

Rare Plant and Vegetation Survey of Lake Chelan State Park



Pacific Biodiversity Institute

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Executive Summary

Pacific Biodiversity Institute (PBI) conducted a rare plant and vegetation survey of Lake Chelan State Park for the Washington State Parks and Recreation Commission (WSPRC). Lake Chelan State Park covers about 147 acres. The park lies within the glacial trough of Lake Chelan Valley, about ten miles above its lower, southernmost end. Lake Chelan is the second-deepest lake in the United States. The park is situated just below a saddle to Navarre Coulee that served as the outlet for glacial ice and water during the Pleistocene glaciation.

A total of 14 polygons covered by 5 plant associations and 2 general land cover types were mapped and visited in Lake Chelan State Park. Existing plant communities were characterized within each polygon. Natural forest types were predominantly dominated by either ponderosa pine or Douglas-fir.

No rare plants listed by the State of Washington were found in Lake Chelan State Park.

We found two Class B noxious weeds and four Class C noxious weeds. The most widespread noxious weed in the park is diffuse knapweed (*Centaurea diffusa*). This plant favors disturbed roadsides.

About 25 % of Lake Chelan State Park is developed. The ecological condition of non-developed plant communities in the park was ranked primarily in good condition. However the rankings do not convey the detrimental effects of fire suppression that is occurring here. Even in stands that are nearly free of invasive species, fire suppression has created dense understories of shrubs that are competing with the native pines for available nutrients. Due to fire suppression, many of the upland areas have become heavily stocked with woody species that now pose a fire hazard. We recommend undertaking a program of thinning and controlled burning to try and save these stands.

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Introduction

Lake Chelan State Park is located in Chelan County along Lake Chelan, a 60-mile long glacial valley with its terminus about a mile away from the Columbia River. The park is bordered on three sides by privately owned parcels. Lake Chelan is a rapidly growing recreational destination used by tourists throughout the country.

Lake Chelan State Park has a stream running through it and several wetlands and small springs that appear to be derived from agricultural runoff. The climate is moderated by the lake, and this in turn offers a less harsh growing environment compared to areas with similar soils and climate elsewhere in the county.

The vegetation is predominantly ponderosa pine forest or bitterbrush-dominated shrub-steppe. Some of the pines are up to four feet in diameter. Both of these plant groups have become densely overstocked with vegetation due to fire suppression.

Survey Conditions and Survey Routes

Lake Chelan State Park was initially visited on May 13, 2008. A second visit was conducted on August 10. The survey routes are shown in Figure 1.

Access to the easternmost portion of Lake Chelan State Park is blocked by a steep cliff above the lake. Access is possible only by crossing private land or by scrambling up the cliff talus. This polygon was only visited once.



Figure 1. Field survey schedule and routes.

Vegetation Communities

Methods

Pre-field reviews of literature, GIS data, and remote sensing data were conducted early in the season. Maps, GIS data, and remotely sensed data were assembled together into an ArcMap GIS project covering the project area. Topographic maps and digital elevation models (DEMs) were also assembled. Using the gathered spatial data resources, discrete vegetation polygons meant to represent specific plant communities or mosaics of plant communities were manually delineated by staff ecologists as polygon features in an ESRI shapefile format.

The park was then visited twice during the field season to assure observation of both early and late-blooming plant species. The first visit was primarily a reconnaissance of the project area, meant to create a basic plant list for the park and to conduct initial rare plant surveys for early bloomers. Later visits focused on collecting field data for the vegetation polygon map and adding more species to the plant list during different times of the season. Before the field season was complete, all vegetation polygons that could be accessed safely were visited and field data was collected.

Plant community data was recorded on a form initially developed by the WSPRC (Appendix A). Recorded data included a wide variety of information about the vegetation composition, environmental characteristics, disturbance history and other notes for each polygon. Each polygon was rated for its overall ecological condition. Vegetation community and land cover classifications were assigned using information and keys from standard literature sources cited in the Reference section of this document.

During field visits survey personnel had printed and digital maps available that included high-resolution aerial imagery. Digital maps were accessed in the field using ArcPad software (ESRI 2007) running on pocket PC, GPS enabled devices. Use of ArcPad allowed all survey routes to be mapped on a GPS recorder in real time, and allowed for viewing and editing data directly from field locations, resulting in field-verified attributes for the vegetation polygons.

Once gathered, the field data was edited and entered into a Microsoft Access database and linked to the vegetation polygon geodatabase. Further refinements and editing of the vegetation data stored in the personal geodatabase was made based on information collected in the field with ArcPad.

Historical Vegetation

The natural vegetation at Lake Chelan State Park is currently undergoing a rapid change. Stands that were formerly open old growth forests or grassy shrub-steppe are now in rapid decline due to the effects of fire suppression. The effects of fire suppression appear more severe here than in any of the other 17 parks we visited in 2008.

Lake Chelan State Park has a temperate climate that is moderated year-round by its proximity to Lake Chelan, which provides humid air and helps prevent freezing weather. The park lies directly in the path of storms that are generated up lake in the Cascade Range. The mountain above the lake is aptly named Stormy Mountain. These storms bring summer thunderstorms to the park, along with additional rain, wind and lightning not felt further away from the lake.

The original lakeshore no longer exists, as a dam maintains the level of the lake at a higher level. The water level of the lake is allowed to rise and fall about 20 feet each year under the control of the dam.

Lake Chelan State Park is dominated by three main vegetative communities: lower elevation coniferous forest, non-forested shrub-steppe, and riparian conifer forest. Of these, only the latter riparian forest could be considered to resemble presettlement conditions. The dry plant communities are no longer kept open and free of dense shrubs by frequent wildfires. During presettlement times, fires burned through the area every 15 years or so, maintaining park-like stand conditions for big “yellow-belly” pines to grow in. Fire was started both by lightning and by the native Chelan Indians, who used fire to improve forage for wildlife and cultural plants. Under historic fire regimes, annual species and grasslands would have been more predominant than they are today.

After a hundred years of fire suppression, live and dead fuels have built up to the point where they are a present a hazard that could result in a severe fire with high mortality to the surviving trees and likely safety concerns for firefighters. The park was threatened with such a wildfire during the Tyee and Rat Lake Fires of 1994, when the entire area around the park was evacuated for weeks. Firefighters were barely able to control the fire about a mile from the park.

On the other hand, Lake Chelan State Park is relatively free of major weed invasions. One reason for this is that the area does not have an extensive agricultural or industrial history. There is an orchard directly

above the park that may be contributing runoff water to the park. Several small seeps and streams in the park do not appear completely natural. They lack a diverse flora and defined stream banks.

