open Grand Fir Forest
			fnodf : Open Douglas-fir Forest
			fnopp : Open Ponderosa Pine Forest
			fnoes : Open Englemann Spruce Forest
			fnol : Open Lodgepole Pine Forest
		Conifer woodland	fnsfw : Subalpine Fir Woodland
		(10–24% tree canopy cover)	fngfw : Grand Fir Woodland
			fndfw : Douglas-fir Woodland
			fnwpp : Ponderosa Pine Woodland
			fnwes : Engelmann Spruce Woodland
			fnwl : Lodgepole Pine Woodland
	Deciduous/Broadleaf	Closed deciduous forest	fbcc : Closed Black Cottonwood Forest
	(<75% cover by conifers;	(60–100% tree canopy cover)	fbos : Closed Willow Forest (lower valley)
	75%+ cover by deciduous trees)		fbqac : Closed Quaking Aspen Forest
			fmbcdfc : Closed Black Cottonwood-Douglas-fir Forest
			fmbcesc : Closed Black Cottonwood-Engelmann Spruce Forest
			fmbcgfc : Closed Black Cottonwood-Grand Fir Forest

Appendix 5. Continued.

Level I	Level II	Level III	Level IV Existing Vegetation Domain Code
			fmbcppc : Closed Black Cottonwood-Ponderosa Pine Forest
		Open deciduous forest	fboc : Open Black Cottonwood Forest
		(25–59% tree canopy cover)	fbcs : Open Willow Forest (lower valley)
			fbqao : Open Quaking Aspen Forest
			fmbcdfo : Open Black Cottonwood-Douglas-fir Forest
			fmbceso : Open Black Cottonwood-Engelmann Spruce Forest
			fmbcgfo : Open Black Cottonwood-Grand Fir Forest
			fmbcppo : Open Black Cottonwood-Ponderosa Pine Forest
		Conifer woodland	fbwc : Black Cottonwood Woodland
		(10–24% tree canopy cover)	fbqaw : Quaking Aspen Woodland
			fmbcdfw : Black Cottonwood-Douglas-fir Woodland
			fmbcesw : Black Cottonwood-Engelmann Spruce Woodland
			fmbcgfw : Black Cottonwood-Grand Fir Woodland
			fmbcppw : Black Cottonwood-Ponderosa Pine Woodland
Shrub	Tall shrub	Closed tall shrub	ssa : Sitka Alder
(25%+ cover of shrubs or 10%+ cover of dwarf trees)	(Shrubs more than 1.5 m tall)	(75%+ canopy cover)	stcat : Closed Thinleaf Alder
			stcw : Closed Tall Willow
			stcbh : Closed Black Hawthorn
			suc : Closed Upland Shrubland
			smxlc : Closed Low Elevation Mixed Shrubland
		Open tall shrub	stoat : Open Thinleaf Alder
		(25–74% canopy cover)	stow : Open Tall Willow
			stobh : Open Black Hawthorn
			suo : Open Upland Shrubland
			smxlo : Open Low Elevation Mixed Shrubland
	Low shrub (Shrubs less than 1.5m tall)	Closed low shrub (75%+ canopy cover)	slwc : Closed Low Willow
		Open low shrub (25–74% canopy cover)	slow : Open Low Willow

Appendix 5. Continued.

Level I	Level II	Level III	Level IV Existing Vegetation Domain Code
Herbaceous	Graminoid	Dry graminoid herbaceous	hgd : Dry Graminoid Meadow
(Less than 10% tree cover and less than 25% shrub cover)	(graminoid plants dominant)	(well-drained, dry sites)	hus : Upland Steppe
		Moist graminoid herbaceous (moist sites, without standing water)	hgm : Moist Graminoid Meadow
		Wet graminoid herbaceous (wet sites; standing water present part of year; includes bogs, marshes and fens)	hgw : Wet Graminoid Meadow
	Forb (forb plants dominant)	Forb herbaceous	hfm : Forb Meadow
Complexes		Herbaceous Complex	hgwmcc : Wet-Moist Graminoid Meadow Complex
		Shrub-Herbaceous Complex	swmmgrlfc : Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex
		Mixed Forest-Shrub-Herbaceous Complex	xr : Riverine Complex
			xu : Upland Complex
Agricultural	Agricultural	Agricultural	hpa : agricultural pasture
			hca : agricultural croplands
			bpa : barren agricultural
			xa : agricultural complex
Barren	Barren	Barren	bbg : Barren
			bpvh : Barren partially vegetated herbaceous
Developed	Developed	Developed	rd : Roads
			ub : Buildings and Other Structures
			xd : Urban Complex
Water	Water	Water	wf : Fresh Water

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Appendix 6. Cross-reference table between potential vegetation classes (PAGs) and plant associations or plant community types. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Dry Subalpine Fir Forest	25–100%	fsfd : Dry Subalpine Fir Forest	Subalpine Fir/Grouse Huckleberry	*Abies lasiocarpa/Vaccinium scoparium*	4
			Subalpine Fir/Grouse Huckleberry/Skunk-leaved Polemonium	*Abies lasiocarpa/Vaccinium scoparium/Polemonium pulcherrimum*	3, 4
			Subalpine Fir/Skunk-leaved Polemonium	*Abies lasiocarpa/Polemonium pulcherrimum*	3
			Lodgepole Pine(Subalpine Fir)/Grouse Huckleberry	*Pinus contorta(Abies lasiocarpa)/Vaccinium scoparium*	3, 4
Subalpine Fir-Engelmann Spruce Forest	25–100%	fsfes : Subalpine Fir-Engelmann Spruce Forest	Subalpine Fir/Twinflower	*Abies lasiocarpa/Linnaea borealis*	3, 4
			Subalpine Fir/Queen's Cup Beadlily	*Abies lasiocarpa/Clintonia uniflora*	3, 4
			Subalpine Fir/Arrowleaf Groundsel	*Abies lasiocarpa/Senecio triangularis*	1
			Subalpine Fir/Big Huckleberry	*Abies lasiocarpa/Vaccinium membranaceum*	3, 4
Open Subalpine Fir-Engelmann Spruce Forest	25–59%	fsfeso : Open Subalpine Fir-Engelmann Spruce Forest	Subalpine Fir/Ladyfern	*Abies lasiocarpa/Athyrium filix-femina*	1
			Subalpine Fir/Soft-leaved Sedge	*Abies lasiocarpa/Carex disperma*	1
Dry Lodgepole Pine Forest	25–59%	flpd : Dry Lodgepole Pine Forest	Lodgepole Pine(Grand Fir)/Pinegrass	*Pinus contorta(Abies grandis)/Calamagrostis rubescens*	4
			Lodgepole Pine(Grand Fir)/Grouse Huckleberry	*Pinus contorta(Abies grandis)/Vaccinium scoparium/Calamagrostis rubescens*	4
Lodgepole Pine Moist Meadow	25–59%	flpmm : Lodgepole Pine Moist Meadow	Lodgepole Pine/Bluejoint Reedgrass	*Pinus contorta/Calamagrostis canadensis*	1
			Lodgepole Pine/Woolly Sedge	*Pinus contorta/Carex lanuginosa*	1
			Lodgepole Pine/Tufted Hairgrass	*Pinus contorta/Deschampsia cespitosa*	1
			Lodgepole Pine/Kentucky Bluegrass	*Pinus contorta/Poa pratensis*	1
Lodgepole Pine Wet Meadow	25–59%	flpwm : Lodgepole Pine Wet Meadow	Lodgepole Pine/Aquatic Sedge	*Pinus contorta/Carex aquatilis*	1
			Lodgepole Pine/Holm's Rocky Mountain Sedge	*Pinus contorta/Carex scopulorum*	7
Cold Grand Fir Forest	25–59%	fgfc : Cold Grand Fir Forest	Grand Fir/Grouse Huckleberry	*Abies grandis/Vaccinium scoparium*	4
			Grand Fir/Grouse Huckleberry-Twinflower	*Abies grandis/Vaccinium scoparium-Linnaea borealis*	4
Grand Fir-Engelmann Spruce Forest	25–100%	fgfes : Grand fir-Engelmann Spruce Forest	Grand Fir/Rocky Mountain Maple	*Abies grandis/Acer glabrum*	3, 4
Open Grand Fir-Engelmann Spruce Forest	25–59%	fgfeso : Open Grand fir-Engelmann Spruce Forest	Grand Fir/Rocky Mountain Maple-Floodplain	*Abies grandis/Acer glabrum-Floodplain*	1
			Grand Fir/Rocky Mountain Maple-Mallow Ninebark	*Abies grandis/Acer glabrum-Physocarpus malvaceus*	3
			Grand Fir/Ladyfern	*Abies grandis/Athyrium filix-femina*	1
			Grand Fir/Common Snowberry-Floodplain	*Abies grandis/Symphoricarpos albus-Floodplain*	1
Engelmann Spruce Forest	25–59%	fes : Engelmann Spruce Forest	Engelmann Spruce/Ladyfern	*Picea engelmannii/Athyrium filix-femina*	1
			Engelmann Spruce/Columbia Brome	*Picea engelmannii/Bromus vulgaris*	1
			Engelmann Spruce/Soft-leaved Sedge	*Picea engelmannii/Carex disperma*	1
			Engelmann Spruce/Drooping Woodreed	*Picea engelmannii/Cinna latifolia*	1

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Engelmann Spruce Forest (continued)			Engelmann Spruce/Red-osier Dogwood	*Picea engelmannii/Cornus stolonifera*	1
			Engelmann Spruce/Common Horsetail	*Picea engelmannii/Equisetum arvense*	1
			Engelmann Spruce/Arrowleaf Groundsel	*Picea engelmannii/Senecio triangularis*	1
Cool-moist Grand Fir Forest	25–100%	fgfcm : Cool-moist Grand Fir Forest	Grand Fir/Queen's Cup Bead-lily	*Abies grandis/Clintonia uniflora*	3, 4
			Grand Fir/Twinflower	*Abies grandis/Linnaea borealis*	3, 4
			Grand Fir/Pacific Yew/Queen's Cup Beadlily	*Abies grandis/Taxus brevifolia/Clintonia uniflora*	3, 4
			Grand Fir/Pacific Yew-Twinflower	*Abies grandis/Taxus brevifolia-Linnaea borealis*	4
Open Cool-moist Grand Fir Forest	25–59%	fgfcmo : Open Cool-moist Grand Fir Forest	Grand Fir/Big Huckleberry	*Abies grandis/Vaccineum membranaceum*	3, 4
Warm-dry Grand Fir Forest	25–100%	fgfwd: Warm-dry Grand Fir Forest	Grand Fir/Elk Sedge	*Abies grandis/Carex geyeri*	4
Open Warm-dry Grand Fir Forest	25–59%	fgfwdo : Open Warm-dry Grand Fir Forest	Grand Fir/Pinegrass	*Abies grandis/Calamagrostis rubescens*	3, 4
			Grand Fir/Birchleaf Spiraea (Blue Mountains)	*Abies grandis/Spiraea betulifolia*	3, 4
Warm-moist Douglas-Fir Forest	25–59%	fdfwm : Warm-moist Douglas-fir Forest	Douglas-fir/Rocky Mountain Maple-Mallow Ninebark	*Pseudotsuga menziesii/Acer glabrum-Physocarpus malvaceus*	3
			Douglas-fir/Rocky Mountain Maple-Mallow Ninebark-Floodplain	*Pseudotsuga menziesii/Acer glabrum-Physocarpus malvaceus-Floodplain*	1
			Douglas-Fir/Oceanspray	*Pseudotsuga menziesii/Holodiscus discolor*	4
			Douglas-Fir/Mallow Ninebark	*Pseudotsuga menziesii/Physocarpus malvaceus*	3, 4
Moist Douglas-fir Forest	60–100%	fdfm : Moist Douglas-fir Forest	Douglas-fir/Common Snowberry	*Pseudotsuga menziesii/Symphoricarpos albus*	3, 4
			Douglas-fir/Common Snowberry-Floodplain	*Pseudotsuga menziesii/Symphoricarpos albus-Floodplain*	1
Low Elevation Moist Douglas-fir Forest	10–59%	fdflm : Low Elevation Moist Douglas-fir Forest	Douglas-fir/Western Birch	*Pseudotsuga menziesii/Betula occidentalis*	2
			Douglas-fir/Black Hawthorn-Common Snowberry	*Pseudotsuga menziesii/Crataegus douglasii-Symphoricarpos albus*	2
Open Moist Douglas-Fir Forest	10–59%	fdfmo : Open Moist Douglas-fir Forest	Douglas-Fir/Birchleaf Spiraea	*Pseudotsuga menziesii/Spiraea betulifolia*	3
			Douglas-fir/Mountain Snowberry (Wallowa Mountains)	*Pseudotsuga menziesii/Symphoricarpos oreophilis*	3, 4
Dry Douglas-fir Forest	25–100%	fdfd : Dry Douglas-fir Forest	Douglas-fir/Pinegrass	*Pseudotsuga menziesii/Calamagrostis rubescens*	3, 4
			Douglas-fir/Elk Sedge	*Pseudotsuga menziesii/Carex geyeri*	4
Moist Ponderosa Pine Forest	25–100%	fppm : Moist Ponderosa Pine Forest	Ponderosa Pine/Kentucky Bluegrass	*Pinus ponderosa/Poa pratensis*	1
			Ponderosa Pine/Black Hawthorn/Kentucky Bluegrass	*Pinus ponderosa/Crataegus douglasii/Poa pratensis*	8

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Open Moist Ponderosa Pine Forest	25–59%	fppmo : Open Moist Ponderosa Pine Forest	Ponderosa Pine/Common Snowberry	*Pinus ponderosa/Symphoricarpos albus*	3, 4
			Ponderosa Pine/Common Snowberry-Floodplain	*Pinus ponderosa/Symphoricarpos albus-Floodplain*	1
			Ponderosa Pine Community Type	*Pinus ponderosa Community Type*	5
Dry Ponderosa Pine Forest	25–59%	fppd : Dry Ponderosa Pine Forest	Ponderosa Pine/Pinegrass	*Pinus ponderosa/Calamagrostis rubescens*	4
			Ponderosa Pine/Elk Sedge	*Pinus ponderosa/Carex geyeri*	4
Ponderosa Pine Steppe Woodland	10–24%	wpps : Ponderosa Pine Steppe Woodland	Ponderosa Pine/Bluebunch Wheatgrass	*Pinus ponderosa/Agropyron spicatum*	3, 4
			Ponderosa Pine/Idaho Fescue	*Pinus ponderosa/Festuca idahoensis*	3, 4
White Willow Forest	60–100%	fbww : White Willow Forest	White Willow	*Salix alba*	8
Black Cottonwood/Willows Floodplain Forest	25–59%	fbbcwf : Black Cottonwood/Willows Floodplain Forest	Black Cottonwood/Shining Willow	*Populus balsamerifera* ssp. *trichocarpa/Salix lucida*	2
			Black Cottonwood/Arroyo Willow	*Populus balsamerifera* ssp. *trichocarpa/Salix lasiolepis*	2
Low Elevation Black Cottonwood Floodplain Forest	25–59%	fbclf : Low Elevation Black Cottonwood Floodplain Forest	Black Cottonwood/Lewis' Mockorange	*Populus balsamerifera* ssp. *trichocarpa/Philadelphus lewisii*	2
			Black Cottonwood/Western Birch	*Populus balsamerifera* ssp. *trichocarpa/Betula occidentalis*	2
			Black Cottonwood/Black Hawthorn	*Populus balsamerifera* ssp. *trichocarpa/Crataegus douglasii*	2
Black Cottonwood Floodplain Forest	25–59%	fbcf : Black Cottonwood Floodplain Forest	Quaking Aspen/Rocky Mountain Maple	*Populus balsamerifera* ssp. *trichocarpa/Acer glabrum*	1
			Black Cottonwood/Mountain Alder-Red-osier Dogwood	*Populus balsamerifera* ssp. *trichocarpa/Alnus incana-Cornus stolonifera*	1
Black Cottonwood Terrace Forest	25–100%	fbct : Black Cottonwood Terrace Forest	Black Cottonwood/Common Snowberry	*Populus balsamerifera* ssp. *trichocarpa/Symphoricarpos albus*	1
Sitka Alder Shrubland	60–100%	ssa : Sitka Alder Shrubland	Sitka Alder	*Alnus sinuata*	4
Mountain Alder Floodplain Shrubland	60–100%	smaf : Mountain Alder Floodplain Shrubland	Mountain Alder-Red-osier Dogwood/Mesic Forb	*Alnus incana-Cornus stolonifera/Mesic Forb*	1
			Mountain Alder-Currants/Mesic Forb	*Alnus incana-Ribes* spp.*/Mesic Forb*	1
			Mountain Alder-Common Snowberry	*Alnus incana-Symphoricarpos albus*	1
			Mountain Alder/Ladyfern	*Alnus incana/Athyrium filix-femina*	1
			Mountain Alder/Bluejoint Reedgrass	*Alnus incana/Calamagrostis canadensis*	1
			Mountain Alder/Dewey's Sedge	*Alnus incana/Carex deweyana*	1
			Mountain Alder/Densely-tufted Sedge	*Alnus incana/Carex lenticularis var. lenticularis*	1
			Mountain Alder/Tall Mannagrass	*Alnus incana/Glyceria elata*	1
			Mountain Alder/Common Cowparsnip	*Alnus incana/Heracleum lanatum*	1
			Mountain Alder/Kentucky Bluegrass	*Alnus incana/Poa pratensis*	1
			Mountain Alder/Common Horsetail	*Alnus incana/Equisetum arvense*	1

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Low Elevation Mountain Alder Floodplain Shrubland	60–100%	smalf : Low Elevation Mountain Alder Floodplain Shrubland	Mountain Alder-Water Birch	*Alnus incana-Betula occidentalis*	2
			Mountain Alder-Red-osier Dogwood-Lewis' Mockorange	*Alnus incana-Cornus sericea-Philadelphus lewisii*	2
			Western Birch-Lewis' Mockorange	*Betula occidentalis-Philadelphus lewisii*	2
			Western Birch-Lewis' Mockorange-Western Serviceberry-Common Snowberry	*Betula occidentalis-Philadelphus lewisii-Amelanchior alnifolia-Symphoricarpos albus*	2
Mountain Alder/Wet Meadow Shrubland	25–100%	smawm : Mountain Alder Wet Meadow Shrubland	Mountain Alder/Woolly Sedge	*Alnus incana/Carex lanuginosa*	1
			Mountain Alder/Smallfruit Bulrush	*Alnus incana/Scirpus microcarpus*	1
			Mountain Alder/Wideleaf Sedge	*Alnus incana/Carex amplifolia*	1
			Mountain Alder/Aquatic Sedge	*Alnus incana/Carex aquatilis*	1
			Mountain Alder/Bladder Sedge	*Alnus incana/Carex utriculata*	1
Red-osier Dogwood Shrubland	60–100%	scs : Red-osier Dogwood Shrubland	Red-osier Dogwood	*Cornus stolonifera*	1
Low Elevation Tall Willows Wet Meadow Shrubland	25–59%	swlwm : Low Elevation Tall Willows/Wet Meadow Shrubland	Shining Willow/Wet Graminoid	*Salix lucida* ssp. *lasiandra/Wet Graminod*	2
			Coyote Willow/Creeping Spikerush-Three Square Bulrush	*Salix exigua/Eleocharis pauciflora-Schoenoplectus americanus*	2
Low Elevation Tall Willows Floodplain Shrubland	25–100%	swlf : Low Elevation Tall Willows Floodplain Shrubland	Tall Willows/Reed Canarygrass	*Salix* spp.*/Phalaris arundinacea*	8
			Shining Willow	*Salix lucida sps. lasiandra*	2
			Coyote Willow-Shining Willow-Red-osier Dogwood	*Salix exigua-Salix lucida ssp. lasiandra-Cornus sericia*	2
			Arroyo Willow-Woods Rose-Red-osier Dogwood	*Salix lasiolepis-Rosa woodsii-Cornus sericea ssp. Sericea*	2
Tall Willows Moist Meadow Shrubland	25–100%	swmm : Tall Willows Moist Meadow Shrubland	Tall Willows/Mesic Forb	*Salix* spp.*/Mesic Forb*	1
			Tall Willows/Woolly Sedge	*Salix* spp.*/Carex lanuginosa*	1
			Tall Willows/Kentucky Bluegrass	*Salix* spp.*/Poa pratensis*	1
Tall Willows Wet Meadow Shrubland	25–59%	swwm : Tall Willows Wet Meadow Shrubland	Tall Willows/Aquatic Sedge	*Salix* spp.*/Carex aquatilis*	1
			Tall Willows/Bladder Sedge	*Salix* spp.*/Carex utriculata*	1
Tall Willlows Gravel Bar Shrubland	60–100%	swgb : Willows Gravel Bar Shrubland	Coyote Willow	*Salix exigua*	1
			Rigid Willow	*Salix rigida*	1
			Gravel Bar/Willow spp./Mixed Forb	*Gravel bar/Salix* spp.*/Mixed Forb*	5
Black Hawthorn Shrubland	60–100%	sbh : Black Hawthorn Shrubland	Black Hawthorn	*Crataegus douglasii*	5
			Black Hawthorn	*Crataegus douglasii*	1
			Black Hawthorn-Common Snowberry	*Crataegus douglasii-Symphoricarpos albus*	2

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Low Elevation Mixed Shrub	25–100%	smxl : Low Elevation Mixed Shrubland	Mackenzie's (Rigid) Willow-Coyote Willow-Black Hawthorn-Red-osier Dogwood-Woods Rose/Reed Canarygrass	*S. rigida ssp. Mackenziana, S. exigua, C. stolonifera, R. woodsii, C. douglasii/Phalaris arunidinacea*	8
			Mackenzie's (Rigid) Willow-Woods Rose	*Salix prolixa (S. rigida* ssp. *Mackenziana)-Rosa woodsii*	2
Dry Upland Shrubland	25–59%	sud : Upland Dry Shrubland	Curlleaf Mountain Mahogany	*Cercocarpus ledifolius*	3, 4
			NRCS Ecol. Site R009XY014OR - Deep Loam (Black Hawthorn/Bluebunch Wheatgrass-Idaho Fescue	*NRCS Ecol. Site R009YT014OR - Deep Loam (Crataegus douglasii/Agropyron spicatum-Festuca idahoensis*	6
Moist Meadow Shrubland	25–59%	smm : Moist Meadow Shrubland	Shrubby Cinquefoil/Tufted Hairgrass	*Potentilla fruticosa/Deschampsia cespitosa*	1
			Shrubby Cinquefoil/Kentucky Bluegrass	*Potentilla fruticosa/Poa pratensis*	1
			NRCS Ecol. Site R010XY007OR - Sodic Bottom (Greasewood/Elymus cinereus-Distichlis spicata)	*NRCS Ecol. Site R010XY007OR - Sodic Bottom (Sarcobatus vermiculatus/Elymus cinereus-Distichlis spicata)*	6
Moist Upland Shrubland	25–100%	sum : Upland Moist Shrubland	Mallow Ninebark-Common Snowberry	*Physocarpus malvaceus-Symphoricarpos albus*	3, 4
			Common Snowberry-Rose	*Symphoricarpos albus-Rosa* spp.	3
Subalpine Steppe Herbland	---	hss : Subalpine Steppe Herbland	Green Fescue	*Festuca viridula*	4
			Green Fescue-Hood's Sedge	*Festuca viridula-Carex hoodii*	3
			Green Fescue-/Spurred Lupine	*Festuca viridula-Lupinus laxiflorus*	3
Dry Upland Steppe-Moist Great Basin Wildrye Complex		husgbwc : Dry Upland Steppe-Moist Great Basin Wildrye Complex	NRCS Ecol. Site R009XY005OR - Mountain Swale (Great Basin Wildrye-Bluebunch Wheatgrass-Idaho Fescue	*NRCS Ecol. Site R009XY005OR - Mountain Swale (Elymus cinereus-Agropyron spicatum-Festuca idahoensis)*	6
			NRCS Ecol. Site R009XY004OR - [Alluvial] Fan (Great Basin Wildrye-Bluebunch Wheatgrass)	*NRCS Ecol. Site R009XY004OR - [Alluvial] Fan (Elymus cinereus-Agropyron spicatum)*	6
Bluebunch Wheatgrass-Idaho Fescue Herbland	---	hbwif : Bluebunch Wheatgrass-Idaho Fescue Herbland	Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine	*Festuca idahoensis-Agropyron spicatum/Lupinus sericeus*	3
			Idaho Fescue-Bluebunch Wheatgrass-Arrowleaf Balsamroot	*Festuca idahoensis-Agropyron spicatum-Balsamorhiza sagittata*	3
			Idaho Fescue-Hood's Sedge	*Festuca idahoensis-Carex hoodii*	3
			Idaho Fescue-Prairie Junegrass (Ridgetops)	*Festuca idahoensis-Koeleria cristata (Ridgetops)*	3
			Idaho Fescue-Prairie Junegrass (High Elevation)	*Festuca idahoensis-Koeleria cristata (High Elevation)*	3
			NRCS Ecol. Site R009XY013OR - Loamy (Idaho Fescue-Bluebunch Wheatgrass)	*NRCS Ecol. Site R009XY013OR - Loamy (Festuca idahoensis-Agropyron spicatum)*	6

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Bluebunch Wheatgrass-Idaho Fescue Herbland (continued)			NRCS Ecol. Site R009XY021OR - Shallow Clayey; NRCS Ecol. Site R009XY016OR - Clayey (Idaho Fescue-Bluebunch Wheatgrass-Sandberg's Bluegrass)	*NRCS Ecol. Site R009XY021OR - Shallow Clayey; NRCS Ecol. Site R009XY016OR - Clayey (Festuca idahoensis-Agropyron spicatum-Poa sandbergii)*	6
			NRCS Ecol. Site R009XY036OR - Mountain Shallow South (Idaho Fescue-Bluebunch Wheatgrass-Arrowleaf Balsamroot)	*NRCS Ecol. Site R009XY036OR - Mountain Shallow South (Festuca idahoensis-Agropyron spicatum-Balsamorhiza sagittata)*	6
Dry Upland Steppe Herbland	---	husd : Dry Upland Steppe Herbland	Sandberg's Bluegrass-Onespike Oatgrass	*Poa sandbergii-Danthonia unispicata*	3, 4
			Bluebunch Wheatgrass-Sandberg's Bluegrass-Onespike Oatgrass	*Agropyron spicatum-Poa sandbergii-Danthonia unispicata*	4
			Bluebunch Wheatgrass-Sandberg's Bluegrass	*Agropyron spicatum-Poa sandbergii*	3, 4
			Bluebunch Wheatgrass-Sandberg's Bluegrass-Onespike Oatgrass	*NRCS Ecol. Site R009XY027OR - Mountain Very Shallow (Agropyron spicatum-Poa sandbergii-Danthonia unispicata)*	6
			Bluebunch Wheatgrass-Sandberg's Bluegrass-Narrowleaf Skullcap	*Agropyron spicatum-Poa sandbergii-Scutellaria angustifolia*	3
			Bluebunch Wheatgrass-Creamy Eriogonum	*Agropyron spicatum-Eriogonum heracleoides*	3
Dry Meadow Herbland		hmd : Dry Meadow Herbland	Common Timothy	*Phleum pratense*	1
			Kentucky Bluegrass	*Poa pratensis*	1
			Idaho Fescue-Bluebunch Wheatgrass/Silky Lupine	*Festuca idahoensis-Agropyron spicatum/Lupinus sericeus*	3
			Sandberg's Bluegrass-Onespike Oatgrass	*Poa sandbergii-Danthonia unispicata*	3, 4
Graminoid-Forb Gravel Bar Herbland	---	hgfgb : Graminoid-Forb Gravel Bar Herbland	Densely-tufted Sedge	*Carex lenticularis var. lenticularis*	1
			Drooping Woodreed	*Cinna latifolia*	1
			Tall Mannagrass	*Glyceria elata*	1
			Smallfruit Bulrush	*Scirpus microcarpus*	1
			Common Horsetail	*Equisetum arvense*	1
			Arrowleaf Groundsel	*Senecio triangularis*	1
Cold-wet Meadow Herbland	---	hwmc : Cold Wet Meadow Herbland	Holm's Rocky Mountain Sedge	*Carex scopulorum*	1, 7
			Few-flowered Spikerush	*Eleocharis pauciflora*	1, 7
			Silvery Sedge	*Carex canescens*	1, 7
Cold-moist Meadow Herbland	---	hmcm : Cold-moist Meadow Herbland	Jones' Sedge	*Carex jonesii*	7
			Black Alpine Sedge	*Carex nigricans*	7
			Mid-Montane (Blue Mtns NFs) Wetland Classification	*Deschampsia cespitosa*	1

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Cold Wet-Moist Meadow Complex Herbland	---	hgmccwmc:Cold Wet-Moist Meadow Complex Herbland	Holm's Rocky Mountain Sedge	*Carex scopulorum*	1, 7
			Few-flowered Spikerush	*Eleocharis pauciflora*	1, 7
			Silvery Sedge	*Carex canescens*	1, 7
			Jones' Sedge	*Carex jonesii*	7
			Black Alpine Sedge	*Carex nigricans*	7
			Tufted Hairgrass	*Deschampsia cespitosa*	1
Wet Meadow Herbland	---	hwm : Wet Meadow Herbland	Aquatic Sedge	*Carex aquatilis*	1
			Big-leaved Sedge	*Carex amplifolia*	1
			Cusick's Sedge	*Carex cusickii*	1
			Sawbeak Sedge	*Carex stipata*	1
			Bladder Sedge	*Carex utriculata*	1
			Inflated Sedge	*Carex vesicaria var. vesicaria*	1
			Creeping Spikerush	*Eleocharis palustris*	1
Moist Meadow Herbland	---	hmm : Moist Meadow Herbland	Tufted Hairgrass	*Deschampsia cespitosa*	1
			NRCS Ecol. Site R010XY004OR - Meadow (Tufted Hairgrass)	*NRCS Ecol. Site R010XY004OR - Meadow (Deschampsia cespitosa)*	6
			NRCS Ecol. Site R010XY005OR - Loamy Bottom (Great Basin wildrye)	*NRCS Ecol. Site R010XY005OR - Loamy Bottom (Elymus cinereus)*	6
			Woolly Sedge	*Carex lanuginosa*	1
			Bluejoint Reedgrass	*Calamagrostis canadensis*	1
			Nebraska Sedge	*Carex nebrascensis*	1
			Baltic Rush	*Juncus balticus*	1
			Meadow Foxtail	*Alopecurus pratensis*	1
			Small-winged Sedge	*Carex microptera*	1
			Kentucky Bluegrass	*Poa pratensis*	1
Wet-Moist Meadow Complex Herbland	---	hgmcwmc:Wet-Moist Meadow Complex Herbland	Aquatic Sedge	*Carex aquatilis*	1
			Big-leaved Sedge	*Carex amplifolia*	1
			Cusick's Sedge	*Carex cusickii*	1
			Sawbeak Sedge	*Carex stipata*	1
			Bladder Sedge	*Carex utriculata*	1
			Inflated Sedge	*Carex vesicaria var. vesicaria*	1
			Creeping Spikerush	*Eleocharis palustris*	1
			Tufted Hairgrass	*Deschampsia cespitosa*	1

Appendix 6. Continued.

Plant Association Group (PAG)	Range of Average Canopy Cover	Domain Code: Description	Plant Association/Plant Community Type–Common Name	Plant Association/Plant Community Type–Scientific Name	Source
Wet-Moist Meadow Complex Herbland (continued)			NRCS Ecol. Site R010XY004OR - Meadow (Tufted Hairgrass)	*NRCS Ecol. Site R010XY004OR - Meadow (Deschampsia cespitosa)*	6
			NRCS Ecol. Site R010XY005OR - Loamy Bottom (Great Basin wildrye)	*NRCS Ecol. Site R010XY005OR - Loamy Bottom (Elymus cinereus)*	6
			Woolly Sedge	*Carex lanuginosa*	1
			Bluejoint Reedgrass	*Calamagrostis canadensis*	1
			Nebraska Sedge	*Carex nebrascensis*	1
			Baltic Rush	*Juncus balticus*	1
			Meadow Foxtail	*Alopecurus pratensis*	1
			Small-winged Sedge	*Carex microptera*	1
			Kentucky Bluegrass	*Poa pratensis*	1
Moist Forb Meadow Herbland	---	hfmm : Moist Forb Meadow Herbland	False Hellebore	*Veratrum* spp.	1
Miscellaneous Mapping Units		a : Agricultural Fields bbg : Barren rd : Roads ro : Rock ub: Buildings and Other Structures wf : Fresh Water xd : Developed Sites xu : Urban Complex			

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8 Classified from field plots sampled in 2014.

Appendix 7. Cross-reference table between potential vegetation complexes and plant association groups (PAGs) or ecological site descriptions (ESDs) and geomorphic units. Riparian vegetation mapping study in the Grande Ronde River watershed, Oregon, 2014.

			Geomorphic Surface(s) on Which Component Could Occur						
PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
Low Elevation Black Cottonwood-Moist Meadow Floodplain Complex	fbcmmlfc : Low Elevation Black Cottonwood/Moist Meadow Floodplain Complex	Low Elevation Mountain Alder Floodplain Shrubland	X	X					
		Black Cottonwood/Willows Floodplain Forest	X	X	X				
		Low Elevation Black Cottonwood Floodplain Forest	X	X	X	X			
		White Willow Forest		X					
		Black Cottonwood Terrace Forest					X	X	
		Moist Ponderosa Pine Forest						X	
		Moist Meadow Herbland					X	X	
Low Elevation Moist Shrub/Graminoid Floodplain Complex	smmgrlfc : Low Elevation Moist Shrub/Graminoid Floodplain Complex	Low Elevation Mixed Shrubland	X	X	X				X
		White Willow Forest		X	X				
		Low Elevation Tall	X	X	X				

Appendix 7. Continued.

			Geomorphic Surface(s) on Which Component Could Occur						
PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
		Willows Floodplain Shrubland							
		Black Hawthorn Shrubland				X	X	X	
		NRCS Ecol. Site R010XY003OR - Wet Meadow: Sedges-Tufted Hairgrass							X
		Moist Meadow Herbland				X	X	X	
Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex	swmmgrlfc : Low Elevation Wet-Moist Shrub/Graminoid Floodplain Complex	Low Elevation Mixed Shrubland		X	X	X			X
		White Willow Forest		X	X				
		Low Elevation Tall Willows Floodplain Shrubland	X	X	X				
		Low Elevation Tall Willows Wet Meadow Shrubland		X	X				
		Black Hawthorn Shrubland				X	X	X	
		NRCS Ecol. Site R010XY003OR - Wet	X	X					X

Appendix 7. Continued.

			Geomorphic Surface(s) on Which Component Could Occur						
PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
		Meadow: Sedges-Tufted Hairgrass							
		Moist Meadow Herbland					X	X	
Low Elevation Brackish Wet-Moist Shrub/Graminoid Meadow Floodplain Complex	swmmgrblfc : Low Elevation Brackish Wet-Moist Shrub/Graminoid Floodplain Complex	Low Elevation Mixed Shrubland		X	X	X			X
		White Willow Forest		X	X				
		Low Elevation Tall Willows Floodplain Shrubland	X	X	X				
		Low Elevation Tall Willows Wet Meadow Shrubland		X	X				
		NRCS Ecol. Site R010XY003OR - Wet Meadow: Sedges-Tufted Hairgrass		X	X				X
		NRCS Ecol. Site R010XY007OR - Sodic Bottom: Greasewood/Great Basin Wildrye-			X	X			

Appendix 7. Continued.

			Geomorphic Surface(s) on Which Component Could Occur						
PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
		Saltgrass							
		NRCS Ecol. Site R010XY005OR - Loamy Bottom: Basin Big Sagebrush/Great Basin Wildrye					X	X	
		Moist Meadow Herbland						X	
Low Elevation Riverine Complex	xrl : Low-elevation Riverine Complex	Barrens (sand, gravel, cobble bars)	X						
		Graminoid-Forb Gravel Bar Herbland	X	X					
		Tall Willlows Gravel Bar Shrubland	X	X					
		Low Elevation Tall Willows Floodplain Shrubland			X				
		White Willow Forest		X					
		Low Elevation Black Cottonwood Floodplain Shrubland			X				
		Warm-moist Douglas-fir Forest			X	X			

Appendix 7. Continued.

			Geomorphic Surface(s) on Which Component Could Occur						
PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
Mid Elevation Riverine Complex	xrm : Mid-elevation Riverine Complex	***Gentler Reaches***							
		Barrens (sand, gravel, cobble bars)	X						
		Graminoid-Forb Gravel Bar Herbland	X	X					
		Tall Willlows Gravel Bar Shrubland	X						
		Black Cottonwood Floodplain Forest			X				
		Steeper Reaches							
		Mountain Alder Floodplain Shrubland	X		X				
Upper Elevation Riverine Complex	xru : Upper-elevation Riverine Complex	***Gentler Reaches***							
		Barrens (sand, gravel, cobble bars)	X						
		Graminoid-Forb Gravel Bar Herbland	X	X					
		Aquatic Sedge Meadows		X					
		Tall Willows Moist Meadow Shrubland			X	X			

Appendix 7. Continued.

PAG Complex	Domain Code: Description	Complex Components: Plant Association Group (PAG); Ecological Site Description (ESD)	Geomorphic Surface(s) on Which Component Could Occur						
			Meander Coarse Active Channel Deposit	Meander Inactive Channel Deposit	Meander Active Overbank Deposit	Meander Inactive Overbank Deposit	Meander Abandoned Overbank Deposit	Recent Alluvial Terrace	Old Oxbow
		Tall Willows Wet Meadow Shrubland			X				
		Lodgepole Pine Moist Meadow				X			
		Dry Lodgepole Pine Forest				X			
		Steeper Reaches							
		Mountain Alder Floodplain Shrublands	X		X				
		Engelmann Spruce Forest			X				
		Cool-moist Grand Fir Forest			X	X			
		Subalpine Fir-Engelmann Spruce Forest			X	X			

Appendix 8. ITU code combination × ecotype × erosion sensitivity crosswalk.

Ecotype	Erosion Sensitivity	ITU
Freshwater	Negligible	L/Fmrox/Water/wf/wf/A
		L/Fmrox/Water/wf/wf/Ha
		L/Fmrox/Water/wf/wf/Hag
		L/Of/Water/wf/wf/Hp
		L/Wh/Water/wf/swmmgrblfc/Hwe
		L/Wh/Water/wf/swmmgrlfc/Hwc
		L/Wh/Water/wf/swwm/Hwe
		L/Wh/Water/wf/wf/Hag
		L/Wh/Water/wf/wf/Hwc
		L/Wh/Water/wf/wf/Hwd
		L/Wh/Water/wf/wf/Hwe
		L/Wh/Water/wf/wf/Hwi
		L/Wh/Water/wf/wf/Ngfe
		R/Fmrox/Water/wf/wf/A
		R/Fmrox/Water/wf/wf/Hag
		R/Fmrox/Water/wf/wf/Hwi
		R/H/Water/wf/wf/Hwi
		R/Wh/Water/wf/swmmgrlfc/Hwc
		R/Wh/Water/wf/wf/Hag
		R/Wh/Water/wf/wf/Hwc
		R/Wh/Water/wf/wf/Hwd
		R/Wr/Water/wf/wf/A
		R/Wr/Water/wf/wf/Hag
		R/Wr/Water/wf/wf/Hwc
		R/Wr/Water/wf/wf/Ngfe
Human Developments	Negligible	L/ff/LGr/ub/husgbwc/Hdr
		L/fmob/LovSk/ub/ub/Hdr
		L/fmob/LovSk/ub/xd/Hdr
		L/fmob/LovSk/xd/xu/DC
		L/fmob/LovSk/xd/xu/Hd
		L/fmob/LSil/ub/ub/Hd
		L/fmob/LSil/ub/ub/Hdr
		L/fmob/LSil/ub/ub/Hsb
		L/fmob/LSil/xd/xu/Hd
		L/fmob/LSilbr/ub/ub/Hd
		L/fmob/MDpCF/ub/ub/Hdr
		L/Fmolp/LSil/ub/ub/Hdr
		L/fto/LovSk/ub/ub/Hdr
		L/fto/LovSk/xd/xu/Hd
		L/fto/LSil/xd/xu/Hd

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Human Developments (continued)		L/ftr/AsilovSk/ub/ub/Haf
		L/ftr/LovSk/ub/fbcmmlfc/Hsb
		L/ftr/LovSk/ub/xd/Hdr
		L/ftr/LSil/ub/ub/Hdr
		L/ftr/LSil/ub/xd/Hdr
		L/H/LovSk/ub/ub/Hag
		L/H/LovSk/ub/ub/Hdr
		L/H/LovSk/xd/fbcmmlfc/Hd
		L/H/LovSk/xd/hmm/Hd
		L/H/LSil/ub/ub/Hdr
		L/H/LSil/xd/xd/Hd
		L/H/LSil/xd/xu/Hd
		L/H/LSil/xd/xu/Hdr
		L/H/LSilbr/ub/ub/Hsb
		R/fmoa/LSil/ub/ub/Hsb
		R/fmoi/LovSk/ub/swgb/Hdr
		R/fmoi/LovSk/ub/xd/Hdr
		R/fmoi/LSil/ub/ub/Hd
		R/H/LSil/ub/ub/Hsb
		U/ch/LGr/ub/ub/Hdr
		U/ch/LiShC/ub/ub/Hdr
		U/ch/LSil/ub/fdfm/Hdr
		U/ch/MDpCF/ub/ub/Hdr
		U/ch/StmBkHG/xd/fppm/DC
		U/ff/MDpCF/ub/ub/Hdr
		U/fto/LSil/ub/ub/Hdr
		U/H/LiShC/ub/ub/Hdr
Loamy Human-modified Barrens and Partially Vegetated	High	L/ff/LGr/bpa/husgbwc/Ha
		L/ff/LGr/bpvh/hmd/Hag
		L/fmob/DpSiCL/bpa/swmmgrlfc/Ha
		L/fmob/LovSk/bbg/fbcmmlfc/DC
		L/fmob/LovSk/bbg/fbcmmlfc/Haf
		L/fmob/LovSk/bpa/fbcmmlfc/Ha
		L/fmob/LovSk/bpa/fbcmmlfc/Hah
		L/fmob/LovSk/bpvh/fdfd/Hc
		L/fmob/LovSk/bpvh/fppm/Hag
		L/fmob/LovSk/bpvh/hmm/DC
		L/fmob/LovSk/bpvh/ub/Hd
		L/fmob/LSil/bpa/fbcmmlfc/Ha
		L/fmob/LSil/bpa/smmgrlfc/Ha