Results

Vegetation Community Mapping

A total of 14 vegetation community polygons were mapped and surveyed in Lake Chelan State Park (Figure 2). These polygons were categorized into five plant associations and two generalized land cover classes (Table 1). Table 2 gives additional reference information about the plant associations. The communities were assigned to a primary, secondary or a tertiary community. Primary community types are the dominant or matrix vegetation community within a polygon, whereas secondary and tertiary community types are less abundant vegetation community types that occur within the same polygon and were not conducive to being mapped as a separate polygon due to the size, shape, or pattern of the community patches within the polygon.



Figure 2. Map of Lake Chelan State Park showing vegetation community polygons overlaid onto an aerial photo of the park.

Table 1. Plant communities observed in Lake Chelan State Park.

Plant Association, Vegetation Community or Land Cover (Codes)	Plant Communities and Land Cover Observed (Codes)
Ponderosa pine/ bitterbrush/ bluebunch wheatgrass (PIPO/PUTR2/PSSP6)	PIPO/PUTR2/PSSP6-BASA3; PIPO/PUTR2-AMAL2/PSSP6; PIPO/PSSP6-CARU; PIPO/PUTR2-SYAL
Ponderosa pine / snowberry (PIPO/SYAL)	PIPO/SYAL-CRDO2-COSE16; PIPO/SYAL/ELGL
Douglas-fir/ snowberry (PSME/SYAL)	PSME/SYAL; PIPO-POBAT-ACMA3/SYAL-ROWO/POPR-ELGL; PIPO-PSME/SYAL-ROWO;
Cottonwood / red-osier dogwood (POBAT / COSE16)	POBAT-ROPS/COSE16
Cottonwood / mountain alder (POBAT / ALIN2)	POBAT-ALIN2/RUPA-ROWO/EQAR
Developed	Campground; Road; Developed areas including roads and campgrounds
Water	Lake

Table 2. Plant association reference table for Lake Chelan State Park. Global status is defined in Appendix C.

Code	Scientific Names	Authority	Global Status
PIPO/PUTR2/PSSP6	<i>Pinus ponderosa</i> / <i>Purshia tridentata</i> / <i>Pseudoroegneria spicata</i>	Lillybridge et al. 1995	G4 (apparently secure)
PIPO/SYAL	<i>Pinus ponderosa</i> / <i>Symphoricarpos albus</i>	Daubenmire and Daubenmire 1984	G4 (apparently secure)
PSME/SYAL	<i>Pseudotsuga menziesii</i> / <i>Symphoricarpos albus</i>	Daubenmire and Daubenmire 1984	G5 (secure)
POBAT/COSE16	<i>Populus trichocarpa</i> / <i>Cornus sericea</i>	Kovalchik and Clausnitzer 2004	G3 (vulnerable)
POBAT/ALIN	<i>Populus trichocarpa</i> / <i>Alnus incana</i>	Kovalchik and Clausnitzer 2004	G3 (vulnerable)

Each vegetation community polygon has at least one primary vegetation community/land cover class assigned to it, and up to two additional classes. Figure 3 shows a map depicting the primary vegetation community/land cover class for each polygon within the park. Appendix D describes the attributes described for each polygon mapped within the project area.

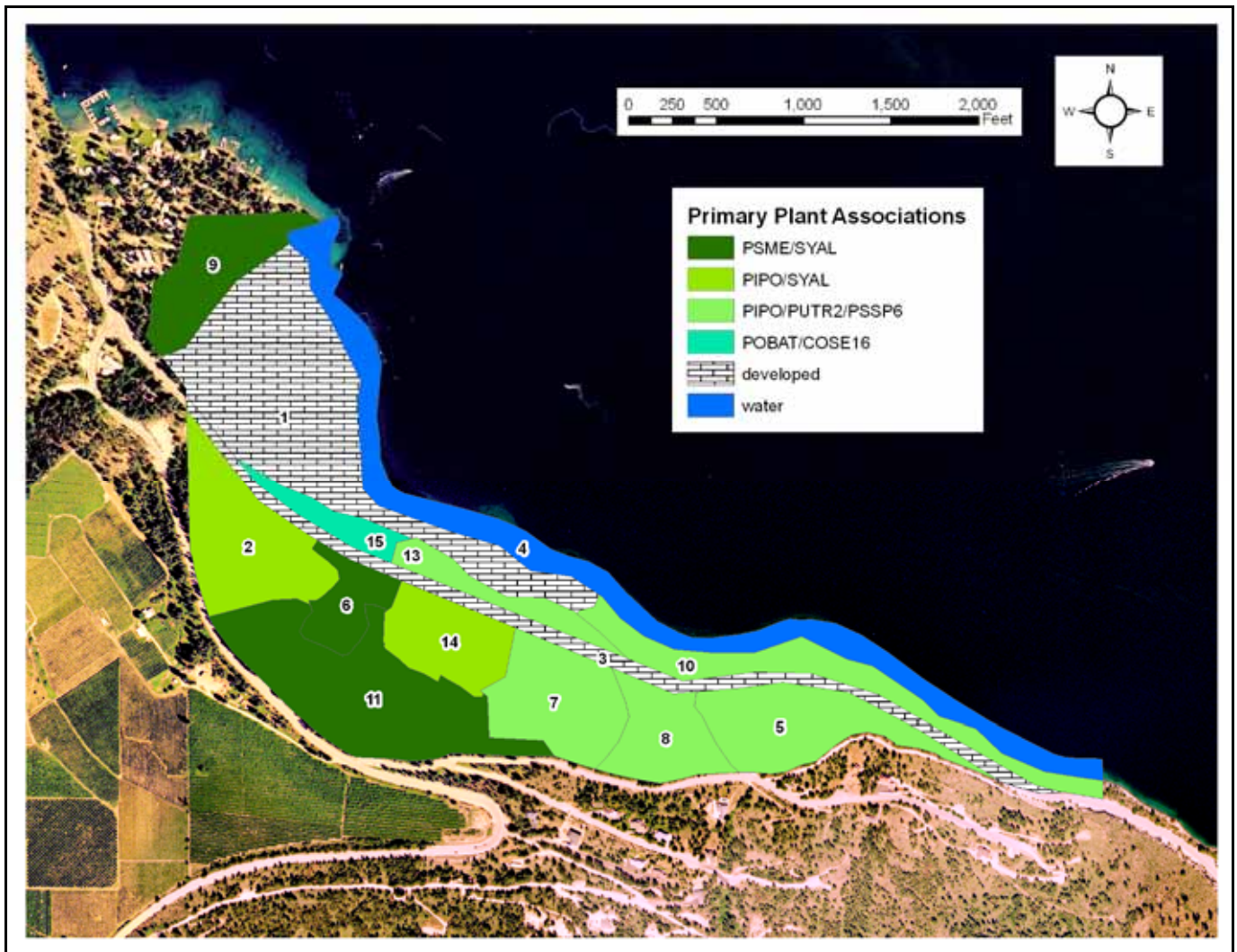


Figure 3. Map of primary plant communities attributed to each vegetation polygon.