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Loamy Human-modified Barrens and Partially Vegetated (continued)		L/fmob/LSil/bpa/smmgrlfc/Hah
		L/fmob/LSil/bpa/smxl/Ha
		L/fmob/LSil/bpa/swmmgrlfc/Ha
		L/fmob/LSil/bpa/swmmgrlfc/Hah
		L/fmob/LSil/bpa/swmmgrlfc/Hwd
		L/fmob/LSilbr/bbg/bbg/Hf
		L/fmob/LSilbr/bpa/swmmgrblfc/Ha
		L/fmob/LSilbr/bpa/swmmgrlfc/DC
		L/fmob/LSilbr/bpa/swmmgrlfc/Ha
		L/fmob/LSilbr/bpa/swmmgrlfc/Hah
		L/fmob/LSilbr/bpa/swmmgrlfc/Hwl
		L/fmoi/LSilbr/bbg/swmmgrblfc/Hag
		L/Fmolp/LSil/bbg/swmmgrlfc/Ha
		L/Fmolp/LSil/bpa/smmgrlfc/Ha
		L/Fmolp/LSil/bpa/swmmgrlfc/Ha
		L/Fmolp/LSilbr/bbg/swmmgrblfc/Ha
		L/Fmolp/LSilbr/bpa/swmmgrblfc/Ha
		L/Fmolp/LSilbr/bpa/swmmgrlfc/Ha
		L/Fmolp/LSilbr/bpa/swmmgrlfc/Hah
		L/Fmrox/LSilbr/bbg/swmmgrlfc/Hag
		L/ftr/LovSk/bpa/fbcmmlfc/Ha
		L/ftr/LSil/bpvh/flpmm/Hag
		L/H/LovSk/bbg/bbg/Hag
		L/H/LSil/bbg/bbg/Hsisd
		L/H/LSil/bbg/bbg/Hwi
		L/H/LSil/bbg/bbg/Hwl
		L/H/LSil/bbg/fbcmmlfc/Hwl
		R/fmob/LSil/bpa/swmmgrlfc/Ha
		R/fmoi/LGr/bpvh/fbcf/Hc
		R/fmoi/LSil/bbg/bbg/Haf
		R/fmoi/LSil/bpa/swmmgrlfc/Ha
		R/fmoi/LSil/bpa/swmmgrlfc/Hag
Lowland Loamy Agricultural Lands	High	L/fmob/AsilovSk/hgm/hmm/Hah
		L/fmob/DpSiCL/hgm/swmmgrlfc/Hah
		L/fmob/LiShC/hgm/fbclf/Hp
		L/fmob/LovSk/hgm/fbbcwf/Hah
		L/fmob/LovSk/hgm/fbclf/Ha
		L/fmob/LovSk/hgm/fbclf/Hah
		L/fmob/LovSk/hgm/fbcmmlfc/Haf
		L/fmob/LovSk/hgm/fbcmmlfc/Hah

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Agricultural Lands (continued)		L/fmob/LovSk/hgm/hmm/Ha
		L/fmob/LovSk/hgm/hmm/Hah
		L/fmob/LovSk/hgm/swmmgrlfc/Hah
		L/fmob/LovSk/hgwmcc/hgmcwmc/Hp
		L/fmob/LovSk/hpa/a/Ha
		L/fmob/LovSk/xa/a/Ha
		L/fmob/LSil/hca/swmmgrblfc/Hac
		L/fmob/LSil/hca/swmmgrlfc/Hac
		L/fmob/LSil/hgm/fbcmmlfc/Ha
		L/fmob/LSil/hgm/fbcmmlfc/Hah
		L/fmob/LSil/hgm/fppm/Haf
		L/fmob/LSil/hgm/hmm/Ha
		L/fmob/LSil/hgm/hmm/Hah
		L/fmob/LSil/hgm/hmm/Hp
		L/fmob/LSil/hgm/smxl/Ha
		L/fmob/LSil/hgm/swmmgrlfc/Ha
		L/fmob/LSil/hgm/swmmgrlfc/Hah
		L/fmob/LSil/hgm/swmmgrlfc/Hp
		L/fmob/LSil/hgw/fbcmmlfc/Hah
		L/fmob/LSil/hgw/hwm/Hp
		L/fmob/LSil/hgwmcc/swmmgrlfc/Hah
		L/fmob/LSil/hpa/hmm/Hp
		L/fmob/LSil/xa/ub/DC
		L/fmob/LSilbr/hca/swmmgrblfc/Hac
		L/fmob/LSilbr/hca/swmmgrlfc/Hac
		L/fmob/LSilbr/hgm/smxl/Ha
		L/fmob/LSilbr/hgm/swmmgrlfc/Hah
		L/fmob/LSilbr/hgwmcc/fbcmmlfc/Hah
		L/fmob/LSilor/hgw/hwm/Ha
		L/fmoi/LSilbr/hgw/swmmgrlfc/Ha
		L/Fmolp/LSil/hca/swmmgrlfc/Hac
		L/Fmolp/LSil/hgm/fbbcwf/Hah
		L/Fmolp/LSil/hgm/swmmgrlfc/Ha
		L/Fmolp/LSil/hgm/swmmgrlfc/Hah
		L/Fmolp/LSil/hpa/swmmgrlfc/Hp
		L/Fmolp/LSilbr/hca/swmmgrlfc/Hac
		L/Fmolp/LSilbr/hgm/swmmgrlfc/Ha
		L/Fmolp/LSilbr/hgm/swmmgrlfc/Hah
		L/fmri/LSil/hgw/swmmgrlfc/Hah
		L/Fmrox/LSil/hgw/swmmgrlfc/Ha
		L/Fmrox/LSilbr/hgm/swmmgrlfc/Ha

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Agricultural Lands (continued)		L/Fmrox/LSilbr/hgm/swmmgrlfc/Hah
		L/Fmrox/LSilbr/hgw/hwm/Ha
		L/fto/LSil/hgm/hmm/Ha
		L/ftr/LiShC/hgw/hwm/Hp
		L/ftr/LSil/hgm/a/Ha
		L/ftr/LSil/hgm/hmm/Hah
		L/ftr/LSil/xa/a/Ha
		L/ftr/LSilor/hgw/hwm/Ha
		L/ftr/LSilor/hgwmcc/hwm/Ha
		L/H/LSil/hgm/swmmgrlfc/Hah
Lowland Loamy Black Cottonwood Forest	Low	L/fmob/AsilovSk/fboc/fbclf/DC
		L/fmob/AsilovSk/fmbcgfo/fgfcmo/A
		L/fmob/LGr/fboc/fbct/DC
		L/fmob/LGr/fmbcdfo/fdfm/A
		L/fmob/LovSk/fbcc/fbclf/DC
		L/fmob/LovSk/fbcc/fbct/DC
		L/fmob/LovSk/fboc/fbcf/A
		L/fmob/LovSk/fboc/fbclf/A
		L/fmob/LovSk/fboc/fbclf/DC
		L/fmob/LovSk/fboc/fbcmmlfc/Hwc
		L/fmob/LovSk/fboc/fbct/A
		L/fmob/LovSk/fboc/fbct/DC
		L/fmob/LovSk/fbwc/fbcmmlfc/A
		L/fmob/LovSk/fbwc/fbct/A
		L/fmob/LovSk/fbwc/fbct/DC
		L/fmob/LovSk/fbwc/fbct/Hd
		L/fmob/LovSk/fmbcdfo/fbclf/A
		L/fmob/LovSk/fmbcdfo/fdfmo/A
		L/fmob/LovSk/fmbceso/fes/A
		L/fmob/LovSk/fmbceso/fgfcm/A
		L/fmob/LovSk/fmbcgfo/fgfcmo/A
		L/fmob/LovSk/fmbcppo/fbclf/A
		L/fmob/LovSk/fmbcppo/fbcmmlfc/A
		L/fmob/LovSk/fmbcppo/fbct/DC
		L/fmob/LovSk/fmbcppo/fppm/A
		L/fmob/LSil/fbcc/fbclf/A
		L/fmob/LSil/fbcc/fbclf/DC
		L/fmob/LSil/fbcc/swmmgrlfc/A
		L/fmob/LSil/fboc/fbcf/Hag
		L/fmob/LSil/fboc/fbclf/DC

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Black Cottonwood Forest		L/fmob/LSil/fboc/fbclf/Hd
		L/fmob/LSil/fboc/fbclf/Hdr
		L/fmob/LSil/fboc/fbct/A
		L/fmob/LSil/fboc/fbct/DC
		L/fmob/LSil/fboc/fbct/Hd
		L/fmob/SSkEnt/fboc/fbct/A
		L/fmri/LovSk/fboc/fbclf/Ha
		L/fmri/LovSk/fmbcppo/fbcf/A
		L/fmri/LSil/fboc/fbclf/Hwc
		L/Fmrox/LovSk/fboc/fbct/DC
		L/H/LovSk/fboc/fbct/DC
		L/H/LSil/fboc/fbclf/Hdr
		L/H/LSil/fboc/fbct/Hc
Lowland Loamy Black Hawthorn Tall Shrub	Low	L/fmob/AsilovSk/stcbh/sbh/Hag
		L/fmob/LGr/stcbh/sbh/A
		L/fmob/LGr/stobh/sbh/Hag
		L/fmob/LGr/stobh/smaf/Hag
		L/fmob/LovSk/stcbh/fbct/Hag
		L/fmob/LovSk/stcbh/fppm/Hag
		L/fmob/LovSk/stcbh/sbh/A
		L/fmob/LovSk/stcbh/sbh/Hag
		L/fmob/LovSk/stobh/fbcf/Hag
		L/fmob/LovSk/stobh/fbclf/Hag
		L/fmob/LovSk/stobh/fbcmmlfc/Hag
		L/fmob/LovSk/stobh/fdfwm/Hag
		L/fmob/LovSk/stobh/fppm/Hag
		L/fmob/LovSk/stobh/sbh/A
		L/fmob/LovSk/stobh/sbh/DC
		L/fmob/LovSk/stobh/sbh/Hag
		L/fmob/LovSk/stobh/smalf/Hag
		L/fmob/LSil/stcbh/fbbcwf/Hag
		L/fmob/LSil/stcbh/fppm/Hag
		L/fmob/LSil/stcbh/sbh/A
		L/fmob/LSil/stcbh/sbh/DC
		L/fmob/LSil/stcbh/sbh/Hag
		L/fmob/LSil/stcbh/sbh/Hdr
		L/fmob/LSil/stobh/fbcmmlfc/Hag
		L/fmob/LSil/stobh/fdfm/Hag
		L/fmob/LSil/stobh/sbh/A
		L/fmob/LSil/stobh/sbh/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Black Hawthorn Tall Shrub (continued)		L/fmob/LSil/stobh/swmmgrlfc/Hag
		L/ftr/LovSk/stcbh/sbh/Hag
		L/ftr/LovSk/stobh/sbh/Hag
		L/ftr/LSil/stcbh/sbh/Hag
Lowland Loamy Douglas-fir Forest	Low	L/ff/DpCF/fncdf/fdfm/A
		L/fmob/AsilovL/fnodf/fdfwm/A
		L/fmob/AsilovSk/fncdf/fdflm/Hc
		L/fmob/AsilovSk/fncdf/fdfwm/A
		L/fmob/AsilovSk/fndfw/fdfm/A
		L/fmob/AsilovSk/fndfw/fdfwm/A
		L/fmob/AsilovSk/fnodf/fdfd/A
		L/fmob/AsilovSk/fnodf/fdfwm/A
		L/fmob/LGr/fndfw/fdfmo/A
		L/fmob/LGr/fndfw/fdfwm/A
		L/fmob/LGr/fnodf/fdfm/A
		L/fmob/LGr/fnodf/fdfwm/A
		L/fmob/LiShC/fnodf/fdfwm/A
		L/fmob/LovSk/fncdf/fdfd/Hc
		L/fmob/LovSk/fncdf/fdfm/A
		L/fmob/LovSk/fncdf/fdfwm/A
		L/fmob/LovSk/fndfw/fdfm/A
		L/fmob/LovSk/fndfw/fdfwm/A
		L/fmob/LovSk/fnodf/fdfm/A
		L/fmob/LovSk/fnodf/fdfmo/A
		L/fmob/LovSk/fnodf/fdfmo/DC
		L/fmob/LovSk/fnodf/fdfwm/A
		L/fmob/LovSk/fnodf/fdfwm/Hcl
		L/fmob/LovSk/fnodf/fdfwm/Hsb
		L/fmob/LSil/fncdf/fdfm/Nf
		L/fmob/LSil/fncdf/fdfwm/A
		L/fmob/LSil/fndfw/fdfm/A
		L/fmob/LSil/fndfw/fdfm/Ngfe
		L/fmob/LSil/fndfw/fdfwm/A
		L/fmob/LSil/fndfw/fdfwm/DC
		L/fmob/LSil/fnodf/fdfm/A
		L/fmob/LSil/fnodf/fdfm/DC
		L/fmob/LSil/fnodf/fdfmo/A
		L/fmob/LSil/fnodf/fdfwm/A
		L/fmob/LSil/fnodf/fdfwm/DC
		L/fmob/LSil/fnodf/fdfwm/Hc

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Douglas-fir Forest (continued)		L/fmob/LSil/fnodf/fdfwm/Nf
		L/fmob/MDpCF/fncdf/fdfwm/A
		L/fmob/MDpCF/fndfw/fdfm/A
		L/fmob/MDpCF/fndfw/fdfwm/A
		L/fmob/MDpCF/fnodf/fdfwm/Haf
		L/fmob/SSkEnt/fndfw/fdfmo/DC
		L/fmob/StmBkHG/fndfw/fdfwm/A
		L/fto/AsilovSk/fnodf/fdfd/A
		L/fto/LGr/fncdf/fdfwm/A
		L/fto/LiShC/fncdf/fdfwm/A
		L/fto/LSil/fncdf/fdfd/DC
		L/fto/LSil/fncdf/fdfm/DC
		L/fto/LSil/fncdf/fdfmo/A
		L/fto/LSil/fnodf/fdfd/DC
		L/fto/LSil/fnodf/fdfmo/DC
		L/fto/MDpCF/fnodf/fdfd/A
		L/fto/MDpCF/fnodf/fdfm/A
		L/ftr/AsilovL/fncdf/fdfd/Hc
		L/ftr/AsilovL/fnodf/fdfwm/A
		L/ftr/AsilovSk/fnodf/fdfm/A
		L/ftr/AsilovSk/fnodf/fdfmo/He
		L/ftr/AsilovSk/fnodf/fdfwm/A
		L/ftr/LovSk/fndfw/fdfm/A
		L/ftr/LovSk/fndfw/fdfwm/A
		L/ftr/LovSk/fnodf/fdfm/A
		L/ftr/LSil/fncdf/fdfd/Hag
		L/ftr/LSil/fnodf/fdfd/A
		L/ftr/LSil/fnodf/fdfm/A
		L/ftr/LSil/fnodf/fdfm/Nf
		L/ftr/LSil/fnodf/fdfwm/A
Lowland Loamy Dry Graminoid Meadow	High	L/ff/LSil/hus/hbwif/DC
		L/fmob/AsilovSk/hgd/fdfm/Hag
		L/fmob/AsilovSk/hus/husd/Hf
		L/fmob/DpCF/hgd/smaf/Hsisd
		L/fmob/LovSk/hgd/fbcmmlfc/DC
		L/fmob/LovSk/hgd/fbcmmlfc/Ha
		L/fmob/LovSk/hgd/fbcmmlfc/Hag
		L/fmob/LovSk/hgd/fbct/DC
		L/fmob/LovSk/hgd/fbct/Hag
		L/fmob/LovSk/hgd/fdfm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Dry Graminoid Meadow (continued)		L/fmob/LovSk/hgd/fdfm/Hc
		L/fmob/LovSk/hgd/fdfm/Nf
		L/fmob/LovSk/hgd/fdfwm/Hag
		L/fmob/LovSk/hgd/fdfwm/Hc
		L/fmob/LovSk/hgd/flpd/Hag
		L/fmob/LovSk/hgd/flpmm/Hag
		L/fmob/LovSk/hgd/fppd/Hag
		L/fmob/LovSk/hgd/fppm/Hag
		L/fmob/LovSk/hgd/fppm/Hc
		L/fmob/LovSk/hgd/fppmo/Hag
		L/fmob/LovSk/hgd/hmd/Hag
		L/fmob/LovSk/hgd/scs/Hag
		L/fmob/LovSk/hgd/smaf/Hag
		L/fmob/LovSk/hgd/smaf/Hc
		L/fmob/LovSk/hgd/smawm/Hag
		L/fmob/LovSk/hgd/smm/DC
		L/fmob/LovSk/hgd/swmm/Hag
		L/fmob/LSil/hgd/a/Ha
		L/fmob/LSil/hgd/fbcmmlfc/DC
		L/fmob/LSil/hgd/fbcmmlfc/Hd
		L/fmob/LSil/hgd/fdfm/A
		L/fmob/LSil/hgd/fdfm/Hag
		L/fmob/LSil/hgd/fgfwd/Hag
		L/fmob/LSil/hgd/flpmm/Hag
		L/fmob/LSil/hgd/fppm/Hag
		L/fmob/LSil/hgd/hmd/A
		L/fmob/LSil/hgd/hmd/Ha
		L/fmob/LSil/hgd/hmd/Hag
		L/fmob/LSil/hgd/hmd/Hdr
		L/fmob/LSil/hgd/hmm/Hag
		L/fmob/LSil/hgd/hwm/Hag
		L/fmob/LSil/hgd/smaf/Hag
		L/fmob/LSil/hgd/swmmgrlfc/Hwc
		L/fmob/LSil/hus/hbwif/Hag
		L/fmob/LSilor/hgd/hmd/Hag
		L/fmob/LSilor/hgd/hmm/Hag
		L/fmob/LSilor/hgd/swwm/Hag
		L/fto/LiShC/hus/hbwif/Hag
		L/fto/LovSk/hgd/fppd/Hag
		L/fto/LovSk/hgd/fppm/Hag
		L/fto/LovSk/hgd/fppm/Hdr

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Dry Graminoid Meadow (continued)		L/fto/LSil/hgd/flpd/Hag
		L/fto/LSil/hgd/hbwif/Hc
		L/fto/LSil/hgd/hgmcwmc/Hag
		L/fto/LSil/hgd/hmd/A
		L/fto/LSil/hgd/hmd/DC
		L/fto/LSil/hgd/hmd/Hag
		L/fto/LSil/hgd/hmm/A
		L/fto/LSil/hgd/hmm/Hag
		L/fto/LSil/hus/hbwif/Hc
		L/ftr/AsilovL/hgd/fdfwm/Hag
		L/ftr/AsilovL/hgd/fppm/Hc
		L/ftr/AsilovL/hus/husd/DC
		L/ftr/AsilovSk/hgd/flpd/Hag
		L/ftr/AsilovSk/hgd/hmm/Hag
		L/ftr/LiShC/hus/hbwif/Hag
		L/ftr/LovSk/hgd/fdfm/Hag
		L/ftr/LovSk/hgd/fppm/Hag
		L/ftr/LovSk/hgd/hmd/Hag
		L/ftr/LSil/hgd/a/Ha
		L/ftr/LSil/hgd/fdfd/Hag
		L/ftr/LSil/hgd/fdfm/Hag
		L/ftr/LSil/hgd/fdfm/Nf
		L/ftr/LSil/hgd/fdfwm/Hag
		L/ftr/LSil/hgd/fgfwd/Hag
		L/ftr/LSil/hgd/flpd/Hag
		L/ftr/LSil/hgd/flpmm/Hag
		L/ftr/LSil/hgd/fppd/Ha
		L/ftr/LSil/hgd/fppm/Hag
		L/ftr/LSil/hgd/hgmcwmc/Hag
		L/ftr/LSil/hgd/hmd/A
		L/ftr/LSil/hgd/hmd/Hag
		L/ftr/LSil/hgd/hmd/Hc
		L/ftr/LSil/hgd/hmd/Hdr
		L/ftr/LSil/hgd/hmm/Hag
		L/ftr/LSil/hgd/hwm/Hag
		L/ftr/LSilor/hgd/hwm/Hag
		L/H/DpCF/hgd/fppd/Hf
		L/H/DpCF/hgd/sbh/Hf
		L/H/LiShC/hus/hbwif/Hf
		L/H/LovSk/hgd/fbcmmlfc/Hag
		L/H/LovSk/hgd/fbcmmlfc/Hf

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Dry Graminoid Meadow (continued)		L/H/LovSk/hgd/hmd/Hf
		L/H/LovSk/hus/husd/Hf
		L/H/LSil/hus/hbwif/A
		L/H/LSil/hus/hbwif/He
		L/H/LSil/hus/husd/Hf
Lowland Loamy Forb Meadow	Moderate	L/fmob/LovSk/hfm/fdfwm/Hag
		L/fmob/LSil/hfm/fdfwm/Hag
		L/fmob/LSilor/hfm/hwm/Hag
		L/ftr/LSil/hfm/hmcm/A
Lowland Loamy Grand-fir Forest	Low	L/ff/LovSk/fnog/fgfwdo/A
		L/fmob/AsilovL/fncg/fgfcm/A
		L/fmob/AsilovSk/fncg/fgfcm/A
		L/fmob/AsilovSk/fncg/fgfcmo/A
		L/fmob/AsilovSk/fncg/fgfwd/A
		L/fmob/AsilovSk/fncg/fgfwdo/A
		L/fmob/AsilovSk/fngfw/fgfcmo/A
		L/fmob/AsilovSk/fnog/fdfwm/A
		L/fmob/AsilovSk/fnog/fgfc/A
		L/fmob/AsilovSk/fnog/fgfcm/A
		L/fmob/AsilovSk/fnog/fgfcmo/A
		L/fmob/AsilovSk/fnog/fgfcmo/Hcl
		L/fmob/AsilovSk/fnog/fgfeso/A
		L/fmob/AsilovSk/fnog/fgfwdo/A
		L/fmob/DpCF/fngfw/fgfes/A
		L/fmob/LovSk/fncg/fgfcm/A
		L/fmob/LovSk/fngfw/fgfcm/A
		L/fmob/LovSk/fngfw/fgfcmo/A
		L/fmob/LovSk/fnog/fdfwm/A
		L/fmob/LovSk/fnog/fgfcm/A
		L/fmob/LovSk/fnog/fgfcmo/A
		L/fmob/LovSk/fnog/fgfwd/A
		L/fmob/LSil/fncg/fgfcmo/A
		L/fmob/LSil/fngfw/fgfwd/A
		L/fmob/LSil/fnog/fgfcm/A
		L/fmob/LSil/fnog/fgfcmo/A
		L/fmob/LSil/fnog/fgfwd/A
		L/fmob/MDpCF/fnog/fgfcmo/A
		L/fmob/MDpCF/fnog/fgfes/Hft
		L/fto/AsilovL/fncg/fgfcm/A
		L/fto/AsilovSk/fnog/fgfcm/A
		L/fto/AsilovSk/fnog/fgfcmo/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Grand-fir Forest (continued)		L/fto/AsilovSk/fnog/fgfwdo/DC
		L/ftr/AsilovL/fncg/fgfcm/A
		L/ftr/AsilovL/fnog/fgfcm/A
		L/ftr/AsilovSk/fngfw/fgfcm/DC
		L/ftr/AsilovSk/fnog/fgfcm/A
		L/ftr/AsilovSk/fnog/fgfeso/A
		L/ftr/AsilovSk/fnog/fgfwd/A
		L/ftr/LiShC/fngfw/fgfcm/A
		L/ftr/LovSk/fncg/fgfcm/A
		L/ftr/LovSk/fnog/fgfcm/A
		L/ftr/LSil/fnog/fgfcm/A
		L/ftr/LSil/fnog/fgfcmo/A
		L/ftr/LSil/fnog/fgfwd/A
		L/ftr/MDpCF/fnog/fgfc/A
		L/H/DpCF/fnog/fgfc/Hft
Lowland Loamy Lodgepole Pine Forest	Low	L/fmob/AsilovL/fncl/flpmm/A
		L/fmob/AsilovL/fnol/flpmm/A
		L/fmob/AsilovL/fnwl/flpmm/A
		L/fmob/AsilovSk/fncl/flpd/A
		L/fmob/AsilovSk/fnol/flpd/A
		L/fmob/AsilovSk/fnol/fsfeso/Nf
		L/fmob/AsilovSk/fnwl/flpmm/A
		L/fmob/AsilovSk/fnwl/flpwm/A
		L/fmob/LGr/fnwl/flpmm/A
		L/fmob/LGr/fnwl/flpwm/Hcl
		L/fmob/LovSk/fncl/flpmm/A
		L/fmob/LovSk/fncl/flpmm/Hft
		L/fmob/LovSk/fncl/flpwm/A
		L/fmob/LovSk/fnol/flpmm/A
		L/fmob/LovSk/fnol/flpwm/A
		L/fmob/LovSk/fnol/fppm/A
		L/fmob/LovSk/fnwl/flpmm/A
		L/fmob/LovSk/fnwl/flpmm/Hag
		L/fmob/LovSk/fnwl/flpmm/Hcl
		L/fmob/LovSk/fnwl/flpwm/A
		L/fmob/LovSk/fnwl/fppm/Hag
		L/fmob/LSil/fncl/flpmm/A
		L/fmob/LSil/fnol/flpmm/A
		L/fmob/LSil/fnwl/flpmm/A
		L/fmob/LSil/fnwl/flpmm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Lodgepole Pine Forest (continued)		L/fmob/LSil/fnwl/flpmm/Hcl
		L/fmob/LSil/fnwl/flpwm/Hag
		L/fmob/LSilor/fncl/flpmm/A
		L/fmob/LSilor/fnol/flpmm/A
		L/fmob/SSkEnt/fncl/flpmm/Hft
		L/fmob/SSkEnt/fnol/flpmm/Hft
		L/fmob/SSkEnt/fnwl/flpmm/Hft
		L/fto/LiShC/fncl/fgfcmo/Nf
		L/fto/LiShC/fncl/flpd/A
		L/fto/LSil/fncl/flpd/A
		L/fto/LSil/fncl/flpmm/A
		L/fto/LSil/fnol/flpd/A
		L/fto/LSil/fnol/flpd/DC
		L/fto/LSil/fnol/flpmm/A
		L/fto/LSil/fnwl/flpd/Hag
		L/fto/LSil/fnwl/flpmm/Hag
		L/ftr/AsilovL/fncl/flpmm/A
		L/ftr/AsilovL/fnol/fgfcm/A
		L/ftr/AsilovL/fnol/flpd/A
		L/ftr/AsilovL/fnol/flpmm/A
		L/ftr/AsilovL/fnwl/flpmm/Hag
		L/ftr/AsilovSk/fnol/fgfwd/Nf
		L/ftr/LiShC/fncl/flpmm/A
		L/ftr/LiShC/fnol/flpmm/A
		L/ftr/LiShC/fnwl/flpmm/Hag
		L/ftr/LovSk/fncl/flpmm/A
		L/ftr/LovSk/fnol/flpmm/A
		L/ftr/LovSk/fnwl/flpmm/A
		L/ftr/LSil/fncl/flpd/A
		L/ftr/LSil/fncl/flpmm/A
		L/ftr/LSil/fnol/flpd/A
		L/ftr/LSil/fnol/flpmm/A
		L/ftr/LSil/fnwl/fgfcmo/Nf
		L/ftr/LSil/fnwl/flpd/A
		L/ftr/LSil/fnwl/flpd/Hag
		L/ftr/LSil/fnwl/flpmm/A
		L/ftr/LSil/fnwl/flpmm/Hag
		L/ftr/LSil/fnwl/flpmm/Hft

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Low Elevation Mixed Shrubland	Low	L/fmob/DpSiCL/smxlc/smxl/Hag
		L/fmob/LovSk/smxlc/fbcmmlfc/Ha
		L/fmob/LovSk/smxlc/smxl/DC
		L/fmob/LSil/smxlc/smmgrlfc/Ha
		L/fmob/LSil/smxlc/smxl/Hag
		L/fmob/LSil/smxlc/smxl/Hwc
		L/fmob/LSil/smxlc/swmmgrlfc/Hwd
		L/fmob/LSil/smxlo/smxl/DC
		L/fmob/LSil/smxlo/smxl/Ha
		L/fmob/LSil/smxlo/smxl/Hf
		L/fmob/LSil/smxlo/smxl/Hwc
		L/fmob/LSilbr/smxlc/swmmgrlfc/Ha
		L/fmob/LSilbr/smxlc/swmmgrlfc/Hag
		L/fmob/LSilbr/smxlo/smxl/Ha
		L/fmob/LSilbr/smxlo/swmmgrlfc/Hag
		L/fmob/Water/smxlo/smxl/DC
		L/Fmolp/LSil/smxlc/swmmgrlfc/Hag
		L/Fmolp/LSil/smxlo/smxl/DC
		L/Fmrox/LSil/smxlc/smxl/DC
		L/Fmrox/LSil/smxlc/smxl/Ha
		L/Fmrox/LSilbr/smxlc/smxl/DC
		L/fto/LiShC/smxlc/smxl/Hag
		L/H/LSilbr/smxlc/swmmgrlfc/Hwd
		L/Wh/LGr/smxlc/smxl/Hwc
		L/Wh/LGr/smxlo/smxl/Hwc
		L/Wh/LGr/smxlo/smxl/Hwd
Lowland Loamy Moist Graminoid Meadow	Moderate	L/ff/DpCF/hgm/fppm/Hag
		L/ff/LSil/hgm/hmm/Hag
		L/fmob/AsilovL/hgm/flpmm/Hag
		L/fmob/AsilovSk/hgm/hmcm/DC
		L/fmob/AsilovSk/hgm/hmm/A
		L/fmob/AsilovSk/hgm/hmm/Hcl
		L/fmob/LovSk/hgm/fbcmmlfc/DC
		L/fmob/LovSk/hgm/fbcmmlfc/Hag
		L/fmob/LovSk/hgm/fbcmmlfc/Hd
		L/fmob/LovSk/hgm/fbct/Hag
		L/fmob/LovSk/hgm/fdfm/Hag
		L/fmob/LovSk/hgm/fdfm/Hc
		L/fmob/LovSk/hgm/fdfwm/DC

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Moist Graminoid Meadow (continued)		L/fmob/LovSk/hgm/fdfwm/Hag
		L/fmob/LovSk/hgm/fdfwm/Hc
		L/fmob/LovSk/hgm/fdfwm/Hcl
		L/fmob/LovSk/hgm/flpmm/Hag
		L/fmob/LovSk/hgm/flpmm/Hcl
		L/fmob/LovSk/hgm/fppm/Hag
		L/fmob/LovSk/hgm/hgmcwmc/Hag
		L/fmob/LovSk/hgm/hmm/A
		L/fmob/LovSk/hgm/hmm/DC
		L/fmob/LovSk/hgm/hmm/Hag
		L/fmob/LovSk/hgm/hwm/Hag
		L/fmob/LovSk/hgm/sbh/Hag
		L/fmob/LovSk/hgm/smaf/Hag
		L/fmob/LovSk/hgm/smawm/Hc
		L/fmob/LovSk/hgm/swmm/Hag
		L/fmob/LovSk/hgm/swmmgrlfc/DC
		L/fmob/LovSk/hgm/swwm/Hag
		L/fmob/LovSk/hgm/xd/Hdr
		L/fmob/LSil/hgm/fbbcwf/Hag
		L/fmob/LSil/hgm/fbclf/Hag
		L/fmob/LSil/hgm/fbcmmlfc/Hag
		L/fmob/LSil/hgm/fbcmmlfc/Hwl
		L/fmob/LSil/hgm/fbct/Hag
		L/fmob/LSil/hgm/fbct/Hf
		L/fmob/LSil/hgm/fdfm/Hag
		L/fmob/LSil/hgm/flpmm/Hag
		L/fmob/LSil/hgm/flpmm/Hcl
		L/fmob/LSil/hgm/fppm/Hag
		L/fmob/LSil/hgm/hfmm/Hag
		L/fmob/LSil/hgm/hgmcwmc/Hag
		L/fmob/LSil/hgm/hmcm/Hag
		L/fmob/LSil/hgm/hmm/DC
		L/fmob/LSil/hgm/hmm/Hag
		L/fmob/LSil/hgm/hwm/Hag
		L/fmob/LSil/hgm/sbh/Hag
		L/fmob/LSil/hgm/swmm/Hag
		L/fmob/LSil/hgm/swmmgrlfc/DC
		L/fmob/LSil/hgm/swmmgrlfc/Hag
		L/fmob/LSil/hgm/swmmgrlfc/Hdr
		L/fmob/LSil/hgm/swmmgrlfc/Hwc
		L/fmob/LSil/hgm/swmmgrlfc/Hwl

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Moist Graminoid Meadow (continued)		L/fmob/LSil/hgm/swwm/Hag
		L/fmob/LSilbr/hgm/fbcmmlfc/Hag
		L/fmob/LSilbr/hgm/swmmgrblfc/DC
		L/fmob/LSilbr/hgm/swmmgrblfc/Hag
		L/fmob/LSilbr/hgm/swmmgrlfc/Hag
		L/fmob/LSilbr/hgm/swmmgrlfc/Hwl
		L/fmob/LSilor/hgm/flpmm/A
		L/fmob/LSilor/hgm/flpmm/Hag
		L/fmob/LSilor/hgm/hfmm/Hag
		L/fmob/LSilor/hgm/hgmcwmc/Hag
		L/fmob/LSilor/hgm/hmm/Hag
		L/fmob/LSilor/hgm/hwm/Hag
		L/fmoi/LSil/hgm/swmmgrlfc/Hag
		L/fmoi/LSilbr/hgm/swmmgrblfc/Hag
		L/fmoi/LSilbr/hgm/swmmgrlfc/Hag
		L/Fmolp/LSil/hgm/fbbcwf/DC
		L/Fmolp/LSil/hgm/smxl/Ngfe
		L/Fmolp/LSil/hgm/swmmgrlfc/DC
		L/Fmolp/LSil/hgm/swmmgrlfc/Hag
		L/Fmolp/LSil/hgm/swmmgrlfc/Hwc
		L/Fmolp/LSilbr/hgm/fbbcwf/DC
		L/Fmolp/LSilbr/hgm/fbbcwf/Hag
		L/Fmolp/LSilbr/hgm/hmm/Hag
		L/Fmolp/LSilbr/hgm/swmmgrlfc/DC
		L/Fmolp/LSilbr/hgm/swmmgrlfc/Hag
		L/Fmolp/LSilbr/hgm/swmmgrlfc/Hwc
		L/fmri/LovSk/hgm/fbcmmlfc/Hag
		L/fmri/LovSk/hgm/hmm/Ngfe
		L/fmri/LSil/hgm/swmmgrlfc/Hag
		L/fmri/LSilbr/hgm/swmmgrlfc/Hag
		L/fto/AsilovCF/hgm/hmm/Hag
		L/fto/LiShC/hgm/hmm/Hag
		L/fto/LiShC/hgm/swmm/DC
		L/fto/LSil/hgm/flpd/Hag
		L/fto/LSil/hgm/flpmm/Hag
		L/fto/LSil/hgm/hmm/DC
		L/fto/LSil/hgm/hmm/Hag
		L/fto/LSil/hgm/swmm/Hag
		L/fto/LSilor/hgm/fgfcmo/Hag
		L/fto/LSilor/hgm/hgmcwmc/Hag
		L/ftr/AsilovCF/hgm/hmm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Moist Graminoid Meadow (continued)		L/ftr/AsilovL/hgm/fdfwm/Hc
		L/ftr/AsilovL/hgm/flpmm/Hcl
		L/ftr/AsilovSk/hgm/hmm/DC
		L/ftr/DpCF/hgm/hmm/DC
		L/ftr/LiShC/hgm/hmm/Hag
		L/ftr/LovSk/hgm/fbcmmlfc/Hag
		L/ftr/LSil/hgm/fbclf/Hag
		L/ftr/LSil/hgm/fbcmmlfc/Hag
		L/ftr/LSil/hgm/fdfd/Hag
		L/ftr/LSil/hgm/fdfm/Hag
		L/ftr/LSil/hgm/fdfm/Hdr
		L/ftr/LSil/hgm/flpmm/Hag
		L/ftr/LSil/hgm/flpmm/Hcl
		L/ftr/LSil/hgm/fppd/Hag
		L/ftr/LSil/hgm/fppm/Hag
		L/ftr/LSil/hgm/hgmcwmc/DC
		L/ftr/LSil/hgm/hgmcwmc/Hag
		L/ftr/LSil/hgm/hmcm/Hag
		L/ftr/LSil/hgm/hmm/A
		L/ftr/LSil/hgm/hmm/DC
		L/ftr/LSil/hgm/hmm/Hag
		L/ftr/LSil/hgm/hwm/Hag
		L/ftr/LSil/hgm/swmm/Hag
		L/ftr/LSil/hgm/swwm/Hag
		L/ftr/LSilor/hgm/flpmm/Hag
		L/ftr/LSilor/hgm/hgmcwmc/Hag
		L/ftr/LSilor/hgm/hmm/Hag
		L/ftr/LSilor/hgm/hwm/Hag
		L/ftr/LSilor/hgm/swmm/Hag
		L/H/LiShC/hgm/hmm/Nf
		L/H/LovSk/hgm/hmm/DC
		L/H/LSil/hgm/fbbcwf/Hwl
		L/H/LSil/hgm/hmm/Hwl
		L/H/LSil/hgm/smxl/Hag
		L/H/LSil/hgm/smxl/Hwl
		L/H/LSil/hgm/swmmgrlfc/Hwd
		L/H/LSil/hgm/swmmgrlfc/Hwl
		L/H/LSilbr/hgm/fbbcwf/Hwl
		L/H/LSilbr/hgm/swmmgrblfc/Hag
		L/H/LSilbr/hgm/swmmgrblfc/Hf
		L/H/LSilbr/hgm/swmmgrlfc/Hwl

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Moist Graminoid Meadow (continued)		L/Wh/LovSk/hgm/fbcmmlfc/Hwc
		L/Wh/LSil/hgm/fbbcwf/Hwc
		L/Wh/LSil/hgm/swmmgrlfc/Hwc
		L/Wh/LSilbr/hgm/fbbcwf/Hwc
		L/Wh/LSilbr/hgm/swmmgrlfc/Hwe
Lowland Loamy Ponderosa Pine Forest	Low	L/ff/AsilovCF/fncpp/fppm/A
		L/ff/LGr/fnwpp/fppm/A
		L/ff/LovSk/fnopp/fppmo/A
		L/fmob/LGr/fnwpp/fppmo/DC
		L/fmob/LovSk/fncpp/fbcmmlfc/A
		L/fmob/LovSk/fncpp/fppm/A
		L/fmob/LovSk/fncpp/fppm/Ngfd
		L/fmob/LovSk/fnopp/fbclf/A
		L/fmob/LovSk/fnopp/fbcmmlfc/A
		L/fmob/LovSk/fnopp/fbcmmlfc/Ha
		L/fmob/LovSk/fnopp/fppm/A
		L/fmob/LovSk/fnopp/fppm/DC
		L/fmob/LovSk/fnopp/fppm/Hag
		L/fmob/LovSk/fnopp/fppm/Hdr
		L/fmob/LovSk/fnopp/fppmo/A
		L/fmob/LovSk/fnwpp/fbcmmlfc/A
		L/fmob/LovSk/fnwpp/fdfd/A
		L/fmob/LovSk/fnwpp/fppd/A
		L/fmob/LovSk/fnwpp/fppm/A
		L/fmob/LovSk/fnwpp/fppmo/A
		L/fmob/LSil/fncpp/fppm/A
		L/fmob/LSil/fnopp/fppd/A
		L/fmob/LSil/fnopp/fppm/A
		L/fmob/LSil/fnopp/fppmo/A
		L/fmob/LSil/fnopp/swmmgrlfc/Ha
		L/fmob/LSil/fnwpp/fppm/A
		L/fmob/LSil/fnwpp/fppmo/A
		L/fmoi/LovSk/fnwpp/fppm/Hag
		L/fto/LovSk/fnwpp/fppd/A
		L/fto/LovSk/fnwpp/swgb/A
		L/fto/LSil/fnwpp/fppd/DC
		L/fto/MDpCF/fnwpp/wpps/A
		L/ftr/AsilovSk/fnopp/fppd/A
		L/ftr/LovSk/fnopp/fbcmmlfc/A
		L/ftr/LovSk/fnopp/fdfd/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Ponderosa Pine Forest (continued)		L/ftr/LovSk/fnwpp/fppd/A
		L/ftr/LovSk/fnwpp/fppm/A
		L/ftr/LSil/fncpp/fppd/A
		L/ftr/LSil/fnwpp/fppm/A
		L/ftr/LSil/fnwpp/wpps/A
		L/ftr/MDpCF/fnopp/fdfd/A
Lowland Loamy Spruce Forest	Low	L/fmob/LovSk/fnces/fes/A
		L/fmob/LovSk/fnces/fgfcm/A
		L/fmob/LovSk/fnoes/fes/A
		L/fmob/LovSk/fnoes/fgfcm/A
		L/fmob/LovSk/fnoes/fgfcmo/A
		L/fmob/LovSk/fnoes/fgfeso/A
		L/fmob/LSil/fnces/fgfeso/A
		L/fmob/LSil/fnoes/fgfeso/A
		L/ftr/AsilovL/fnoes/fes/A
		L/ftr/AsilovL/fnoes/fsfes/A
		L/ftr/LSil/fnces/fgfeso/A
Lowland Loamy Subalpine Fir Forest	Low	L/fmob/AsilovSk/fnscf/fsfes/A
		L/fmob/DpCF/fnscf/fsfes/A
		L/fmob/DpCF/fnsfo/fsfd/A
		L/fmob/DpCF/fnsfw/fsfes/A
		L/fmob/LSilor/fnscf/fsfes/A
		L/fmob/LSilor/fnsfo/fsfes/A
		L/ftr/AsilovSk/fnscf/fsfd/A
		L/ftr/AsilovSk/fnscf/fsfes/A
Lowland Loamy Thinleaf Alder Tall Shrub	Low	L/ff/DpCF/stcat/fdfm/Hdr
		L/fmob/AsilovSk/stoat/smaf/A
		L/fmob/LGr/stcat/fdfwm/A
		L/fmob/LGr/stcat/smaf/A
		L/fmob/LGr/stcat/smaf/Hag
		L/fmob/LGr/stoat/smaf/Hag
		L/fmob/LiShC/stcat/smalf/Hag
		L/fmob/LovSk/stcat/smaf/A
		L/fmob/LovSk/stcat/smaf/DC
		L/fmob/LovSk/stcat/smaf/Hag
		L/fmob/LovSk/stcat/smaf/Hc
		L/fmob/LovSk/stcat/smalf/DC
		L/fmob/LovSk/stcat/smalf/Hag
		L/fmob/LovSk/stoat/fbclf/DC