Vegetation Community and Land Cover Types

Ponderosa pine / bitterbrush / bluebunch wheatgrass (PIPO/PUTR2/PSSP6) (G4)



Figure 4. An example of the ponderosa pine / bitterbrush / bluebunch wheatgrass association at Lake Chelan State Park, here with an overstocked understory of bitterbrush.

The ponderosa pine / bitterbrush / bluebunch wheatgrass association has an overstory of ponderosa pine, a shrub layer dominated by bitterbrush, and a forb layer dominated by bluebunch wheatgrass (Figure 4). It was described by Lillybridge (1995). It has a G4 ranking, which implies that it is globally secure.

The ponderosa pine / bitterbrush / bluebunch wheatgrass association occurs in the eastern part of Lake Chelan State Park. This part of the park is more exposed and has drier soils than the rest of the park. A number of other shrubs are commonly found in this community including Lewis' mock-orange (*Philadelphus lewisii*; PHLE4), Wood's rose (*Rosa woodsii*; ROWO), parsnip-flowered desert buckwheat (*Eriogonum heracleoides*; ERHE2), buckbrush (*Ceanothus velutinus*; CEVE), bitter cherry (*Prunus emarginata*; PREM) and serviceberry (*Amelanchier alnifolia*; AMAL2). Common forbs are arrowleaf balsamroot (*Balsamorhiza sagittata*; BASA3) and common yarrow (*Achillea millefolium*; ACMI2).

The ponderosa pine / bitterbrush / bluebunch wheatgrass association is fire-adapted. In pre-settlement times, fires would burn through this community every 5 to 15 years (Ohlson 1996). Both the bluebunch wheatgrass and the litter from ponderosa pines are highly flammable and carry fire readily. Pine can

survive fire well, but bitterbrush survival requires a less intense burn such as a spring burn (personal communication, Tod Johnson, FMO, North Cascades National Park).

The reintroduction of prescribed fire on a maintenance schedule would benefit this community by maintaining an open stand with abundant wildflowers and lower fuel hazards. In addition, the bitterbrush is more palatable when it has recently sprouted. Due to fire suppression, some of the stands of ponderosa pine / bitterbrush / bluebunch wheatgrass have become densely overstocked with shrubs that are outcompeting grasses and forbs. Figure 4 illustrates this condition. Because the fuel loads are much higher than the historic norm, it will be difficult to restore fire to this stand without prior fuel reduction, or some means of reducing flame lengths to a controllable length. See the restoration section for further discussion.

Ponderosa pine / snowberry (PIPO/SYAL) G4



Figure 5. An example of the ponderosa pine / snowberry plant association at Lake Chelan State Park. Trees have succumbed to competition and root rot pathogens, releasing the snowberry.

The ponderosa pine / snowberry plant association was described by Daubenmire and Daubenmire (1984). It is composed of an overstory of ponderosa pine with an understory of common snowberry. It is ranked G4, globally secure.

The ponderosa pine / snowberry association occurs on moister sites than that of the ponderosa pine / bitterbrush plant association. The presence of this association is indicative of soils that are more

productive. This association has evolved with fire, and would normally burn every 15-30 years in a natural fire-regime (Ohlson 1996). Periodic use of prescribed fire may be necessary to maintain this plant association.

Douglas fir / snowberry (PSME/SYAL) G5



Figure 6. An example of the Douglas fir / snowberry plant association at Lake Chelan State Park. Non-native invading English walnut trees are visible in the left background of this photo that are contributing to the decline of ponderosa pine such as the fallen one in the foreground.

The Douglas fir / snowberry plant association was originally described by Daubenmire and Daubenmire (1984). It is composed of an overstory of Douglas fir with an understory of common snowberry. It occurs on moister, shadier sites than the ponderosa pine associations. It is ranked G5, globally secure.

The Douglas fir / snowberry plant association is fire-adapted. It has a slightly longer mean fire-return interval than the drier ponderosa pine plant associations and a mixed severity fire regime (Washington State University 2004). Fire severity is more variable in stands with a mixed-severity fire regime, resulting in a patchy mosaic of young and older forest.

Cottonwood / red-osier dogwood (POBAT/COSE16) G3



Figure 7. An example of the cottonwood / red-osier dogwood plant association at Lake Chelan State Park.

The cottonwood / red-osier dogwood plant association was described by Kovalchik and Clausnitzer (2004). This plant association is a wetland/riparian community with an overstory of cottonwood (*Populus balsamifera* ssp. *trichocarpa*; POBAT) and with an understory dominated by red-osier dogwood (*Cornus sericea*; COSE16). This plant association has a rank of G3, implying that it is vulnerable globally.

At Lake Chelan State Park, the cottonwood / red-osier dogwood plant association often occurs as inclusions within drier coniferous forests at Lake Chelan State Park. The one polygon that was classified as the cottonwood / red-osier dogwood association is highly altered by non-native species and irrigation. It does not resemble a natural stand. Some of the wetlands and streams that support this association appear to be derived from agricultural runoff from above the park, in addition to irrigation. The species mix in these wetlands is highly altered, and contains a number of exotic ornamentals such as English walnut (*Juglans nigra*; JURE80), and escaped apples (*Malus pumilus*; MAPU). The presence of cottonwood in these stands is declining while the native black hawthorn (*Crataegus douglasii*; CRDO2) is becoming more dominant. Red-osier dogwood appears stable. Normally, these stands would burn in a mixed-severity fire regime, with some patchy underburns occurring and less frequent crown fires on a longer cycle. With fire suppression, the black hawthorn and invasive woody species will continue to dominate the stand.

Cottonwood / mountain alder (POBAT/ALIN2) G3



Figure 8. An example of the cottonwood / mountain alder association at Lake Chelan State Park, forming a narrow band along the stream in the western part of the park.

The cottonwood / mountain alder association was described by Kovalchik and Clausnitzer (2004). It occurs as a narrow riparian strip in the western part of the park, within a polygon classified primarily as Douglas fir / snowberry. The cottonwood / mountain alder association occupied 40% of the polygon that it occurred in, so it was classified as the secondary plant association. This plant association is ranked G3, vulnerable globally.

The cottonwood / mountain alder association is controlled by a hydrologic disturbance regime, as much or more than fire disturbance. Ecological factors include the chemistry and physics of organic transport, timing and amount of rock and woody debris, bank characteristics and the flow regime.