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Thinleaf Alder Tall Shrub (continued)		L/fmob/LovSk/stoat/fdfwm/A
		L/fmob/LovSk/stoat/smaf/A
		L/fmob/LovSk/stoat/smaf/DC
		L/fmob/LovSk/stoat/smaf/Hag
		L/fmob/LovSk/stoat/smalf/Hag
		L/fmob/LSil/stcat/smaf/Hag
		L/fmob/LSil/stoat/smaf/Hag
		L/fmob/LSil/stoat/smalf/Hag
		L/fmob/MDpCF/stcat/fbclf/Hag
		L/fmob/MDpCF/stcat/smalf/Hag
		L/fmob/MDpCF/stoat/fbcmmlfc/Hag
		L/fmob/SSkEnt/stcat/fdfwm/Hag
		L/fmob/SSkEnt/stcat/smaf/Hft
		L/fmri/LovSk/stoat/smalf/Hag
		L/H/LovSk/stoat/smawm/DC
Lowland Loamy Willow Forest	Low	L/fmob/LovSk/fbos/fbww/A
		L/fmob/LSil/fbcs/fbbcwf/DC
		L/fmob/LSil/fbos/fbww/Hag
		L/fmob/LSilbr/fbos/swmmgrlfc/Hag
		L/fmob/LSilbr/fbos/swmmgrlfc/Hwd
		L/fmoi/LSilbr/fbos/fbbcwf/Hag
		L/Fmolp/LSil/fbos/fbww/Hag
		L/Fmolp/LSilbr/fbcs/fbbcwf/A
		L/Fmrox/LSil/fbos/swmmgrlfc/Hag
		L/H/LSil/fbos/swmmgrlfc/Hwd
		L/H/LSilbr/fbcs/swmmgrlfc/Hwl
		L/Wh/LSil/fbos/swmmgrlfc/Hwc
Lowland Loamy Willow Low and Tall Shrub	Low	L/fmob/LGr/stow/swwm/A
		L/fmob/LovSk/stcw/fbcmmlfc/DC
		L/fmob/LovSk/stcw/fbcmmlfc/He
		L/fmob/LovSk/stcw/sbh/Hag
		L/fmob/LovSk/stcw/swmm/Hag
		L/fmob/LovSk/stow/fbbcwf/A
		L/fmob/LovSk/stow/swmm/Hag
		L/fmob/LSil/stcw/fbbcwf/DC
		L/fmob/LSil/stcw/swmmgrlfc/Hag
		L/fmob/LSil/stow/fbcmmlfc/DC
		L/fmob/LSil/stow/swmm/Hag
		L/fmob/LSil/stow/swmmgrlfc/Hag
		L/fmob/LSil/stow/swmmgrlfc/Hah

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy Willow Low and Tall Shrub (continued)		L/fmob/LSil/stow/swwm/A
		L/fmob/MDpCF/stcw/fdfm/DC
		L/fmoi/LSil/stcw/fbbcwf/Hag
		L/fmoi/LSil/stcw/swmmgrlfc/Hag
		L/fmoi/LSilbr/stcw/fbbcwf/Hag
		L/fmoi/LSilbr/stcw/swmmgrlfc/Hag
		L/Fmolp/LSilbr/stcw/swmmgrlfc/Hac
		L/fmri/LovSk/stow/fbcmmlfc/Hag
		L/Fmrox/LSil/stow/swwm/DC
		L/fto/MDpCF/stcw/swmm/DC
		L/ftr/LSil/stcw/swmm/DC
		L/Wh/LovSk/stow/swwm/Hwe
		L/Wh/LSilbr/stow/swmmgrlfc/Hwc
		L/Wh/Water/stow/swmmgrlfc/Hwe
Lowland Loamy-Organic Wet Graminoid Meadow	Low	L/fmob/LovSk/hgw/fbclf/Hag
		L/fmob/LovSk/hgw/hgmcwmc/Hag
		L/fmob/LovSk/hgw/hwm/Hag
		L/fmob/LovSk/hgwmcc/fbcmmlfc/Hag
		L/fmob/LovSk/hgwmcc/hgmcwmc/DC
		L/fmob/LovSk/hgwmcc/hgmcwmc/Hag
		L/fmob/LovSk/hgwmcc/swmm/Hag
		L/fmob/LSil/hgw/hwm/DC
		L/fmob/LSil/hgw/hwm/Hag
		L/fmob/LSil/hgw/swmmgrlfc/Hag
		L/fmob/LSil/hgwmcc/hgmcwmc/A
		L/fmob/LSil/hgwmcc/hgmcwmc/DC
		L/fmob/LSil/hgwmcc/hgmcwmc/Hag
		L/fmob/LSil/hgwmcc/hwm/Hag
		L/fmob/LSil/hgwmcc/swmmgrlfc/Hag
		L/fmob/LSil/hgwmcc/swwm/Hag
		L/fmob/LSilbr/hgw/swmmgrblfc/Hag
		L/fmob/LSilbr/hgw/swmmgrlfc/Hag
		L/fmob/LSilbr/hgwmcc/fbbcwf/Ngfe
		L/fmob/LSilbr/hgwmcc/hgmcwmc/Hag
		L/fmob/LSilbr/hgwmcc/swmmgrlfc/Hag
		L/fmob/LSilor/hgw/hwm/A
		L/fmob/LSilor/hgw/hwm/Hag
		L/fmob/LSilor/hgw/swwm/Hag
		L/fmob/LSilor/hgwmcc/hwm/Hag
		L/fmoi/LSil/hgw/swmmgrlfc/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Loamy-Organic Wet Graminoid Meadow (continued)		L/fmoi/LSilbr/hgw/swmmgrblfc/Hag
		L/fmoi/LSilbr/hgw/swmmgrlfc/Hag
		L/fmoi/LSilbr/hgwmcc/swmmgrlfc/Hag
		L/Fmolp/LSilbr/hgw/swmmgrblfc/Hag
		L/fmri/AsilovSk/hgw/hwm/A
		L/fmri/LovSk/hgw/smawm/Hag
		L/Fmrox/LSilbr/hgw/swmmgrlfc/Hag
		L/fto/LSil/hgw/hwm/Hag
		L/fto/LSil/hgwmcc/hgmcwmc/Hag
		L/fto/LSilor/hgw/hwm/A
		L/fto/LSilor/hgw/hwm/Hag
		L/fto/LSilor/hgwmcc/hwm/Hag
		L/ftr/AsilovSk/hgw/hwm/Hag
		L/ftr/LSil/hgw/hmcm/Hag
		L/ftr/LSil/hgw/hwm/DC
		L/ftr/LSil/hgwmcc/hwm/Hag
		L/ftr/LSilor/hgw/hwm/Hag
		L/ftr/LSilor/hgw/hwmc/A
		L/ftr/LSilor/hgw/swwm/Hag
		L/ftr/LSilor/hgwmcc/hwm/Hag
		L/H/LovSk/hgw/hwm/Hwd
		L/H/LSil/hgw/hwm/Hwd
		L/H/LSilor/hgw/hwm/Hrr
		L/Of/LSilor/hgw/hwm/A
		L/Of/LSilor/hgw/hwmc/Hag
		L/Of/LSilor/hgwmcc/hgmccwmc/Hag
		L/Of/LSilor/hgwmcc/hgmcwmc/A
		L/Wh/LovSk/hgw/fbcmmlfc/Hwc
		L/Wh/LSil/hgw/fbcmmlfc/Hwc
		L/Wh/LSil/hgw/hwm/Hwc
		L/Wh/LSil/hgw/swmmgrlfc/Hwc
		L/Wh/LSilbr/hgw/swmmgrlfc/Hwc
		L/Wh/LSilor/hgwmcc/swmmgrlfc/Hwe
		L/Wh/Water/hgw/swmmgrlfc/Hwc
		L/Wh/Water/hgw/swmmgrlfc/Hwd
Lowland Rocky Dry Graminoid Meadow	High	L/ff/LGr/hgd/fppm/Hag
		L/ff/LGr/hgd/hmd/Hah
		L/ff/LGr/hgd/husgbwc/Ha
		L/ff/LGr/hgd/husgbwc/Hag
		L/ff/LGr/hgd/husgbwc/Hah

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Lowland Rocky Dry Graminoid Meadow (continued)		L/ff/LGr/hus/husgbwc/Hag
		L/ff/LGr/hus/husgbwc/Hp
		L/fmob/LGr/hgd/fbct/Hag
		L/fmob/LGr/hgd/fdfwm/DC
		L/fmob/LGr/hgd/fppm/Hag
		L/fmob/LGr/hgd/smaf/Hag
		L/fmob/LGr/hgd/smawm/Hag
		L/fmob/MDpCF/hgd/hmd/Hag
		L/fmob/SSkEnt/hgd/hmd/DC
		L/fmob/SSkEnt/hgd/smaf/Hc
		L/ftr/LGr/hgd/fdfm/Hag
		L/H/LGr/hus/husd/Hf
		L/H/LGr/hus/husgbwc/Hf
Lowland Rocky Moist Graminoid Meadow	Moderate	L/fmob/LGr/hgm/fbct/Hag
		L/fmob/LGr/hgm/fppmo/DC
		L/fmob/LGr/hgm/hgmcwmc/Hag
		L/fmob/LGr/hgm/hmm/DC
		L/fmob/LGr/hgm/hmm/Hag
		L/fmob/LGr/hgm/swmm/A
		L/fmob/LGr/hgm/swmm/Hag
		L/fmob/LGr/hgm/swwm/Hag
		L/fmob/SSkEnt/hgm/hmm/Hag
Riverine Complex	Moderate	L/fmob/LGr/xr/smawm/Hag
		L/fmob/SSkEnt/xr/smawm/Hag
		L/Wh/LSilbr/xr/swmmgrlfc/Hwc
		R/fmoa/LGr/xr/fbbcwf/Hag
		R/fmoa/LGr/xr/swwm/Hag
		R/fmoa/LovSk/xr/fes/A
		R/fmoa/LovSk/xr/xru/A
		R/fmoa/LovSk/xr/xru/Hag
		R/fmoa/SSkEnt/xr/fbbcwf/Hag
		R/fmoa/SSkEnt/xr/fbcf/Ngfd
		R/fmoa/SSkEnt/xr/hgfgb/Ngfe
		R/fmoa/SSkEnt/xr/sbh/Ngfe
		R/fmoa/SSkEnt/xr/swgb/Ngfe
		R/fmoi/LGr/fboc/fbct/DC
		R/fmoi/LGr/xr/fbbcwf/Hag
		R/fmoi/LGr/xr/fbcf/Hag
		R/fmoi/LGr/xr/fbct/Hc
		R/fmoi/LGr/xr/fdfm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Complex (continued)		R/fmoi/LGr/xr/flpmm/Hag
		R/fmoi/LGr/xr/hmcm/Hag
		R/fmoi/LGr/xr/smaf/A
		R/fmoi/LGr/xr/smaf/Hag
		R/fmoi/LGr/xr/smawm/Hag
		R/fmoi/LGr/xr/swmm/Hag
		R/fmoi/LGr/xr/swwm/A
		R/fmoi/LGr/xr/swwm/Hag
		R/fmoi/LovSk/xr/fbcmmlfc/Hah
		R/fmoi/LovSk/xr/fbct/Hag
		R/fmoi/LovSk/xr/flpmm/A
		R/fmoi/LovSk/xr/flpmm/Hag
		R/fmoi/LovSk/xr/smaf/A
		R/fmoi/LovSk/xr/xru/Hag
		R/fmoi/LSilor/xr/hmcm/A
		R/fmoi/LSilor/xr/swwm/A
		R/fmoi/LSilor/xr/swwm/Hag
		R/fmoi/LSilor/xr/xru/A
		R/fmoi/SSkEnt/xr/smaf/A
		R/fmrac/LovSk/xr/hgfgb/Hag
		R/fmrac/SSkEnt/xr/fdfwm/Ngfe
		R/fmrac/SSkEnt/xr/hgfgb/Ngfe
		R/fmrac/SSkEnt/xr/swgb/Hag
		R/fmrac/SSkEnt/xr/swgb/Ngfe
		R/fmrac/SSkEnt/xr/xrl/Ngfe
		R/fmrac/SSkEnt/xr/xrm/A
		R/fmrac/SSkEnt/xr/xrm/DC
		R/fmrac/SSkEnt/xr/xrm/Hag
		R/fmrac/SSkEnt/xr/xrm/Ngfe
		R/fmrac/SSkEnt/xr/xru/A
		R/fmrac/SSkEnt/xr/xru/Hag
		R/fmri/LGr/xr/fdfwm/Hag
		R/fmri/LGr/xr/swgb/Ngfd
		R/fmri/SSkEnt/xr/fbcf/Hag
Riverine Loamy Black Cottonwood Forest	Low	R/fmoa/LiShC/fboc/fbclf/A
		R/fmoa/LovSk/fboc/fbbcwf/Ngfe
		R/fmoa/LovSk/fboc/fbcf/A
		R/fmoa/LovSk/fboc/fbcf/Hd
		R/fmoa/LovSk/fboc/fbclf/A
		R/fmoa/LovSk/fboc/fbclf/DC

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Black Cottonwood Forest (continued)		R/fmoa/LovSk/fboc/fbclf/Hwc
		R/fmoa/LovSk/fboc/fbclf/Ngfd
		R/fmoa/LovSk/fboc/fbclf/Ngfe
		R/fmoa/LovSk/fmbcdfc/fdflm/A
		R/fmoa/LovSk/fmbcdfo/fbclf/A
		R/fmoa/LovSk/fmbceso/fbcf/A
		R/fmoa/LovSk/fmbcppo/fbcf/A
		R/fmoa/LovSk/fmbcppo/fbclf/A
		R/fmoa/LovSk/fmbcppo/fbclf/Hag
		R/fmoa/LovSk/fmbcppo/fppmo/A
		R/fmoa/LSil/fboc/fbclf/A
		R/fmoa/LSil/fboc/fbclf/Hwc
		R/fmob/LovSk/fboc/fbclf/A
		R/fmoi/LovSk/fbcc/fbcf/A
		R/fmoi/LovSk/fbcc/fbclf/A
		R/fmoi/LovSk/fbcc/fbclf/DC
		R/fmoi/LovSk/fbcc/fbclf/Ngfd
		R/fmoi/LovSk/fbcc/fbct/A
		R/fmoi/LovSk/fboc/fbcf/A
		R/fmoi/LovSk/fboc/fbcf/DC
		R/fmoi/LovSk/fboc/fbcf/Hag
		R/fmoi/LovSk/fboc/fbcf/Ngfd
		R/fmoi/LovSk/fboc/fbclf/A
		R/fmoi/LovSk/fboc/fbclf/DC
		R/fmoi/LovSk/fboc/fbclf/Ngfe
		R/fmoi/LovSk/fboc/fbct/A
		R/fmoi/LovSk/fboc/fbct/DC
		R/fmoi/LovSk/fbwc/fbcf/A
		R/fmoi/LovSk/fbwc/fbct/A
		R/fmoi/LovSk/fbwc/fbct/DC
		R/fmoi/LovSk/fmbcdfo/fbclf/A
		R/fmoi/LovSk/fmbcdfo/fdfwm/A
		R/fmoi/LovSk/fmbcdfo/fdfwm/DC
		R/fmoi/LovSk/fmbceso/fes/A
		R/fmoi/LovSk/fmbceso/fgfcm/A
		R/fmoi/LovSk/fmbcgfo/fgfcmo/A
		R/fmoi/LovSk/fmbcppo/fbcf/A
		R/fmoi/LovSk/fmbcppo/fbclf/A
		R/fmoi/LovSk/fmbcppo/fppmo/A
		R/fmoi/LSil/fbcc/fbcf/Hd
		R/fmoi/LSil/fbcc/fbclf/Hdr

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Black Cottonwood Forest (continued)		R/fmoi/LSil/fboc/fbcf/A
		R/fmoi/LSil/fboc/fbcf/DC
		R/fmoi/LSil/fboc/fbclf/A
		R/fmoi/LSil/fboc/fbclf/Hd
		R/fmoi/LSil/fmbcppo/fppmo/A
		R/fmrac/LovSk/fboc/fbcf/DC
Riverine Loamy Douglas-fir Forest	Low	R/fmoa/LGr/fndfw/fdfwm/A
		R/fmoa/LiShC/fnodf/fdfmo/A
		R/fmoa/LovSk/fnodf/fdfwm/A
		R/fmoa/SSkEnt/fndfw/fdfwm/A
		R/fmoi/LGr/fncdf/fdfwm/A
		R/fmoi/LGr/fndfw/fdfwm/A
		R/fmoi/LGr/fnodf/fdfm/A
		R/fmoi/LGr/fnodf/fdfwm/A
		R/fmoi/LiShC/fndfw/fdfwm/A
		R/fmoi/LovSk/fncdf/fdfm/A
		R/fmoi/LovSk/fncdf/fdfwm/A
		R/fmoi/LovSk/fndfw/fdfm/A
		R/fmoi/LovSk/fndfw/fdfmo/A
		R/fmoi/LovSk/fndfw/fdfmo/Ngfe
		R/fmoi/LovSk/fndfw/fdfwm/A
		R/fmoi/LovSk/fndfw/fdfwm/DC
		R/fmoi/LovSk/fndfw/fdfwm/Nf
		R/fmoi/LovSk/fnodf/fdfd/A
		R/fmoi/LovSk/fnodf/fdfm/A
		R/fmoi/LovSk/fnodf/fdfwm/A
		R/fmoi/LovSk/fnodf/fdfwm/DC
		R/fmoi/LSil/fnodf/fdfm/A
		R/fmoi/LSil/fnodf/fdfmo/A
		R/fmoi/LSil/fnodf/fdfwm/A
		R/fmoi/MDpCF/fncdf/fdfwm/A
		R/fmoi/MDpCF/fndfw/fdfwm/A
		R/fmoi/MDpCF/fnodf/fdfm/DC
		R/fmoi/MDpCF/fnodf/fdfwm/A
		R/fmoi/SSkEnt/fndfw/fdfwm/A
		R/fmoi/SSkEnt/fnodf/fdfd/Ngfe
		R/fmoi/SSkEnt/fnodf/fdfwm/A
Riverine Loamy Forb Meadow	Moderate	R/fmoi/LGr/hfm/swmm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Low Elevation Mixed Shrubland	Low	R/fmoa/LovSk/smxlc/fbclf/Hag
		R/fmoa/LovSk/smxlc/smxl/Hwc
		R/fmoa/LovSk/smxlo/smxl/Hwc
		R/fmoa/LSil/smxlc/smxl/Hag
		R/fmoa/LSil/smxlc/smxl/Hah
		R/fmoa/LSil/smxlc/smxl/Hwc
		R/fmoa/LSil/smxlc/smxl/Ngfd
		R/fmoa/LSil/smxlc/smxl/Ngfe
		R/fmoa/LSil/smxlo/fbbcwf/Ngfe
		R/fmoa/LSil/smxlo/smxl/Hag
		R/fmoa/LSil/smxlo/smxl/Hwc
		R/fmoa/LSil/smxlo/smxl/Ngfd
		R/fmoa/LSil/smxlo/smxl/Ngfe
		R/fmoa/LSilbr/smxlc/smxl/Hag
		R/fmoa/LSilbr/smxlc/smxl/Hwc
		R/fmoa/LSilbr/smxlc/smxl/Ngfe
		R/fmoa/LSilbr/smxlo/fbbcwf/Ngfe
		R/fmoa/LSilbr/smxlo/smxl/Hag
		R/fmoa/LSilbr/smxlo/smxl/Hwc
		R/fmoa/LSilbr/smxlo/smxl/Ngfd
		R/fmoa/LSilbr/smxlo/smxl/Ngfe
		R/fmoa/LSilbr/smxlo/swmmgrlfc/Hag
		R/fmoa/LSilbr/smxlo/swmmgrlfc/Ngfe
		R/fmoa/SSkEnt/smxlc/smxl/Hwc
		R/fmoa/SSkEnt/smxlc/smxl/Ngfd
		R/fmoi/LovSk/smxlo/smxl/DC
		R/fmoi/LSil/smxlc/smxl/Hag
		R/fmoi/LSil/smxlc/smxl/Hwc
		R/fmoi/LSil/smxlc/swmmgrlfc/Hag
		R/fmoi/LSil/smxlo/smmgrlfc/Hag
		R/fmoi/LSil/smxlo/smxl/Ha
		R/fmoi/LSil/smxlo/smxl/Hag
		R/fmoi/LSil/smxlo/smxl/Hwc
		R/fmoi/LSil/smxlo/smxl/Ngfe
		R/fmoi/LSil/smxlo/swmmgrlfc/Hag
		R/fmoi/LSilbr/smxlc/smxl/Hag
		R/fmoi/LSilbr/smxlc/smxl/Ngfe
		R/fmoi/LSilbr/smxlc/swmmgrlfc/Hag
		R/fmoi/LSilbr/smxlc/swmmgrlfc/Ngfe
		R/fmoi/LSilbr/smxlo/smxl/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Low Elevation Mixed Shrubland (continued)		R/fmoi/LSilbr/smxlo/smxl/Ngfe
		R/fmoi/LSilbr/smxlo/swmmgrlfc/Hag
		R/fmoi/LSilbr/smxlo/swmmgrlfc/Ngfe
		R/fmoi/Water/smxlc/swmmgrlfc/Ha
		R/fmrac/SSkEnt/smxlo/smxl/A
		R/Fmrox/LSil/smxlc/smxl/Ha
		R/H/LSil/smxlo/smxl/Hwc
		R/H/LSilbr/smxlc/smxl/Hwc
Riverine Loamy Moist Graminoid Meadow	Moderate	R/fmoa/LovSk/hgm/fbcf/DC
		R/fmoa/LovSk/hgm/fbclf/DC
		R/fmoa/LovSk/hgm/hmm/DC
		R/fmoa/LovSk/hgm/hmm/Ha
		R/fmoa/LSil/hgm/fbbcwf/DC
		R/fmoa/LSil/hgm/fbbcwf/Hag
		R/fmoa/LSil/hgm/fbbcwf/Ngfe
		R/fmoa/LSil/hgm/smxl/Hag
		R/fmoa/LSil/hgm/smxl/Hwc
		R/fmoa/LSil/hgm/smxl/Ngfe
		R/fmoa/LSilbr/hgm/fbbcwf/Ngfe
		R/fmoa/LSilbr/hgm/smxl/Hag
		R/fmoa/LSilbr/hgm/smxl/Hwc
		R/fmoa/LSilbr/hgm/smxl/Ngfe
		R/fmoa/LSilbr/hgm/swmmgrblfc/Hag
		R/fmoa/Water/hgm/smxl/Hag
		R/fmoi/LovSk/hgm/fbclf/Hag
		R/fmoi/LovSk/hgm/fbcmmlfc/Hag
		R/fmoi/LovSk/hgm/fbct/Hag
		R/fmoi/LovSk/hgm/fbct/Hc
		R/fmoi/LovSk/hgm/fbct/Nf
		R/fmoi/LovSk/hgm/fdfwm/DC
		R/fmoi/LovSk/hgm/hmm/A
		R/fmoi/LovSk/hgm/hmm/Ha
		R/fmoi/LovSk/hgm/hmm/Ngfd
		R/fmoi/LovSk/hgm/sbh/Hag
		R/fmoi/LovSk/hgm/smaf/Hag
		R/fmoi/LovSk/hgm/smawm/Hag
		R/fmoi/LovSk/hgm/swmm/Hag
		R/fmoi/LovSk/hgm/swwm/Hag
		R/fmoi/LSil/hgm/fbbcwf/Hag
		R/fmoi/LSil/hgm/fbclf/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Moist Graminoid Meadow (continued)		R/fmoi/LSil/hgm/fbcmmlfc/Hag
		R/fmoi/LSil/hgm/fdfm/Hag
		R/fmoi/LSil/hgm/flpmm/Hcl
		R/fmoi/LSil/hgm/hfmm/Hag
		R/fmoi/LSil/hgm/hmm/Ha
		R/fmoi/LSil/hgm/hmm/Hag
		R/fmoi/LSil/hgm/hwm/Hag
		R/fmoi/LSil/hgm/smawm/Hag
		R/fmoi/LSil/hgm/smmgrlfc/Hag
		R/fmoi/LSil/hgm/smxl/Ha
		R/fmoi/LSil/hgm/smxl/Hag
		R/fmoi/LSil/hgm/swmmgrlfc/DC
		R/fmoi/LSil/hgm/swmmgrlfc/Hag
		R/fmoi/LSil/hgm/swmmgrlfc/Hah
		R/fmoi/LSil/hgm/swwm/Hag
		R/fmoi/LSilbr/hgm/smxl/Ha
		R/fmoi/LSilbr/hgm/smxl/Hag
		R/fmoi/LSilbr/hgm/swmmgrlfc/DC
		R/fmoi/LSilbr/hgm/swmmgrlfc/Ha
		R/fmoi/LSilbr/hgm/swmmgrlfc/Hag
		R/fmoi/LSilor/hgm/swwm/Hag
		R/fmoi/Water/hgm/smxl/Hag
		R/fmrac/LSil/hgm/hgfgb/Ngfe
		R/fmrac/LSilbr/hgm/hgfgb/Ngfe
		R/fmri/LSil/hgm/hwm/Ha
		R/fmri/LSil/hgm/swmmgrblfc/Hag
Riverine Loamy Ponderosa Pine Forest	Low	R/fmoa/LGr/fnwpp/fppm/A
		R/fmoa/LovSk/fnopp/fppm/Hag
		R/fmoi/LGr/fnwpp/fppmo/A
		R/fmoi/LovSk/fncpp/fppm/A
		R/fmoi/LovSk/fnopp/fbcmmlfc/A
		R/fmoi/LovSk/fnopp/fdfwm/A
		R/fmoi/LovSk/fnopp/fppm/A
		R/fmoi/LovSk/fnopp/fppm/DC
		R/fmoi/LovSk/fnopp/fppmo/A
Riverine Loamy Spruce Forest	Low	R/fmoa/LGr/fnoes/fgfcm/A
		R/fmoa/LovSk/fnces/fgfcm/A
		R/fmoi/LGr/fnoes/fes/A
		R/fmoi/LGr/fnoes/fgfeso/A
		R/fmoi/LovSk/fnces/fgfeso/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy Spruce Forest (continued)		R/fmoi/LovSk/fnoes/fes/A
		R/fmoi/LovSk/fnoes/fgfeso/A
Riverine Loamy Subalpine Fir Forest	Low	R/fmoi/LovSk/fnsfo/fsfd/A
		R/fmoi/LovSk/fnsfo/fsfes/A
		R/fmoi/LovSk/fnsfo/fsfeso/A
		R/fmoi/LSil/fnscf/fsfes/A
Riverine Loamy Willow Forest	Low	R/fmoa/LSil/fbcs/fbbcwf/A
		R/fmoa/LSil/fbcs/fbbcwf/Hah
		R/fmoa/LSil/fbcs/fbbcwf/Ngfe
		R/fmoa/LSil/fbos/fbbcwf/DC
		R/fmoa/LSil/fbos/fbbcwf/Hd
		R/fmoa/LSil/fbos/fbbcwf/Ngfd
		R/fmoa/LSil/fbos/fbclf/Hah
		R/fmoa/LSilbr/fbcs/fbbcwf/A
		R/fmoa/LSilbr/fbcs/fbbcwf/Ngfe
		R/fmoa/LSilbr/fbos/fbbcwf/Hag
		R/fmoa/LSilbr/fbos/fbbcwf/Ngfe
		R/fmrac/SSkEnt/fbos/fbbcwf/Ngfe
		R/H/LSil/fbcs/swmmgrlfc/Hwc
Riverine Loamy-Organic Wet Graminoid Meadow	Low	R/fmoa/LSil/hgwmcc/hgmcwmc/DC
		R/fmoa/LSil/hgwmcc/hgmcwmc/Hag
		R/fmoa/LSilor/hgw/swwm/Hag
		R/fmoa/LSilor/hgwmcc/swwm/Hag
		R/fmoi/LSil/hgwmcc/hgmcwmc/DC
		R/fmoi/LSilor/hgw/hwm/Hag
		R/fmoi/LSilor/hgw/swwm/Hag
		R/fmri/LSilbr/hgw/hwm/Hag
		R/Fmrox/LSilbr/hgw/hwm/Hag
		R/Wh/LSilbr/hgw/swmmgrblfc/Hwd
Riverine Loamy-Rocky Dry Graminoid Meadow	High	R/fmoa/LGr/hgd/fbbcwf/Hag
		R/fmoa/LGr/hgd/swgb/Hag
		R/fmoa/LovSk/hgd/hmd/DC
		R/fmoi/LGr/hgd/fbbcwf/Hag
		R/fmoi/LGr/hgd/fbcf/Hag
		R/fmoi/LGr/hgd/fdfm/Hag
		R/fmoi/LGr/hgd/smaf/Hag
		R/fmoi/LGr/hgd/smawm/Hag
		R/fmoi/LovSk/hgd/fdfm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy-Rocky Dry Graminoid Meadow (continued)		R/fmoi/LovSk/hgd/hmm/Hag
		R/fmoi/MDpCF/hgd/smaf/Hag
		R/fmri/LGr/hgd/fbbcwf/Hag
		R/fmri/LGr/hgd/smaf/Hag
Riverine Loamy-Rocky Grand Fir Forest	Low	R/fmoa/LGr/fnog/fgfc/A
		R/fmoa/LovSk/fncg/fgfcm/A
		R/fmoa/SSkEnt/fncg/fgfwdo/A
		R/fmoi/LGr/fngfw/fgfcm/A
		R/fmoi/LGr/fnog/fgfcm/A
		R/fmoi/LiShC/fncg/fgfc/A
		R/fmoi/LovSk/fncg/fdfwm/A
		R/fmoi/LovSk/fncg/fgfcm/A
		R/fmoi/LovSk/fncg/fgfcmo/A
		R/fmoi/LovSk/fncg/fgfwd/A
		R/fmoi/LovSk/fngfw/fgfcmo/A
		R/fmoi/LovSk/fnog/fdfwm/A
		R/fmoi/LovSk/fnog/fgfcm/A
		R/fmoi/LovSk/fnog/fgfcmo/A
		R/fmoi/LovSk/fnog/fgfcmo/Hag
		R/fmoi/LovSk/fnog/fgfes/A
		R/fmoi/LovSk/fnog/fgfeso/A
		R/fmoi/LovSk/fnog/fgfwdo/A
		R/fmoi/LSil/fncg/fgfcm/A
		R/fmoi/LSil/fnog/fgfcmo/A
		R/fmoi/SSkEnt/fncg/fgfwdo/A
		R/fmoi/SSkEnt/fnog/fdfwm/A
		R/fmoi/SSkEnt/fnog/fgfcmo/A
		R/fmoi/SSkEnt/fnog/fgfwdo/A
Riverine Loamy-Rocky Hawthorn Tall Shrub	Low	R/fmoa/LGr/stobh/fbbcwf/Hag
		R/fmoa/LGr/stobh/sbh/A
		R/fmoa/LGr/stobh/sbh/Hag
		R/fmoa/LovSk/stcbh/smalf/Hag
		R/fmoa/LovSk/stobh/smalf/Hag
		R/fmoa/LSil/stcbh/sbh/Hag
		R/fmoa/LSil/stobh/sbh/Hag
		R/fmoi/LGr/stcbh/fbct/Hag
		R/fmoi/LGr/stcbh/sbh/A
		R/fmoi/LGr/stcbh/sbh/Hag
		R/fmoi/LGr/stobh/sbh/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy-Rocky Hawthorn Tall Shrub (continued)		R/fmoi/LGr/stobh/sbh/Hag
		R/fmoi/LovSk/stcbh/sbh/A
		R/fmoi/LovSk/stcbh/sbh/Hag
		R/fmoi/LovSk/stobh/fbcmmlfc/Hag
		R/fmoi/LovSk/stobh/sbh/A
		R/fmoi/LovSk/stobh/sbh/DC
		R/fmoi/LovSk/stobh/sbh/Hag
		R/fmoi/LSil/stcbh/sbh/Hag
		R/fmoi/LSil/stcbh/smxl/DC
		R/fmoi/LSil/stobh/swmmgrlfc/Hag
		R/fmoi/LSilbr/stobh/sbh/Hag
		R/fmoi/SSkEnt/stobh/sbh/Ngfd
Riverine Loamy-Rocky Lodgepole Pine Forest	Low	R/fmoa/LGr/fnol/flpmm/A
		R/fmoa/LGr/fnwl/flpwm/Hag
		R/fmoa/LGr/fnwl/flpwm/Hcl
		R/fmoi/LGr/fncl/flpmm/A
		R/fmoi/LGr/fncl/flpwm/A
		R/fmoi/LGr/fnol/flpmm/A
		R/fmoi/LGr/fnol/flpwm/A
		R/fmoi/LGr/fnol/flpwm/Hcl
		R/fmoi/LGr/fnwl/flpmm/A
		R/fmoi/LGr/fnwl/flpmm/Hag
		R/fmoi/LGr/fnwl/flpwm/Hag
		R/fmoi/LGr/fnwl/flpwm/Hcl
		R/fmoi/LovSk/fncl/flpd/A
		R/fmoi/LovSk/fncl/flpwm/A
		R/fmoi/LovSk/fnol/flpmm/A
		R/fmoi/LovSk/fnol/flpwm/A
		R/fmoi/LovSk/fnwl/flpmm/A
		R/fmoi/LovSk/fnwl/flpwm/Hag
		R/fmoi/LovSk/fnwl/smawm/Hag
		R/fmoi/LSil/fnol/flpmm/A
		R/fmoi/LSil/fnol/flpwm/A
		R/fmoi/LSilor/fnol/flpmm/A
		R/fmoi/LSilor/fnol/flpwm/A
		R/fmoi/LSilor/fnwl/flpmm/Hag
		R/fmoi/SSkEnt/fncl/flpmm/Hft
		R/fmoi/SSkEnt/fnwl/flpmm/Hft
		R/fmri/LGr/fnwl/flpwm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Loamy-Rocky Wet Graminoid Meadow	Low	R/fmoa/LGr/hgwmcc/swwm/Hag
		R/fmoa/LovSk/hgwmcc/hgmcwmc/Hag
		R/fmoa/LovSk/hgwmcc/swwm/Hag
		R/fmoa/LSil/hgw/hwmc/Hag
		R/fmoi/LGr/hgw/hwm/DC
		R/fmoi/LGr/hgwmcc/fbct/Hc
		R/fmoi/LGr/hgwmcc/smawm/DC
		R/fmoi/LovSk/hgw/fbclf/Hah
		R/fmoi/LovSk/hgwmcc/fbclf/Hah
		R/fmoi/LovSk/hgwmcc/fbcmmlfc/Hag
		R/fmoi/LovSk/hgwmcc/swwm/Hag
		R/fmoi/LSil/hgw/fbclf/Hag
		R/fmoi/LSil/hgw/hwm/DC
		R/fmoi/LSil/hgw/hwm/Hag
		R/fmoi/LSil/hgw/smawm/Hag
		R/fmoi/LSil/hgw/smawm/He
		R/fmoi/SSkEnt/hgwmcc/hgmcwmc/DC
		R/fmri/LGr/hgw/hwm/Hag
		R/fmri/LGr/hgw/smawm/Hag
		R/fmri/LGr/hgw/swwm/Hag
		R/fmri/LGr/hgwmcc/swwm/Hag
		R/fmri/LSil/hgw/swmmgrlfc/Hag
		R/fmri/SSkEnt/hgw/hwm/DC
Riverine Rocky Barrens and Partially Vegetated	High	R/fmoa/LGr/bpvh/fbclf/Hag
		R/fmoa/LGr/bpvh/swgb/A
		R/fmoa/LovSk/bpvh/hgfgb/Hag
		R/fmoa/MDpCF/bbg/bbg/Ngfd
		R/fmoa/SSkEnt/bbg/bbg/Hwc
		R/fmoa/SSkEnt/bbg/bbg/Ngfd
		R/fmoa/SSkEnt/bbg/swgb/A
		R/fmoa/SSkEnt/bpvh/smaf/Hag
		R/fmoa/SSkEnt/bpvh/swgb/A
		R/fmoa/SSkEnt/bpvh/swgb/Hag
		R/fmoi/LGr/bpvh/smaf/Hag
		R/fmoi/LGr/bpvh/smawm/Hag
		R/fmoi/SSkEnt/bbg/fbct/A
		R/fmoi/SSkEnt/bbg/hmm/A
		R/fmrac/LovSk/bpvh/hgfgb/Ngfe
		R/fmrac/SSkEnt/bbg/bbg/Ngfd

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Rocky Barrens and Partially Vegetated (continued)		R/fmrac/SSkEnt/bbg/bbg/Ngfe
		R/fmrac/SSkEnt/bbg/hgfgb/Hag
		R/fmrac/SSkEnt/bbg/hgfgb/Ngfd
		R/fmrac/SSkEnt/bbg/swgb/A
		R/fmrac/SSkEnt/bbg/swgb/Hag
		R/fmrac/SSkEnt/bbg/swgb/Ngfd
		R/fmrac/SSkEnt/bpvh/fbbcwf/Ngfd
		R/fmrac/SSkEnt/bpvh/hgfgb/A
		R/fmrac/SSkEnt/bpvh/hgfgb/DC
		R/fmrac/SSkEnt/bpvh/hgfgb/Ngfe
		R/fmrac/SSkEnt/bpvh/swgb/Hag
		R/fmrac/SSkEnt/bpvh/swgb/Ngfd
		R/fmrac/SSkEnt/bpvh/swgb/Ngfe
		R/fmri/SSkEnt/bbg/bbg/Ngfe
		R/fmri/SSkEnt/bbg/swgb/A
		R/fmri/SSkEnt/bbg/swgb/Hag
		R/fmri/SSkEnt/bpvh/fbbcwf/Hag
		R/fmri/SSkEnt/bpvh/hgfgb/DC
		R/fmri/SSkEnt/bpvh/swgb/A
		R/fmri/SSkEnt/bpvh/swgb/Hag
Riverine Rocky Black Cottonwood Forest	Low	R/fmoa/LGr/fboc/fbcf/DC
		R/fmoa/LGr/fboc/fbcf/Ngfd
		R/fmoa/LGr/fboc/fbclf/A
		R/fmoa/LGr/fboc/fbclf/Hag
		R/fmoa/SSkEnt/fbcc/fbclf/Hag
		R/fmoa/SSkEnt/fboc/fbcf/Ngfe
		R/fmoa/SSkEnt/fboc/fbclf/A
		R/fmoa/SSkEnt/fboc/fbclf/DC
		R/fmoa/SSkEnt/fboc/fbclf/Hag
		R/fmoa/SSkEnt/fbwc/fbbcwf/DC
		R/fmoa/SSkEnt/fmbcppo/fbclf/DC
		R/fmoi/LGr/fboc/fbcf/A
		R/fmoi/LGr/fboc/fbcf/DC
		R/fmoi/LGr/fboc/fbclf/Hdr
		R/fmoi/LGr/fbwc/fbbcwf/A
		R/fmoi/LGr/fmbcppo/fppmo/A
		R/fmoi/MDpCF/fboc/fbclf/A
		R/fmoi/SSkEnt/fbcc/fbclf/Ngfd
		R/fmoi/SSkEnt/fboc/fbcf/A
		R/fmoi/SSkEnt/fmbcdfo/fbclf/DC