The polygon containing the cottonwood / mountain alder association was one of only two polygons ranked in excellent ecological condition in Alta Lake State Park. This stand is likely to remain functional if the hydrologic functions continue to be maintained. Currently the area is used for tent camping. At the present level of use, this appears to be ecologically neutral; however, expanded camping should be carefully weighed with the potential for deleterious hydrologic changes.

Other Land Cover Types

Lake Chelan State Park had a number of unclassified areas and general land cover types including the following:

- Water;
- Developed areas including roads and campgrounds

Rare Plant Surveys

Methods

Lake Chelan State Park was visited two times during the 2008 field season. We used the Washington Department of Natural Resources Natural Heritage Program's (DNR NHP) rare plant list to determine the conservation status of vascular plants encountered in the field. We collected plant specimens for later identification when needed. We used a wide range of floras and other plant identification references (e.g. Boersma et al 2006, Flora of North America 1993+, Jolley 1988, Hitchcock and Cronquist 1973, Hitchcock et al 1955, Hickman 1993, University of Washington Burke Museum Herbarium Vascular Plant Collection, USDA 2008, Washington Natural Heritage Program 2008, Washington Natural Heritage Program. no date, Whitson et al 2000, Wilson 2006).

Field surveys were conducted on May 13 and August 10. During the field surveys, we were equipped with reference literature, rare plant lists for the area, and maps showing rare plant locations from previous surveys. We looked for rare plants in habitats previously identified as being likely occurrence sites. So as not to miss any rare plants, all vascular plant species encountered during the inventory were identified on site, at base camp in the portable laboratory, or back at our office.

Survey routes were determined based on the need to cover efficiently a large proportion of the park's area throughout the field season. We surveyed areas of the park more intensively where rare plants were felt more likely to occur. This method is referred to as the intuitive-controlled method of rare plant surveys (Whiteaker 1998). These areas were the lakeshore, wetlands, and the stream at the west end of the park. Survey routes for the rare plant inventory and rare plant locations were recorded either by hand, on a hardcopy topographic map, or as GPS waypoints and trackpoints, all of which were later compiled into a single GIS data layer, depicted in Figure 1.

Results

No rare plants were listed by DNR NHP as occurring within Lake Chelan State Park. Our surveys did locate any new populations of threatened, endangered or sensitive plants at this park.

Vascular Plant List for the 2008 Project Area

There were 134 vascular taxa identified to species during surveys of Lake Chelan State Park (Table 3). An additional four genera were observed that were only identifiable to the rank of genus or family. Of those, all probably represent additional taxa, bringing the total number of taxa accounted for to approximately 138. Table 3 also identifies 45 non-native species identified within the park, or approximately 33% of the total number of species observed.

Table 3. Vascular Plant Species of Lake Chelan State Park. The column “Symbol” represents the plant code used on the USDA PLANTS database.

Symbol	Scientific Name with Author	National Common Name	Family	Exotic
ABGR	<i>Abies grandis</i> (Douglas ex D. Don) Lindl.	grand fir	Pinaceae	
ACGLD4	<i>Acer glabrum</i> Torr. var. <i>douglasii</i> (Hook.) Dippel	Douglas maple	Aceraceae	
ACJA2	<i>Acer japonicum</i> Thunb.	Amur maple	Aceraceae	yes
ACMA3	<i>Acer macrophyllum</i> Pursh	bigleaf maple	Aceraceae	
ACMI2	<i>Achillea millefolium</i> L.	common yarrow	Asteraceae	
ACNE2	<i>Acer negundo</i> L.	boxelder	Aceraceae	
ACNED	<i>Achnatherum nelsonii</i> (Scribn.) Barkworth ssp. <i>dorei</i> (Barkworth & Maze) Barkworth	Dore's needlegrass	Poaceae	
ACPA2	<i>Acer palmatum</i> Thunb.	Japanese maple	Aceraceae	yes
AIAL	<i>Ailanthus altissima</i> (Mill.) Swingle	tree of heaven	Simaroubaceae	yes
ALIN2	<i>Alnus incana</i> (L.) Moench	gray alder	Betulaceae	
AMAL2	<i>Amelanchier alnifolia</i> (Nutt.) Nutt. ex M. Roem.	Saskatoon serviceberry	Rosaceae	
ANCA14	<i>Anthriscus caucalis</i> M. Bieb.	bur chervil	Apiaceae	yes
ANMI3	<i>Antennaria microphylla</i> Rydb.	littleleaf pussytoes	Asteraceae	
ARDR4	<i>Artemisia dracunculus</i> L.	tarragon	Asteraceae	
ARHOR	<i>Arabis holboellii</i> Hornem. var. <i>retrofracta</i> (Graham) Rydb.	second rockcress	Brassicaceae	
ARM12	<i>Arctium minus</i> Bernh.	lesser burdock	Asteraceae	yes
ASCLE	<i>Asclepias</i> L.	milkweed	Asclepiadaceae	
ASOF	<i>Asparagus officinalis</i> L.	garden asparagus	Liliaceae	yes
BASA3	<i>Balsamorhiza sagittata</i> (Pursh) Nutt.	arrowleaf balsamroot	Asteraceae	
BRIN2	<i>Bromus inermis</i> Leyss.	smooth brome	Poaceae	yes
BRTE	<i>Bromus tectorum</i> L.	cheatgrass	Poaceae	yes
BRVU	<i>Bromus vulgaris</i> (Hook.) Shear	Columbia brome	Poaceae	
CALY	<i>Calochortus lyallii</i> Baker	Lyall's mariposa lily	Liliaceae	
CARO5	<i>Carex rossii</i> Boott	Ross' sedge	Cyperaceae	
CARU	<i>Calamagrostis rubescens</i> Buckley	pinegrass	Poaceae	
CEDI3	<i>Centaurea diffusa</i> Lam.	diffuse knapweed	Asteraceae	yes
CEVE	<i>Ceanothus velutinus</i> Douglas ex Hook.	snowbrush ceanothus	Rhamnaceae	
CHAN9	<i>Chamerion angustifolium</i> (L.) Holub	fireweed	Onagraceae	
CIAL	<i>Circaea alpina</i> L.	small enchanter's nightshade	Onagraceae	
CIVU	<i>Cirsium vulgare</i> (Savi) Ten.	bull thistle	Asteraceae	yes
CLLI2	<i>Clematis ligusticifolia</i> Nutt.	western white clematis	Ranunculaceae	
CLPE	<i>Claytonia perfoliata</i> Donn ex Willd.	miner's lettuce	Portulacaceae	
COCA5	<i>Conyza canadensis</i> (L.) Cronquist	Canadian horseweed	Asteraceae	
COPA3	<i>Collinsia parviflora</i> Lindl.	maiden blue eyed Mary	Scrophulariaceae	
COSE16	<i>Cornus sericea</i> L.	redosier dogwood	Cornaceae	

Symbol	Scientific Name with Author	National Common Name	Family	Exotic
COUM	<i>Comandra umbellata</i> (L.) Nutt.	bastard toadflax	Santalaceae	
CRDO2	<i>Crataegus douglasii</i> Lindl.	black hawthorn	Rosaceae	
CYFR2	<i>Cystopteris fragilis</i> (L.) Bernh.	brittle bladderfern	Dryopteridaceae	
CYOF	<i>Cynoglossum officinale</i> L.	gypsyflower	Boraginaceae	yes
DAGL	<i>Dactylis glomerata</i> L.	orchardgrass	Poaceae	
DELI3	<i>Delphinium lineapetalum</i> Ewan	thinpetal larkspur	Ranunculaceae	
DEPI	<i>Descurainia pinnata</i> (Walter) Britton	western tansymustard	Brassicaceae	
DOPU	<i>Dodecatheon pulchellum</i> (Raf.) Merr.	darkthroat shootingstar	Primulaceae	
DRVE2	<i>Draba verna</i> L.	spring draba	Brassicaceae	
ELGL	<i>Elymus glaucus</i> Buckley	blue wildrye	Poaceae	
EPMI	<i>Epilobium minutum</i> Lindl. ex Lehm.	chaparral willowherb	Onagraceae	
EQAR	<i>Equisetum arvense</i> L.	field horsetail	Equisetaceae	
EQHY	<i>Equisetum hyemale</i> L.	scouringrush horsetail	Equisetaceae	
ERCI	<i>Eragrostis cilianensis</i> (All.) Vign. ex Janchen	stinkgrass	Poaceae	yes
ERCO5	<i>Erigeron corymbosus</i> Nutt.	longleaf fleabane	Asteraceae	
EREL5	<i>Eriogonum elatum</i> Douglas ex Benth.	tall woolly buckwheat	Polygonaceae	
ERHE2	<i>Eriogonum heracleoides</i> Nutt.	parsnipflower buckwheat	Polygonaceae	
FEID	<i>Festuca idahoensis</i> Elmer	Idaho fescue	Poaceae	
FEOC	<i>Festuca occidentalis</i> Hook.	western fescue	Poaceae	
FOIN3	<i>Forsythia X intermedia</i> Zabel [suspensa X viridissima]	showy forsythia	Oleaceae	yes
GAAP2	<i>Galium aparine</i> L.	stickywilly	Rubiaceae	yes
GADI2	<i>Gayophytum diffusum</i> Torr. & A. Gray	spreading groundsmoke	Onagraceae	
GLTR	<i>Gleditsia triacanthos</i> L.	honeylocust	Fabaceae	yes
HECYG	<i>Heuchera cylindrica</i> Douglas ex Hook. var. <i>glabella</i> (Torr. & A. Gray) Wheelock	beautiful alumroot	Saxifragaceae	
HISC2	<i>Hieracium scouleri</i> Hook.	Scouler's woollyweed	Asteraceae	
HODI	<i>Holodiscus discolor</i> (Pursh) Maxim.	oceanspray	Rosaceae	
HYCA4	<i>Hydrophyllum capitatum</i> Douglas ex Benth.	ballhead waterleaf	Hydrophyllaceae	
HYPE	<i>Hypericum perforatum</i> L.	common St. Johnswort	Clusiaceae	yes
JURE80	<i>Juglans regia</i> L.	English walnut	Juglandaceae	yes
JUSC2	<i>Juniperus scopulorum</i> Sarg.	Rocky Mountain juniper	Cupressaceae	
LAPA5	<i>Lathyrus pauciflorus</i> Fernald	fewflower pea	Fabaceae	
LASE	<i>Lactuca serriola</i> L.	prickly lettuce	Asteraceae	
LECI4	<i>Leymus cinereus</i> (Scribn. & Merr.) A. Löve	basin wildrye	Poaceae	
LIDAD	<i>Linaria dalmatica</i> (L.) Mill. ssp. <i>dalmatica</i>	Dalmatian toadflax	Scrophulariaceae	yes
LIGL2	<i>Lithophragma glabrum</i> Nutt.	bulbous woodland-star	Saxifragaceae	
LIPA5	<i>Lithophragma parviflorum</i> (Hook.) Nutt. ex Torr. & A. Gray	smallflower woodland-star	Saxifragaceae	
LIRU4	<i>Lithospermum ruderales</i> Douglas ex Lehm.	western stone seed	Boraginaceae	
LOAM	<i>Lomatium ambiguum</i> (Nutt.) J.M. Coulter & Rose	Wyeth biscuitroot	Apiaceae	
LOPE	<i>Lolium perenne</i> L.	perennial ryegrass	Poaceae	yes
LOTUS	<i>Lotus</i> L.	trefoil	Fabaceae	
LUSE4	<i>Lupinus sericeus</i> Pursh	silky lupine	Fabaceae	
MAAQ2	<i>Mahonia aquifolium</i> (Pursh) Nutt.	hollyleaved barberry	Berberidaceae	
MANE	<i>Malva neglecta</i> Wallr.	common mallow	Malvaceae	yes
MAPU	<i>Malus pumila</i> Mill.	paradise apple	Rosaceae	yes
MARA7	<i>Maianthemum racemosum</i> (L.) Link	feathery false lily of the valley	Liliaceae	