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Rocky Black Cottonwood Forest (continued)		R/fmrac/SSkEnt/fboc/fbbcwf/DC
		R/fmrac/SSkEnt/fboc/fbclf/Ngfd
		R/fmrac/SSkEnt/fbwc/fbclf/Ngfe
		R/fmri/LGr/fboc/fbcf/DC
		R/fmri/SSkEnt/fboc/fbcf/A
		R/fmri/SSkEnt/fboc/fbcf/Ngfd
		R/fmri/SSkEnt/fboc/fbclf/Ngfe
Riverine Rocky Moist Graminoid Meadow	Moderate	R/fmoa/LGr/hgm/fbbcwf/A
		R/fmoa/LGr/hgm/fbbcwf/Hag
		R/fmoa/LGr/hgm/fbcf/Hag
		R/fmoa/LGr/hgm/flpmm/Hag
		R/fmoa/LGr/hgm/smaf/Hag
		R/fmoa/LGr/hgm/smawm/Hag
		R/fmoa/LGr/hgm/swgb/Hag
		R/fmoa/LGr/hgm/swmm/Hag
		R/fmoa/LGr/hgm/swwm/Hag
		R/fmoa/SSkEnt/hgm/fbclf/Hag
		R/fmoa/SSkEnt/hgm/hgfgb/DC
		R/fmoa/SSkEnt/hgm/hmm/Hag
		R/fmoa/SSkEnt/hgm/smaf/Hag
		R/fmoa/SSkEnt/hgm/smawm/Hcl
		R/fmoa/SSkEnt/hgm/smawm/Hft
		R/fmoa/SSkEnt/hgm/swwm/Hag
		R/fmoi/LGr/hgm/fbbcwf/Hag
		R/fmoi/LGr/hgm/fbcf/Hc
		R/fmoi/LGr/hgm/fbclf/Hag
		R/fmoi/LGr/hgm/fbclf/Ngfd
		R/fmoi/LGr/hgm/fbct/A
		R/fmoi/LGr/hgm/fbct/Hag
		R/fmoi/LGr/hgm/fdfm/Hag
		R/fmoi/LGr/hgm/smaf/A
		R/fmoi/LGr/hgm/smaf/Hag
		R/fmoi/LGr/hgm/smawm/Hag
		R/fmoi/LGr/hgm/smawm/Hc
		R/fmoi/LGr/hgm/swmm/Hag
		R/fmoi/LGr/hgm/swwm/Hag
		R/fmoi/SSkEnt/hgm/hmm/DC
		R/fmoi/SSkEnt/hgm/hmm/Hag
		R/fmoi/SSkEnt/hgm/smawm/Hft
		R/fmrac/SSkEnt/hgm/fbclf/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Rocky Moist Graminoid Meadow (continued)		R/fmrac/SSkEnt/hgm/hgfgb/Ngfd
		R/fmrac/SSkEnt/hgm/hgfgb/Ngfe
		R/fmrac/SSkEnt/hgm/swgb/A
		R/fmri/LGr/hgm/hwm/Hag
		R/fmri/LGr/hgm/smawm/Hag
		R/fmri/LGr/hgm/swwm/Hag
		R/fmri/SSkEnt/hgm/swgb/A
		R/fmri/SSkEnt/hgm/swgb/Hag
		R/fmri/SSkEnt/hgm/swgb/Ngfd
		R/Wr/SSkEnt/hgm/smxl/Ngfe
Riverine Rocky Thinleaf Alder Tall Shrub	Low	R/fmoa/DpSiCL/stoat/smalf/Hag
		R/fmoa/LGr/stcat/smaf/A
		R/fmoa/LGr/stcat/smalf/Hag
		R/fmoa/LGr/stoat/smaf/A
		R/fmoa/LGr/stoat/smaf/Ngfd
		R/fmoa/LGr/stoat/smalf/Hag
		R/fmoa/LGr/stoat/smawm/A
		R/fmoa/LGr/stoat/smawm/Hag
		R/fmoa/LiShC/stcat/fbclf/DC
		R/fmoa/LiShC/stcat/smalf/Hag
		R/fmoa/LovSk/stcat/fbcmmlfc/Hag
		R/fmoa/LovSk/stcat/smaf/Hag
		R/fmoa/LovSk/stcat/smalf/Hag
		R/fmoa/LovSk/stcat/smalf/Ngfd
		R/fmoa/LovSk/stoat/smaf/DC
		R/fmoa/LovSk/stoat/smaf/Hag
		R/fmoa/LovSk/stoat/smaf/Hc
		R/fmoa/LovSk/stoat/smaf/Ngfe
		R/fmoa/LovSk/stoat/smalf/DC
		R/fmoa/LovSk/stoat/smalf/Hag
		R/fmoa/LovSk/stoat/smawm/Hag
		R/fmoa/LSil/stcat/smaf/Hag
		R/fmoa/LSil/stoat/smaf/DC
		R/fmoa/SSkEnt/stcat/fdfwm/Hag
		R/fmoa/SSkEnt/stcat/fdfwm/Ngfd
		R/fmoa/SSkEnt/stcat/smaf/Hag
		R/fmoa/SSkEnt/stcat/smalf/Hag
		R/fmoa/SSkEnt/stcat/smawm/A
		R/fmoa/SSkEnt/stoat/smaf/DC
		R/fmoa/SSkEnt/stoat/smaf/Ngfd

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Rocky Thinleaf Alder Tall Shrub (continued)		R/fmoa/SSkEnt/stoat/smawm/Hag
		R/fmoi/LGr/stcat/smaf/A
		R/fmoi/LGr/stcat/smaf/Ha
		R/fmoi/LGr/stcat/smaf/Hag
		R/fmoi/LGr/stcat/smalf/Hag
		R/fmoi/LGr/stcat/smawm/A
		R/fmoi/LGr/stcat/swwm/A
		R/fmoi/LGr/stoat/smaf/A
		R/fmoi/LGr/stoat/smaf/Hag
		R/fmoi/LGr/stoat/smawm/A
		R/fmoi/LGr/stoat/smawm/Hag
		R/fmoi/LovSk/stcat/fbcf/Hag
		R/fmoi/LovSk/stcat/smaf/A
		R/fmoi/LovSk/stcat/smaf/Hag
		R/fmoi/LovSk/stcat/smalf/Hag
		R/fmoi/LovSk/stoat/fbcf/Hag
		R/fmoi/LovSk/stoat/fdfwm/Hag
		R/fmoi/LovSk/stoat/smaf/A
		R/fmoi/LovSk/stoat/smaf/DC
		R/fmoi/LovSk/stoat/smaf/Hag
		R/fmoi/LovSk/stoat/smawm/A
		R/fmoi/LovSk/stoat/smawm/Hag
		R/fmoi/LSil/stoat/smaf/DC
		R/fmoi/MDpCF/stoat/smaf/DC
		R/fmoi/SSkEnt/stcat/fdfwm/Hag
		R/fmoi/SSkEnt/stcat/smaf/Ngfd
		R/fmoi/SSkEnt/stoat/smaf/Ngfd
		R/fmrac/LovSk/stcat/smaf/Ngfd
		R/fmrac/LovSk/stcat/smalf/Ngfe
		R/fmri/LGr/stoat/smawm/Hag
		R/fmri/LovSk/stoat/smawm/Hag
Riverine Rocky Willow Low and Tall Shrub	Low	R/fmoa/LGr/stow/fbbcwf/A
		R/fmoa/LGr/stow/fbbcwf/Hag
		R/fmoa/LGr/stow/fbcf/Hag
		R/fmoa/LovSk/stcw/swgb/Ngfe
		R/fmoa/LovSk/stcw/swwm/Hag
		R/fmoa/LovSk/stow/swgb/Ngfe
		R/fmoa/LSil/stcw/fbbcwf/Hag
		R/fmoa/LSil/stow/fbbcwf/DC
		R/fmoa/LSilbr/stcw/swgb/Ngfe

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Riverine Rocky Willow Low and Tall Shrub (continued)		R/fmoa/SSkEnt/stcw/swgb/DC
		R/fmoa/SSkEnt/stcw/swgb/Ngfd
		R/fmoa/SSkEnt/stcw/swgb/Ngfe
		R/fmoa/SSkEnt/stcw/swmm/Hag
		R/fmoa/SSkEnt/stow/fbbcwf/A
		R/fmoa/SSkEnt/stow/swgb/Ngfd
		R/fmoa/SSkEnt/stow/swgb/Ngfe
		R/fmoa/SSkEnt/stow/swmm/Ngfe
		R/fmoi/LGr/stow/fbbcwf/Hag
		R/fmoi/LGr/stow/fdfwm/Hag
		R/fmoi/LGr/stow/swmm/Hag
		R/fmoi/LovSk/stcw/swmm/Hag
		R/fmoi/LovSk/stow/fbbcwf/A
		R/fmoi/LovSk/stow/fppmo/Hag
		R/fmoi/LovSk/stow/swgb/DC
		R/fmoi/LovSk/stow/swgb/Hag
		R/fmoi/LovSk/stow/swgb/Ngfd
		R/fmoi/LovSk/stow/swmm/A
		R/fmoi/LSilor/stow/swwm/A
		R/fmoi/MDpCF/stcw/swmm/DC
		R/fmrac/LovSk/stcw/swgb/A
		R/fmrac/LovSk/stcw/swgb/Ngfd
		R/fmrac/LSilbr/stcw/swgb/Ngfe
		R/fmrac/LSilbr/stow/swgb/Ngfe
		R/fmrac/SSkEnt/stcw/swgb/Ngfe
		R/fmrac/SSkEnt/stow/fbbcwf/Ngfd
		R/fmrac/SSkEnt/stow/fbbcwf/Ngfe
		R/fmrac/SSkEnt/stow/fbcf/Hag
		R/fmrac/Water/stcw/swgb/Hag
		R/fmri/LovSk/stcw/swgb/Ngfd
		R/fmri/LovSk/stow/fbbcwf/Hag
		R/H/LSil/stow/swmmgrlfc/Hwc
Roads	Negligible	L/H/Roads/rd/rd/Hf
		L/H/Roads/rd/rd/Hfgrp
		L/H/Roads/rd/rd/Hfgru
		L/H/Roads/rd/rd/Hrr
		L/H/Roads/rd/rd/Hwl
		R/H/Roads/rd/rd/Hfgrp
		R/H/Roads/rd/rd/Hfgru
		S/H/Roads/rd/rd/Hfgru
		U/H/Roads/rd/rd/Hf

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Roads (continued)		U/H/Roads/rd/rd/Hfgrp
		U/H/Roads/rd/rd/Hfgru
		U/H/Roads/rd/rd/Hrr
Rocky Sitka Alder Tall Shrub	Low	S/ch/DpCF/ssa/ssa/Hag
		U/ch/LiShC/ssa/ssa/A
Subalpine Loamy-Rocky Grand Fir Forest	Low	S/ch/AsilovSk/fncg/fsfd/A
		S/ch/AsilovSk/fnog/fgfwd/A
		S/ch/AsilovSk/fnog/fgfwdo/A
		S/ch/DpCF/fnog/fgfc/A
		S/ch/LiShC/fnog/fgfc/A
		S/ch/LiShC/fnog/fgfwdo/A
		S/ch/MDpCF/fnog/fgfc/A
		S/ch/MDpCF/fnog/fgfcmo/A
		S/ch/MDpCF/fnog/fgfwd/A
		S/ch/MDpCF/fnog/fgfwdo/A
		S/ff/LGr/fnog/fgfcmo/A
		S/H/LiShC/fnog/fsfd/A
Subalpine Loamy-Rocky Lodgepole Pine Forest	Low	S/ch/AsilovSk/fnol/flpd/A
		S/ch/DpCF/fnol/fgfc/Nf
		S/ch/DpCF/fnol/flpd/A
		S/ch/MDpCF/fnol/fgfc/A
		S/ch/MDpCF/fnol/fgfc/Nf
		S/H/LiShC/fnol/fgfc/A
Subalpine Loamy-Rocky Subalpine Fir Forest	Low	S/ch/AsilovSk/fnscf/fsfd/A
		S/ch/AsilovSk/fnscf/fsfes/A
		S/ch/DpCF/fnscf/fsfd/A
		S/ch/DpCF/fnscf/fsfes/A
		S/ch/DpCF/fnsfo/fsfd/A
		S/ch/DpCF/fnsfw/hss/A
		S/ch/MDpCF/fnscf/fgfc/A
		S/ch/MDpCF/fnsfo/fsfd/A
		S/ff/DpCF/fnscf/fsfes/A
		S/ff/LGr/fnscf/fsfes/A
		S/fto/AsilovSk/fnscf/fsfd/A
		S/fto/DpCF/fnscf/fsfd/A
		S/fto/DpCF/fnscf/fsfes/A
		S/fto/DpCF/fnsfo/fsfd/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Subalpine Organic-rich Wet Graminoid Meadow	Low	S/Of/LSilor/hgw/hwmc/Hag
Subalpine Rocky Dry Graminoid Meadow	High	S/ch/DpCF/hus/hbwif/Hag
		S/ch/DpCF/hus/hss/Hag
		S/fto/DpCF/hus/hss/Hag
Upland Loamy Forb Meadow	Moderate	U/ch/AsilovSk/hfm/hfmm/A
Upland Loamy-Rocky Douglas-fir Forest	Low	U/Bx/LiShC/fncdf/fdfd/A
		U/Bx/LiShC/fncdf/fdfwm/A
		U/Bx/LiShC/fndfw/fdfwm/A
		U/Bx/LiShC/fndfw/fdfwm/Nf
		U/Bx/LiShC/fnodf/fdfd/A
		U/Bx/LiShC/fnodf/fdfwm/A
		U/Bx/LiShC/fnodf/fdfwm/Nf
		U/Bx/MDpCF/fnodf/fdfd/A
		U/ch/AsilovCF/fncdf/fdfwm/A
		U/ch/AsilovL/fncdf/fdflm/A
		U/ch/AsilovL/fncdf/fdfm/A
		U/ch/AsilovL/fncdf/fdfwm/A
		U/ch/AsilovL/fndfw/fdfm/Hcl
		U/ch/AsilovL/fndfw/fdfwm/A
		U/ch/AsilovL/fndfw/fdfwm/Hcl
		U/ch/AsilovL/fndfw/fdfwm/Nf
		U/ch/AsilovL/fnodf/fdfm/A
		U/ch/AsilovL/fnodf/fdfmo/A
		U/ch/AsilovL/fnodf/fdfmo/DC
		U/ch/AsilovL/fnodf/fdfwm/A
		U/ch/AsilovL/fnodf/fdfwm/Nf
		U/ch/AsilovSk/fncdf/fdfd/A
		U/ch/AsilovSk/fncdf/fdfwm/A
		U/ch/AsilovSk/fncdf/fdfwm/DC
		U/ch/AsilovSk/fndfw/fdfwm/A
		U/ch/AsilovSk/fnodf/fdfd/A
		U/ch/AsilovSk/fnodf/fdfm/A
		U/ch/AsilovSk/fnodf/fdfmo/A
		U/ch/AsilovSk/fnodf/fdfwm/A
		U/ch/DpCF/fncdf/fdfd/A
		U/ch/DpCF/fncdf/fdfm/A
		U/ch/DpCF/fncdf/fdfwm/A
		U/ch/DpCF/fncdf/fdfwm/Hd

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Douglas-fir Forest (continued)		U/ch/DpCF/fndfw/fdfd/A
		U/ch/DpCF/fndfw/fdfm/A
		U/ch/DpCF/fndfw/fdfwm/A
		U/ch/DpCF/fnodf/fdfmo/A
		U/ch/DpCF/fnodf/fdfwm/A
		U/ch/LGr/fnodf/fdfwm/A
		U/ch/LiShC/fmbcdfo/fdfwm/Hd
		U/ch/LiShC/fncdf/fdflm/DC
		U/ch/LiShC/fncdf/fdfmo/A
		U/ch/LiShC/fncdf/fdfwm/A
		U/ch/LiShC/fndfw/fdfd/A
		U/ch/LiShC/fndfw/fdfm/A
		U/ch/LiShC/fndfw/fdfmo/A
		U/ch/LiShC/fndfw/fdfwm/A
		U/ch/LiShC/fndfw/fdfwm/DC
		U/ch/LiShC/fndfw/fgfwdo/A
		U/ch/LiShC/fndfw/hbwif/A
		U/ch/LiShC/fnodf/fdfd/A
		U/ch/LiShC/fnodf/fdfm/A
		U/ch/LiShC/fnodf/fdfmo/A
		U/ch/LiShC/fnodf/fdfwm/A
		U/ch/LovSk/fncdf/fdfwm/A
		U/ch/MDpCF/fncdf/fdfd/A
		U/ch/MDpCF/fncdf/fdflm/A
		U/ch/MDpCF/fncdf/fdflm/Hc
		U/ch/MDpCF/fncdf/fdfm/A
		U/ch/MDpCF/fncdf/fdfm/Nf
		U/ch/MDpCF/fncdf/fdfmo/A
		U/ch/MDpCF/fncdf/fdfwm/A
		U/ch/MDpCF/fncdf/fdfwm/DC
		U/ch/MDpCF/fncdf/fdfwm/Nf
		U/ch/MDpCF/fndfw/fdfd/A
		U/ch/MDpCF/fndfw/fdfd/DC
		U/ch/MDpCF/fndfw/fdfd/Hag
		U/ch/MDpCF/fndfw/fdfd/Nf
		U/ch/MDpCF/fndfw/fdfmo/A
		U/ch/MDpCF/fndfw/fdfwm/A
		U/ch/MDpCF/fndfw/fdfwm/Hcl
		U/ch/MDpCF/fndfw/fdfwm/Nf
		U/ch/MDpCF/fndfw/wpps/A
		U/ch/MDpCF/fnodf/fdfd/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Douglas-fir Forest (continued)		U/ch/MDpCF/fnodf/fdfd/Hag
		U/ch/MDpCF/fnodf/fdfd/Hdr
		U/ch/MDpCF/fnodf/fdfd/Nf
		U/ch/MDpCF/fnodf/fdfm/A
		U/ch/MDpCF/fnodf/fdfm/Nf
		U/ch/MDpCF/fnodf/fdfmo/A
		U/ch/MDpCF/fnodf/fdfmo/DC
		U/ch/MDpCF/fnodf/fdfwm/A
		U/ch/MDpCF/fnodf/fdfwm/DC
		U/ch/MDpCF/fnodf/fdfwm/Hcl
		U/ch/MDpCF/fnodf/fdfwm/Nf
		U/ch/StmBkHG/fnodf/fdfd/A
		U/ch/StmBkHG/fnodf/fdfwm/A
		U/ff/AsilovSk/fnodf/fdfm/A
		U/ff/AsilovSk/fnodf/fdfwm/A
		U/ff/DpCF/fnodf/fdfd/A
		U/ff/DpCF/fnodf/fdfwm/A
		U/ff/LiShC/fnodf/fdfwm/A
		U/ff/MDpCF/fndfw/fdfwm/A
		U/ff/MDpCF/fnodf/fdfd/A
		U/ff/MDpCF/fnodf/fdfwm/A
		U/fto/LSil/fmbcdfc/fdflm/DC
		U/fto/LSil/fndfw/fdflm/Hdr
		U/fto/LSil/fnodf/fdflm/DC
		U/fto/LSil/fnodf/fdfwm/DC
		U/fto/MDpCF/fncdf/fdfwm/DC
		U/fto/MDpCF/fndfw/fdfwm/DC
		U/ftr/AsilovL/fnodf/fdfwm/A
		U/H/LiShC/fndfw/fdfd/Hf
		U/H/Rock/fndfw/fdfd/He
Upland Loamy-Rocky Dry Graminoid Meadow	High	U/ff/AsilovSk/hus/hbwif/Hag
		U/ff/DpCF/hgd/fppd/Hag
		U/ff/DpCF/hgd/hmd/Hag
		U/ff/LGr/hus/hbwif/Hag
		U/ff/LGr/hus/husgbwc/Hag
		U/ff/LGr/hus/husgbwc/Hah
		U/ff/LSil/hgd/hmd/A
		U/ff/LSilor/hgd/hmd/A
		U/ff/MDpCF/hus/hbwif/Hag
		U/fmob/DpCF/hgd/fdfm/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Dry Graminoid Meadow (continued)		U/fmob/LGr/hgd/hmd/A
		U/fto/LSil/hgd/hmd/DC
		U/fto/MDpCF/hus/fdfmo/Hcl
		U/fto/MDpCF/hus/hbwif/Hag
		U/fto/SSkEnt/hgd/hmd/Hag
		U/ftr/AsilovL/hgd/hmd/A
		U/H/DpCF/hus/fgfcmo/Hag
		U/H/DpSiCL/hgd/fppm/Hag
		U/H/LGr/hus/husd/Hf
		U/H/LovSk/hus/husd/Hf
		U/H/MDpCF/hus/husd/DC
		U/H/MDpCF/hus/husd/Hf
	Low	U/Bx/LiShC/hgd/a/Ha
		U/Bx/LiShC/hgd/fgfc/A
		U/Bx/LiShC/hgd/flpd/A
		U/Bx/LiShC/hgd/hbwif/A
		U/Bx/LiShC/hgd/hbwif/Nf
		U/Bx/LiShC/hgd/husd/A
		U/Bx/MDpCF/hgd/husd/A
		U/Bx/Rock/hus/hbwif/Hag
	Moderate	U/ch/AsilovL/hgd/hbwif/A
		U/ch/AsilovL/hgd/hmd/Hag
		U/ch/AsilovL/hgd/wpps/Hag
		U/ch/AsilovL/hus/hbwif/Hag
		U/ch/AsilovL/hus/hss/Hag
		U/ch/AsilovSk/hgd/fgfc/Hcl
		U/ch/AsilovSk/hgd/hbwif/A
		U/ch/AsilovSk/hgd/husd/A
		U/ch/AsilovSk/hgd/husd/Hag
		U/ch/AsilovSk/hus/hbwif/A
		U/ch/AsilovSk/hus/hbwif/Hag
		U/ch/AsilovSk/hus/hss/Hag
		U/ch/AsilovSk/hus/husd/A
		U/ch/DpCF/hgd/fgfc/A
		U/ch/DpCF/hgd/fppd/Hag
		U/ch/DpCF/hgd/hbwif/A
		U/ch/DpCF/hgd/husd/A
		U/ch/DpCF/hgd/sum/Hag
		U/ch/DpCF/hus/hbwif/A
		U/ch/DpCF/hus/hbwif/Hag
		U/ch/DpSiCL/hus/hbwif/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Dry Graminoid Meadow (continued)		U/ch/LGr/hus/hbwif/Hag
		U/ch/LGr/hus/husd/Hf
		U/ch/LiShC/hgd/fppm/DC
		U/ch/LiShC/hgd/hbwif/Hag
		U/ch/LiShC/hgd/hmd/Hag
		U/ch/LiShC/hgd/hmd/Hc
		U/ch/LiShC/hgd/husd/A
		U/ch/LiShC/hus/fgfcmo/Hag
		U/ch/LiShC/hus/hbwif/A
		U/ch/LiShC/hus/hbwif/DC
		U/ch/LiShC/hus/hbwif/Ha
		U/ch/LiShC/hus/hbwif/Haf
		U/ch/LiShC/hus/hbwif/Hag
		U/ch/LiShC/hus/hbwif/Nf
		U/ch/LiShC/hus/hss/A
		U/ch/LiShC/hus/hss/Hag
		U/ch/LiShC/hus/husd/Hag
		U/ch/LiShC/hus/husd/Nf
		U/ch/LovSk/hus/husd/Hag
		U/ch/LSil/hus/hbwif/Hag
		U/ch/LSil/hus/hss/Hag
		U/ch/LSilor/hgd/husd/A
		U/ch/LSilor/hus/fgfcmo/Hag
		U/ch/LSilor/hus/hss/Hag
		U/ch/MDpCF/hgd/fdfd/DC
		U/ch/MDpCF/hgd/fdfd/Hc
		U/ch/MDpCF/hgd/fdfwm/Hcl
		U/ch/MDpCF/hgd/hbwif/A
		U/ch/MDpCF/hgd/hbwif/Hag
		U/ch/MDpCF/hgd/hbwif/Nf
		U/ch/MDpCF/hus/fdfwm/Hcl
		U/ch/MDpCF/hus/fgfwdo/Hcl
		U/ch/MDpCF/hus/hbwif/A
		U/ch/MDpCF/hus/hbwif/DC
		U/ch/MDpCF/hus/hbwif/Hag
		U/ch/MDpCF/hus/hbwif/Hcl
		U/ch/MDpCF/hus/hbwif/Hdr
		U/ch/MDpCF/hus/hbwif/He
		U/ch/MDpCF/hus/husd/A
		U/ch/MDpCF/hus/sum/Hag
		U/ch/Rock/hus/hbwif/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Dry Graminoid Meadow (continued)		U/ch/Rock/hus/hbwif/Hag
		U/ch/StmBkHG/hgd/fdfd/Hc
		U/ch/StmBkHG/hgd/hmd/A
Upland Loamy-Rocky Grand Fir Forest	Low	U/Bx/LiShC/fngfw/fgfwd/A
		U/Bx/LiShC/fnog/fdfwm/A
		U/Bx/LiShC/fnog/fgfcm/A
		U/Bx/LiShC/fnog/fgfwd/A
		U/ch/AsilovCF/fncg/fgfcm/A
		U/ch/AsilovCF/fncg/fgfes/A
		U/ch/AsilovL/fncg/fdfwm/A
		U/ch/AsilovL/fncg/fgfc/A
		U/ch/AsilovL/fncg/fgfwd/A
		U/ch/AsilovL/fnog/fgfwdo/A
		U/ch/AsilovSk/fncg/fdfwm/A
		U/ch/AsilovSk/fncg/fgfc/A
		U/ch/AsilovSk/fncg/fgfcm/A
		U/ch/AsilovSk/fncg/fgfcmo/A
		U/ch/AsilovSk/fncg/fgfwd/A
		U/ch/AsilovSk/fngfw/fgfc/Hcl
		U/ch/AsilovSk/fngfw/fgfcm/Hcl
		U/ch/AsilovSk/fngfw/fgfcmo/A
		U/ch/AsilovSk/fngfw/fgfwd/A
		U/ch/AsilovSk/fngfw/fgfwdo/A
		U/ch/AsilovSk/fnog/fdfwm/A
		U/ch/AsilovSk/fnog/fgfc/A
		U/ch/AsilovSk/fnog/fgfcm/A
		U/ch/AsilovSk/fnog/fgfcmo/A
		U/ch/AsilovSk/fnog/fgfcmo/Hcl
		U/ch/AsilovSk/fnog/fgfwd/A
		U/ch/AsilovSk/fnog/fgfwdo/A
		U/ch/DpCF/fncg/fdfwm/A
		U/ch/DpCF/fncg/fgfc/A
		U/ch/DpCF/fncg/fgfcm/A
		U/ch/DpCF/fncg/fgfcmo/A
		U/ch/DpCF/fncg/fgfes/A
		U/ch/DpCF/fncg/fgfwd/A
		U/ch/DpCF/fncg/fgfwdo/A
		U/ch/DpCF/fngfw/fgfwdo/A
		U/ch/DpCF/fnog/fgfc/A
		U/ch/DpCF/fnog/fgfcmo/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Grand Fir Forest (continued)		U/ch/DpCF/fnog/fgfwd/A
		U/ch/DpCF/fnog/fgfwdo/A
		U/ch/DpSiCL/fncg/fgfcm/A
		U/ch/LiShC/fncg/fdfwm/A
		U/ch/LiShC/fncg/fgfc/A
		U/ch/LiShC/fncg/fgfcm/A
		U/ch/LiShC/fncg/fgfcmo/A
		U/ch/LiShC/fncg/fgfwd/A
		U/ch/LiShC/fncg/fgfwdo/A
		U/ch/LiShC/fngfw/fgfc/A
		U/ch/LiShC/fngfw/fgfcm/A
		U/ch/LiShC/fngfw/fgfcm/Hcl
		U/ch/LiShC/fngfw/fgfcmo/A
		U/ch/LiShC/fngfw/fgfwd/A
		U/ch/LiShC/fngfw/fgfwdo/A
		U/ch/LiShC/fnog/fgfc/A
		U/ch/LiShC/fnog/fgfcm/A
		U/ch/LiShC/fnog/fgfcmo/A
		U/ch/LiShC/fnog/fgfwd/A
		U/ch/LiShC/fnog/fgfwdo/A
		U/ch/LovSk/fncg/fgfcm/A
		U/ch/LSil/fnog/fgfcm/Hf
		U/ch/LSilor/fngfw/fgfwdo/A
		U/ch/LSilor/fnog/fgfcm/A
		U/ch/MDpCF/fncg/fdfwm/A
		U/ch/MDpCF/fncg/fgfc/A
		U/ch/MDpCF/fncg/fgfcm/A
		U/ch/MDpCF/fncg/fgfcmo/A
		U/ch/MDpCF/fncg/fgfes/A
		U/ch/MDpCF/fncg/fgfwd/A
		U/ch/MDpCF/fngfw/fdfwm/A
		U/ch/MDpCF/fngfw/fgfcm/A
		U/ch/MDpCF/fngfw/fgfcmo/A
		U/ch/MDpCF/fngfw/fgfcmo/Hcl
		U/ch/MDpCF/fngfw/fgfwd/A
		U/ch/MDpCF/fngfw/fgfwdo/A
		U/ch/MDpCF/fnog/fdfwm/A
		U/ch/MDpCF/fnog/fgfc/A
		U/ch/MDpCF/fnog/fgfcm/A
		U/ch/MDpCF/fnog/fgfcmo/A
		U/ch/MDpCF/fnog/fgfcmo/Hcl

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Grand Fir Forest (continued)		U/ch/MDpCF/fnog/fgfes/A
		U/ch/MDpCF/fnog/fgfwd/A
		U/ch/MDpCF/fnog/fgfwdo/A
		U/ch/Rock/fngfw/fgfwdo/A
		U/ch/Rock/fnog/fgfc/A
		U/ch/Water/fncg/fgfwd/A
		U/ff/AsilovSk/fncg/fgfcm/A
		U/ff/AsilovSk/fncg/fgfcmo/A
		U/ff/AsilovSk/fnog/fgfcmo/A
		U/ff/DpCF/fnog/fdfwm/A
		U/ff/DpCF/fnog/fgfcmo/A
		U/ff/LGr/fnog/fgfcmo/A
		U/ff/MDpCF/fncg/fgfcm/A
		U/ff/MDpCF/fnog/fgfcmo/A
		U/fto/AsilovSk/fncg/fgfcm/A
		U/fto/LiShC/fnog/fgfcmo/A
		U/fto/MDpCF/fnog/fgfcmo/A
		U/ftr/AsilovSk/fnog/fgfcm/A
Upland Loamy-Rocky Lodgepole Pine Forest	Low	U/Bx/LiShC/fncl/flpd/A
		U/Bx/LiShC/fnol/flpd/A
		U/Bx/LiShC/fnwl/flpd/A
		U/ch/AsilovCF/fnol/fgfwd/Nf
		U/ch/AsilovCF/fnol/flpd/A
		U/ch/AsilovL/fncl/fgfwd/A
		U/ch/AsilovL/fncl/flpd/A
		U/ch/AsilovL/fnol/fgfc/A
		U/ch/AsilovL/fnol/fgfwd/Nf
		U/ch/AsilovL/fnol/flpd/A
		U/ch/AsilovL/fnwl/fgfc/A
		U/ch/AsilovL/fnwl/flpd/A
		U/ch/AsilovL/fnwl/flpmm/A
		U/ch/AsilovSk/fncl/fgfcm/A
		U/ch/AsilovSk/fncl/flpd/A
		U/ch/AsilovSk/fnol/fgfcmo/A
		U/ch/AsilovSk/fnol/flpd/A
		U/ch/AsilovSk/fnwl/fgfwd/Nf
		U/ch/AsilovSk/fnwl/flpd/A
		U/ch/DpCF/fncl/flpd/A
		U/ch/DpCF/fnol/fgfcm/Nf
		U/ch/DpCF/fnol/fgfwd/Nf

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Lodgepole Pine Forest (continued)		U/ch/DpCF/fnol/flpd/A
		U/ch/LiShC/fncl/fgfc/A
		U/ch/LiShC/fncl/fgfcm/A
		U/ch/LiShC/fncl/fgfcmo/Nf
		U/ch/LiShC/fncl/fgfwd/Nf
		U/ch/LiShC/fncl/flpd/A
		U/ch/LiShC/fncl/fsfd/A
		U/ch/LiShC/fnol/fgfc/A
		U/ch/LiShC/fnol/fgfcm/A
		U/ch/LiShC/fnol/fgfcm/Nf
		U/ch/LiShC/fnol/fgfcmo/Nf
		U/ch/LiShC/fnol/fgfwd/A
		U/ch/LiShC/fnol/fgfwd/Nf
		U/ch/LiShC/fnol/flpd/A
		U/ch/LiShC/fnwl/fgfcm/A
		U/ch/LiShC/fnwl/fgfcm/Nf
		U/ch/LiShC/fnwl/fgfcmo/Nf
		U/ch/LiShC/fnwl/fgfwd/A
		U/ch/LiShC/fnwl/fgfwd/Nf
		U/ch/LiShC/fnwl/flpd/A
		U/ch/LiShC/fnwl/flpd/Hag
		U/ch/LiShC/fnwl/flpmm/A
		U/ch/LiShC/fnwl/flpmm/DC
		U/ch/LiShC/fnwl/wpps/Nf
		U/ch/LSilor/fnol/fgfcmo/Nf
		U/ch/LSilor/fnol/flpd/A
		U/ch/LSilor/fnwl/fgfwd/Nf
		U/ch/MDpCF/fncl/fgfcm/Nf
		U/ch/MDpCF/fncl/fgfwd/Nf
		U/ch/MDpCF/fncl/flpd/A
		U/ch/MDpCF/fnol/fgfcm/Nf
		U/ch/MDpCF/fnol/fgfwd/A
		U/ch/MDpCF/fnol/fgfwd/Nf
		U/ch/MDpCF/fnol/flpd/A
		U/ch/MDpCF/fnwl/fgfwd/Nf
		U/ch/SSkEnt/fnol/flpd/A
		U/ff/DpCF/fnol/flpd/A
		U/ff/MDpCF/fnol/flpd/A
		U/fmob/AsilovSk/fncl/flpd/A
		U/fmob/MDpCF/fnol/flpmm/A
		U/fto/LSilor/fnol/flpd/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Lodgepole Pine Forest (continued)		U/H/AsilovSk/fncl/fgfcm/Hf
		U/H/AsilovSk/fnwl/flpd/A
		U/H/LiShC/fnwl/fgfcmo/Nf
		U/H/LiShC/fnwl/fsfd/He
		U/H/SSkEnt/fnol/flpd/Hft
Upland Loamy-Rocky Low Elevation Mixed Shrubland	Low	U/ch/LGr/smxlc/smxl/Hag
		U/ch/LiShC/smxlo/smxl/Hag
Upland Loamy-Rocky Moist Graminoid Meadow	Moderate	U/ch/AsilovL/hgm/hmm/A
		U/ch/AsilovL/hgm/hmm/DC
		U/ch/AsilovSk/hgm/hmcm/A
		U/ch/AsilovSk/hgm/hmm/Hag
		U/ch/AsilovSk/hgm/husd/Hag
		U/ch/DpCF/hgm/husd/Hag
		U/ch/DpCF/hgwmcc/hgmcwmc/Hag
		U/ch/DpSiCL/hgm/fdfwm/Hsb
		U/ch/DpSiCL/hgm/fppm/Hag
		U/ch/LiShC/hgm/fgfcmo/Hcl
		U/ch/LiShC/hgm/hmm/DC
		U/ch/LiShC/hgm/hmm/Hag
		U/ch/LiShC/hgw/hwm/Hag
		U/ch/MDpCF/hgm/fsfd/A
		U/ch/MDpCF/hgm/hmm/Hag
		U/ch/MDpCF/hgm/sum/Hag
		U/ff/DpCF/hgm/fdfwm/Hag
		U/ff/DpCF/hgm/fppm/Hag
		U/ff/DpCF/hgm/hmm/A
		U/fto/AsilovL/hgm/hmm/Hag
		U/H/LiShC/hgm/sum/Hah
		U/H/LovSk/hgm/fbclf/Hsb
Upland Loamy-Rocky Ponderosa Pine Forest	Low	U/Bx/LiShC/fnopp/fppd/A
		U/Bx/LiShC/fnwpp/fppd/A
		U/Bx/LiShC/fnwpp/fppd/Nf
		U/ch/AsilovL/fncpp/fdfd/Nf
		U/ch/AsilovL/fnopp/wpps/A
		U/ch/AsilovL/fnwpp/fdfd/Nf
		U/ch/AsilovL/fnwpp/fppd/A
		U/ch/AsilovL/fnwpp/fppd/Nf
		U/ch/AsilovL/fnwpp/fppmo/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Ponderosa Pine Forest (continued)		U/ch/AsilovL/fnwpp/wpps/A
		U/ch/AsilovSk/fncpp/fppm/A
		U/ch/DpCF/fnopp/fppd/A
		U/ch/DpCF/fnopp/fppm/A
		U/ch/DpSiCL/fnopp/fppm/A
		U/ch/LiShC/fncpp/fppd/A
		U/ch/LiShC/fncpp/fppm/A
		U/ch/LiShC/fnopp/fdfd/Nf
		U/ch/LiShC/fnopp/fdfwm/Nf
		U/ch/LiShC/fnopp/fppd/A
		U/ch/LiShC/fnopp/fppm/A
		U/ch/LiShC/fnopp/fppmo/A
		U/ch/LiShC/fnopp/wpps/A
		U/ch/LiShC/fnopp/wpps/DC
		U/ch/LiShC/fnwpp/fdfwm/Nf
		U/ch/LiShC/fnwpp/fppd/A
		U/ch/LiShC/fnwpp/fppm/A
		U/ch/LiShC/fnwpp/fppmo/A
		U/ch/LiShC/fnwpp/wpps/A
		U/ch/LovSk/fnopp/fppmo/DC
		U/ch/LovSk/fnwpp/fppd/A
		U/ch/LovSk/fnwpp/wpps/A
		U/ch/LSil/fnwpp/fppd/A
		U/ch/LSil/fnwpp/fppm/A
		U/ch/MDpCF/fncpp/fdfwm/Nf
		U/ch/MDpCF/fncpp/fppd/A
		U/ch/MDpCF/fnopp/fppd/A
		U/ch/MDpCF/fnopp/fppd/DC
		U/ch/MDpCF/fnopp/fppd/Nf
		U/ch/MDpCF/fnopp/fppm/A
		U/ch/MDpCF/fnopp/fppmo/A
		U/ch/MDpCF/fnopp/wpps/A
		U/ch/MDpCF/fnwpp/fppd/A
		U/ch/MDpCF/fnwpp/fppd/Hcl
		U/ch/MDpCF/fnwpp/fppd/Nf
		U/ch/MDpCF/fnwpp/fppmo/A
		U/ch/MDpCF/fnwpp/wpps/A
		U/ch/MDpCF/fnwpp/wpps/DC
		U/ch/MDpCF/fnwpp/wpps/Hcl
		U/ff/DpCF/fnwpp/fppd/A
		U/ff/LiShC/fnwpp/wpps/A

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Loamy-Rocky Ponderosa Pine Forest (continued)		U/ff/MDpCF/fnwpp/wpps/A
		U/fto/AsilovSk/fnopp/fppd/A
		U/H/LiShC/fnwpp/fppm/A
		U/H/MDpCF/fnopp/fppm/Hf
Upland Loamy-Rocky Subalpine Fir Forest	Low	U/ch/AsilovSk/fnscf/fgfes/A
		U/ch/AsilovSk/fnscf/fsfes/A
		U/ch/AsilovSk/fnsfo/fsfes/A
		U/ch/AsilovSk/fnsfo/fsfeso/A
		U/ch/LiShC/fnscf/fsfd/A
		U/ch/LiShC/fnsfo/fsfd/A
		U/ch/MDpCF/fnscf/fsfd/A
		U/ch/MDpCF/fnsfo/fsfd/A
Upland Loamy-Rocky Thinleaf Alder Tall Shrub	Low	U/ch/MDpCF/stcat/smaf/DC
		U/ch/MDpCF/stcat/smaf/Hag
		U/fto/LovSk/stcat/smaf/DC
Upland Rocky Barrens and Partially Vegetated	High	U/Bx/LiShC/bpvh/ro/A
		U/Bx/Rock/bbg/ro/A
		U/Bx/Rock/bbg/ro/Hag
		U/Bx/Rock/bpvh/ro/A
		U/Bx/Rock/bpvh/ro/Hag
		U/ch/LiShC/bbg/bbg/A
		U/ch/LiShC/bbg/ro/A
		U/ch/LiShC/bbg/ro/Hag
		U/ch/LiShC/bpvh/bbg/A
		U/ch/LiShC/bpvh/bbg/Hag
		U/ch/MDpCF/bbg/ro/Nf
		U/ch/Rock/bbg/ro/Hag
		U/fto/StmBkHG/bbg/swmm/Ngfe
Upland Rocky Black Cottonwood Forest	Low	U/ff/DpCF/fbwc/fbct/A
		U/H/MDpCF/fboc/fbct/DC
Upland Rocky Black Hawthorn Tall Shrub	Low	U/ch/LiShC/stcbh/fppm/Hag
		U/ch/LiShC/stobh/sbh/Hag
		U/ch/MDpCF/stobh/fdfm/Hag
		U/ch/MDpCF/stobh/sbh/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Rocky Human-modified Barrens and Partially Vegetated	High	U/ch/DpSiCL/bpvh/ub/Hdr
		U/ch/LiShC/bpvh/bbg/He
		U/ch/LiShC/bpvh/ub/Hdr
		U/ch/MDpCF/bpvh/hmd/Hc
		U/H/DpCF/bbg/bbg/He
		U/H/DpCF/bbg/bbg/Hft
		U/H/LGr/bbg/husgbwc/Hp
		U/H/LiShC/bpvh/bbg/He
		U/H/SSkEnt/bbg/bbg/Hc
		U/H/SSkEnt/bpvh/bbg/Hft
		U/Wh/LGr/bbg/bbg/Hf
Upland Rocky Willow Tall Shrub	Low	U/H/MDpCF/stcw/swmm/Hf
Upland Rocky-Loamy Undiffentiated Shrubland	Low	L/fmob/LSil/suo/sum/Hag
		L/fmob/MDpCF/suo/sum/Hf
		L/fto/LSil/suo/sum/Hd
		L/H/LSil/suc/sum/Hf
		R/fmoa/DpSiCL/suc/sum/Hag
		R/fmoa/LiShC/suc/sum/Hag
		U/Bx/LiShC/suo/sud/A
		U/Bx/LiShC/suo/sum/A
		U/ch/AsilovL/suc/sum/Hag
		U/ch/AsilovL/suc/sum/Hcl
		U/ch/AsilovL/suo/sum/DC
		U/ch/AsilovL/suo/sum/Hag
		U/ch/AsilovSk/suo/scs/A
		U/ch/AsilovSk/suo/sum/A
		U/ch/DpCF/suc/sum/A
		U/ch/DpCF/suc/sum/Hag
		U/ch/DpCF/suo/fppm/Hsisd
		U/ch/DpSiCL/suc/sum/Hag
		U/ch/LGr/suc/sum/Hag
		U/ch/LiShC/suc/sum/Hag
		U/ch/LiShC/suo/smxl/Hag
		U/ch/LiShC/suo/sud/A
		U/ch/LiShC/suo/sum/A
		U/ch/LiShC/suo/sum/Hag
		U/ch/MDpCF/suc/sud/Hag
		U/ch/MDpCF/suc/sum/DC
		U/ch/MDpCF/suc/sum/Hag

Appendix 8. Continued.

Ecotype	Erosion Sensitivity	ITU
Upland Rocky-Loamy Undiffentiated Shrubland (continued)		U/ch/MDpCF/suc/sum/Hcl
		U/ch/MDpCF/suo/smxl/Hag
		U/ch/MDpCF/suo/sum/A
		U/ch/MDpCF/suo/sum/Hag
		U/ch/Rock/suo/sud/Hag
		U/ch/StmBkHG/suo/scs/A
		U/H/LiShC/suo/sum/Hf
		U/H/MDpCF/suc/sum/Hf