Symbol	Scientific Name with Author	National Common Name	Family	Exotic
MAST4	<i>Maianthemum stellatum</i> (L.) Link	starry false lily of the valley	Liliaceae	
MELO4	<i>Mertensia longiflora</i> Greene	small bluebells	Boraginaceae	
MEOF	<i>Melilotus officinalis</i> (L.) Lam.	yellow sweetclover	Fabaceae	yes
MYST2	<i>Myosotis stricta</i> Link ex Roem. & Schult.	strict forget-me-not	Boraginaceae	
NECA2	<i>Nepeta cataria</i> L.	catnip	Lamiaceae	yes
ORPI2	<i>Orobanche pinorum</i> Geyer ex Hook.	conifer broomrape	Orobanchaceae	
PAMY	<i>Paxistima myrsinites</i> (Pursh) Raf.	Oregon boxleaf	Celastraceae	
PARTH3	<i>Parthenocissus</i> Planch.	creeper	Vitaceae	yes
PHAR3	<i>Phalaris arundinacea</i> L.	reed canarygrass	Poaceae	yes
PHFL9	<i>Photinia floribunda</i> (Lindl.) Robertson & Phipps	purple chokeberry	Rosaceae	yes
PHLE4	<i>Philadelphus lewisii</i> Pursh	Lewis' mock orange	Hydrangeaceae	
PHSP	<i>Phlox speciosa</i> Pursh	showy phlox	Polemoniaceae	
PIPO	<i>Pinus ponderosa</i> C. Lawson	ponderosa pine	Pinaceae	
PLLA	<i>Plantago lanceolata</i> L.	narrowleaf plantain	Plantaginaceae	yes
PLMA2	<i>Plantago major</i> L.	common plantain	Plantaginaceae	yes
POAN	<i>Poa annua</i> L.	annual bluegrass	Poaceae	yes
POBAT	<i>Populus balsamifera</i> L. ssp. <i>trichocarpa</i> (Torr. & A. Gray ex Hook.) Brayshaw	black cottonwood	Salicaceae	
POBU	<i>Poa bulbosa</i> L.	bulbous bluegrass	Poaceae	yes
PODO4	<i>Polygonum douglasii</i> Greene	Douglas' knotweed	Polygonaceae	
POPR	<i>Poa pratensis</i> L.	Kentucky bluegrass	Poaceae	yes
POWH2	<i>Poa wheeleri</i> Vasey	Wheeler's bluegrass	Poaceae	
PREM	<i>Prunus emarginata</i> (Douglas ex Hook.) D. Dietr.	bitter cherry	Rosaceae	
PRVI	<i>Prunus virginiana</i> L.	chokecherry	Rosaceae	
PSCAT	<i>Pseudognaphalium canescens</i> (DC.) W.A. Weber ssp. <i>thermale</i> (E.E. Nelson) Kartesz	Wright's cudweed	Asteraceae	
PSME	<i>Pseudotsuga menziesii</i> (Mirb.) Franco	Douglas-fir	Pinaceae	
PSSP6	<i>Pseudoroegneria spicata</i> (Pursh) A. Löve	bluebunch wheatgrass	Poaceae	
PTAN2	<i>Pterospora andromedea</i> Nutt.	woodland pinedrops	Monotropaceae	
PUTR2	<i>Purshia tridentata</i> (Pursh) DC.	antelope bitterbrush	Rosaceae	
RICE	<i>Ribes cereum</i> Douglas	wax currant	Grossulariaceae	
ROPS	<i>Robinia pseudoacacia</i> L.	black locust	Fabaceae	yes
ROSA5	<i>Rosa</i> L.	rose	Rosaceae	yes
ROWO	<i>Rosa woodsii</i> Lindl.	Woods' rose	Rosaceae	
RULE	<i>Rubus leucodermis</i> Douglas ex Torr. & A. Gray	whitebark raspberry	Rosaceae	
RUPA	<i>Rubus parviflorus</i> Nutt.	thimbleberry	Rosaceae	
SAIN4	<i>Saxifraga integrifolia</i> Hook.	wholeleaf saxifrage	Saxifragaceae	
SANIC5	<i>Sambucus nigra</i> L. ssp. <i>cerulea</i> (Raf.) R. Bolli	blue elderberry	Caprifoliaceae	
SASC	<i>Salix scouleriana</i> Barratt ex Hook.	Scouler's willow	Salicaceae	
SEIN2	<i>Senecio integerrimus</i> Nutt.	lambstongue ragwort	Asteraceae	
SIAL2	<i>Sisymbrium altissimum</i> L.	tall tumbledmustard	Brassicaceae	yes
SILAA3	<i>Silene latifolia</i> Poir. ssp. <i>alba</i> (Mill.) Greuter & Burdet	bladder campion	Caryophyllaceae	yes
SOAU	<i>Sorbus aucuparia</i> L.	European mountain ash	Rosaceae	yes
SODU	<i>Solanum dulcamara</i> L.	climbing nightshade	Solanaceae	yes
SPBEL	<i>Spiraea betulifolia</i> Pall. var. <i>lucida</i> (Douglas ex Greene) C.L. Hitchc.	shinyleaf spirea	Rosaceae	
SPCR	<i>Sporobolus cryptandrus</i> (Torr.) A. Gray	sand dropseed	Poaceae	

Symbol	Scientific Name with Author	National Common Name	Family	Exotic
SYAL	Symphoricarpos albus (L.) S.F. Blake	common snowberry	Caprifoliaceae	
TAOF	Taraxacum officinale F.H. Wigg.	common dandelion	Asteraceae	yes
THIN6	Thinopyrum intermedium (Host) Barkworth & D.R. Dewey	intermediate wheatgrass	Poaceae	yes
TIAM	Tilia americana L.	American basswood	Tiliaceae	yes
TORY	Toxicodendron rydbergii (Small ex Rydb.) Greene	western poison ivy	Anacardiaceae	
TRDU	Tragopogon dubius Scop.	yellow salsify	Asteraceae	yes
TRGR7	Triteleia grandiflora Lindl.	largeflower triteleia	Liliaceae	
TRRE3	Trifolium repens L.	white clover	Fabaceae	yes
ULPU	Ulmus pumila L.	Siberian elm	Ulmaceae	yes
URDI	Urtica dioica L.	stinging nettle	Urticaceae	
VETH	Verbascum thapsus L.	common mullein	Scrophulariaceae	yes
VISA	Vicia sativa L.	garden vetch	Fabaceae	yes
VULPI	Vulpia C.C. Gmel.	fescue	Poaceae	
ZIVE	Zigadenus venenosus S. Watson	meadow deathcamas	Liliaceae	

Discussion and Recommendations

Noxious Weeds

A list of the noxious weeds found at Lake Chelan State Park is presented in Table 4. We found two Class B noxious weeds and four Class C weeds. The most widespread noxious weed observed was *Centaurea diffusa* (CEDI3), which occurs primarily in disturbed soils and along roadsides. The noxious weeds that were observed within each polygon are recorded in the corresponding record in the vegetation database for the park, which is included in this report as Appendix D.

Table 4. State listed noxious weeds at Lake Chelan State Park.

Symbol	Scientific Name with Author	National Common Name	State Weed Status
CEDI3	Centaurea diffusa Lam.	diffuse knapweed	B
CIVU	Cirsium vulgare (Savi) Ten.	bull thistle	C
CYOF	Cynoglossum officinale L.	Gypsyflower	B
HYPE	Hypericum perforatum L.	St. John's wort	C
PHAR3	Phalaris arundinacea L.	reed canarygrass	C
SILAA3	Silene latifolia Poir. ssp. alba (Mill.) Greuter & Burdet	bladder campion	C

Ecological Condition

Most of Lake Chelan State Park was classified in good ecological condition based on the rating descriptions (see Appendix B for definitions). A map of the overall ecological condition is presented in Figure 9.

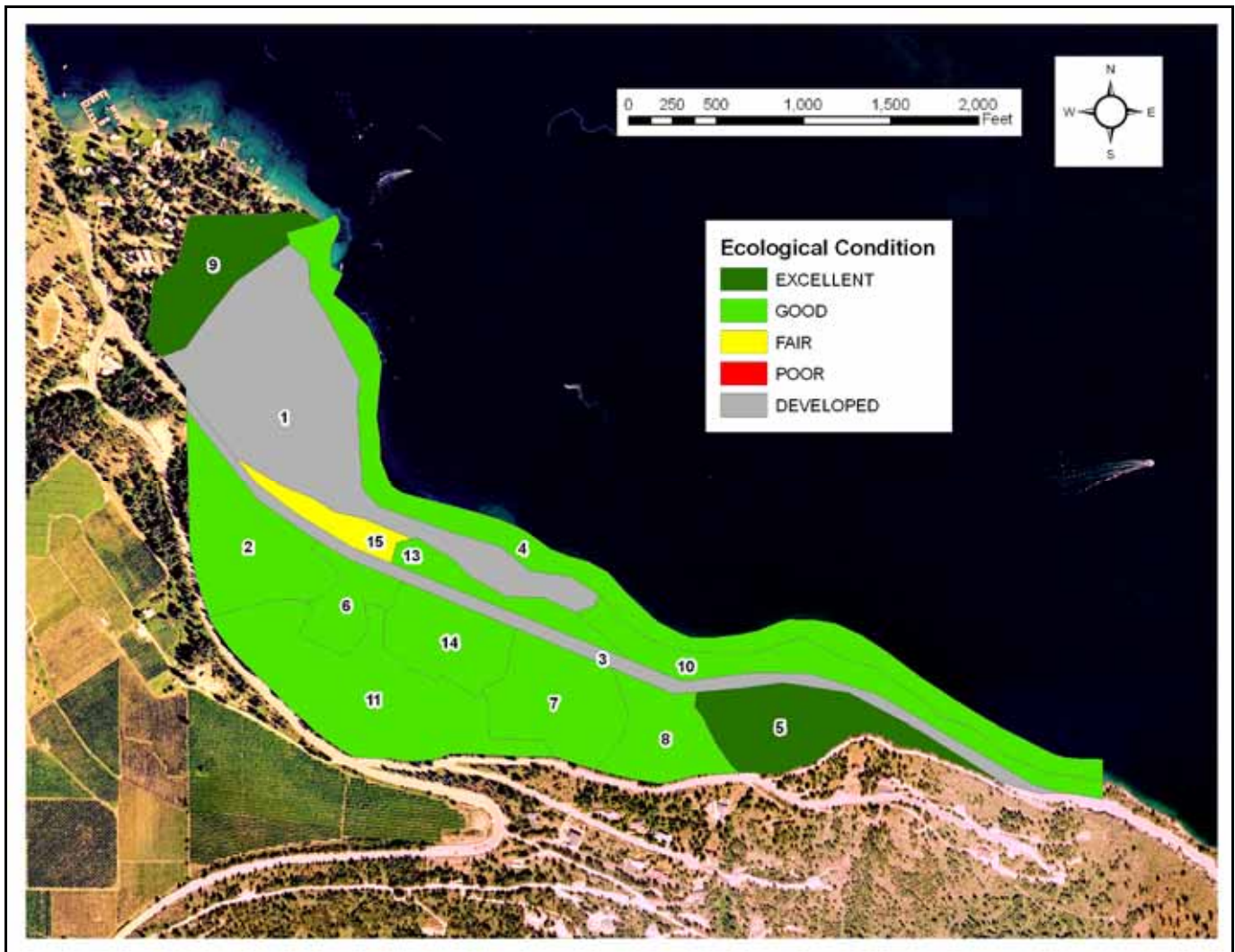


Figure 9. Ecological condition assessed for vegetation polygons at Lake Chelan State Park.

The large amount of area in Lake Chelan State Park rated as “Good” in Figure 9 needs explanation. Some polygons would have been rated higher except that they were dominated by dense monoclonal shrubs resulting from a hundred years of fire suppression. Figure 10 shows a trail through a monoclone of native black hawthorn (*Crataegus douglasii*) in polygon 6.

The effects of fire suppression were more severe at Lake Chelan State Park than any of the other 17 parks we visited in 2008. For example, refer to Figure 5, showing a picture of polygon 11. Polygon 11 is a stand of mature ponderosa pine. This polygon is nearly free of noxious weeds. However, the effects of fire suppression have produced an understory so dense that it is competing with the pines for available nutrients. This is also visible in Figure 6, where a dead pine log is visible. Due to the advanced regeneration of shrubs and non-native deciduous trees, the pines are unable to replace themselves.

Lake Chelan State Park has a large amount of area that historically burned approximately every 5-30 years with low-severity fire (Ohlson 1996). After 100 years of fire suppression, fuels have built up to the point where the next fire could be high-severity with likely high mortality to desirable trees and with dangerous firefighting conditions. Some stands of trees and shrubs have become overstocked and stressed due to competition for nutrients and sunlight. This has led in turn to a high potential for insect outbreaks. This also presents a safety hazard for park visitors.

Fire suppression has had a similar negative impact on areas of shrub-steppe in the park, although at the east end of the park, polygon 5 was still open enough to deserve a rating of “Excellent”. The only other stand rated excellent was polygon 9, which is a stand of mature forest with a stream flowing through it. Polygon 15 was the only stand rated “Fair”, primarily due to a large number of invasive overstory trees in the stand.



Figure 10. Example of dense shrub understory canopies at Lake Chelan State Park in polygon 6. The most common shrub is the native black hawthorn.

There number of native taxa observed in the park was approximately 93 species, which is much lower than expected for a lowland adjacent to a lake, wetlands and streams. The main reason for this is most likely due to the dense understory that is preventing the normal growth of early seral species.

Lake Chelan has a relatively low amount of area covered by invasive species, despite a relatively high percentage of species that are non-native. This can also be attributed to the dense stocking of native shrubs that are preventing the establishment of both weeds and desirable natives. Most of the invasive species were observed along roads and as ornamentals in the developed areas.

Restoration Opportunities

There is a need for fuel reduction at Lake Chelan State Park. Forested stands are suffering from encroachment by dense stands of deciduous shrubs. While these are less flammable than conifers, they can burn with severe, high mortality fire during dry, windy weather conditions. Some of the areas covered

by shrub-steppe vegetation are also severe fire hazards (Figure 5). However, polygon 5 is in a somewhat less advanced state of fuel buildup, probably because it has a drier microclimate.

The best solution to the problem of hazardous fuel build up in fire-prone ecosystems at Lake Chelan State Park would be to return controlled fire to those areas. Controlled fire is a management tool that can accomplish thinning and fuel reduction at a lower cost than mechanical thinning. However reintroduction of controlled fire will require some thinning and creation of fuel breaks beforehand in order to reduce fuels to a level that can be burned safely by hand crews. Controlled fire can take advantage of roads as fuel breaks. Thinning by fire or mechanical means should be put onto a regular schedule, so that this problem does not become so severe in the future.

In order for controlled fire to be used at Lake Chelan State Park, an outreach and education effort needs to take place in the community. Smoke and fire are always a strong concern for the public, but studies have shown that the public can be accepting of fire if they understand the reasons why it is needed. Those who remember the fires of 1994 probably do not need reminding that “No fire is not an option; no smoke is not an option.”

Thinning alone may be necessary in some areas, for example if the risk smoke or fire escapement are insurmountable. In that case, managers should be aware that without fire, these areas will eventually lose their fire-adapted species such as ponderosa pine. For this reason, both the forested and non-forested areas should both be treated. While the need is more critical in the forest, there is a cost-advantage in assembling all treatments under a single burn plan. A burn plan is an official document that describes how a controlled burn will occur.

Thinning and fire have the potential to increase the presence of invasive species. In order to prevent noxious weeds from becoming established following fire, it is important that fire-fighters take care not to spread seed during operations and that managers specify the use of noxious-weed-free seed for reseeding where it is necessary. Monitoring and control of new invaders should occur the first, second and fifth years after treatment.

Where equipment can access the vegetation, chipping could be considered as a means of reducing biomass. However, chips would have to be hauled off site as leaving them on the ground would impede nitrogen cycling and possibly contribute to root decay or other maladaptive vegetation responses.

GIS Products Produced

Associated with this report are polygon layers created by Pacific Biodiversity Institute depicting the vegetation community types and associated data mapped within Lake Chelan State Park. These datasets have been converted into ESRI shapefile formats and provided to the WSPRC. The spatial datasets are complete with metadata meeting FGDC standards. Refer to the associated metadata for descriptions and attribute definitions for each spatial dataset.

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(<http://www.blm.gov/or/plans/surveyandmanage/SP/VascularPlants/section1.htm>)

Appendix A – Vegetation Survey Codes and Instructions

Site = name of locality of map project

Name/Date = your name / day-month-year completed polygon survey

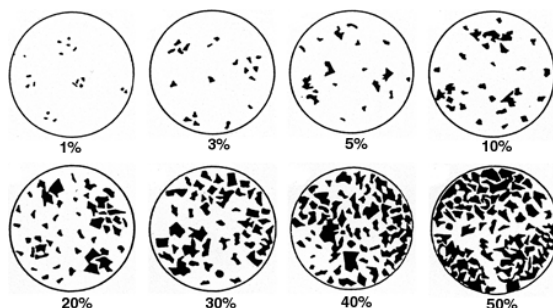
Polygon # = number you put on map

Survey intensity

- 1 = walked or could see most of polygon (high confidence in survey data)
- 2 = walked or could see part of polygon interior (moderate confidence)
- 3 = walked perimeter or could see part of polygon interior (low confidence)
- 4 = photo interpretation or other remote survey

TOTAL VEGETATION COVER includes all vascular plants, mosses, lichens and foliose lichens (crustose lichens excluded they are considered rock); this never exceeds 100%. Space between leaves/branches is included in "cover".

Code	Cover (%)	Cover mid-pt
0	0	0
1	<1	0.5
2	1-5	3
3	5-25	15
4	25-60	43
5	60-90	75
6	>90	95



TREES, SHRUBS, GRAMINOIDS, FORBS, EXOTICS cover includes the space between leaves/branches. Each Life form category canopy cover must be 0-100%. Therefore, the sum of all life forms (layers) can exceed 100%. List most abundant species in each life form category; when trees are cored, note DBH, species, length of core, number of rings counted.

EXOTICS = primary species observed; secondary species observed (please pay special attention to noxious weeds). Also, note the relative abundance of exotics in each polygon, using the 1-6 cover codes noted above.

SUBSTRATES estimate to nearest % the following, the sum of the categories adds to 100%. Describe in comments if there is wide variation in any category; note % standing water if it is persistent or characteristic of site.

Water = exposed standing or flowing water

Rock Outcrop = exposed bedrock including detached boulders over 1m across

Talus = exposed large, loose rocks

Gravel/Cobble = large fragments between sand and boulder

Bare Ground = exposed mineral soil

Mosses/Lichens = nonvascular plant cover on soil

Litter = includes logs, branches, and basal area of plants

Caves = area covered by caves

Mines = area covered by mines

LAND USE - put 0 (zero) if not applicable to site.

Logging

- 1 = unlogged, no evidence of past logging or occasional cut stumps not part of systematic harvest of trees, no or very little impact on stand composition
- 2 = selectively logged: frequent cut stumps but origin of dominant or co-dominant cohort appears to be natural disturbance
- 3 = heavy logging disturbance with natural regeneration: many cut stumps that predate the dominant or co-dominant cohort with no tree planting
- 4 = tree plantation: dominant cohort appears to be planted after clearcutting

Stand Age

- 1 = very young 0-40 yr
- 2 = young 40-90 yr
- 3 = mature 90-200 yr
- 4 = old-growth 200+ yr
- 5 = young with scattered old trees (2-10 old trees per acre)
- 6 = mature with scattered old trees

Fire

Note presence of fire (i.e. charcoal, fire scars, etc.) and, if present, estimate time of fire.

Agriculture

- 1 = active annual cropping
- 2 = active perennial herbaceous cropping
- 3 = active woody plant cultivation
- 4 = fallow, plowed no crops this yr
- 5 = Federal CRP
- 6 = other

Livestock

- 1 = active heavy grazing (most forage used, soil compaction or churning)
- 2 = active moderate grazing (25-75% forage used)
- 3 = active light grazing (lots of last yr's litter left)
- 4 = no current, heavy past grazing
- 5 = no current, light past grazing
- 6 = no obvious sign of grazing

Development

- 1 = actively used facilities
- 2 = roads
- 3 = established trails

- 4 = abandoned facilities
- 5 = none obvious
- 6 = multiple types (detail in comments)

Wildlife

- 1 = heavy ungulate use
- 2 = moderate ungulate use
- 3 = light to no ungulate use
- 4 = burrowing animals

- 5 = active beaver
- 6 = active porcupine
- 7 = other, list animal

Recreation Use Severity

- 1 = heavy use, abundant soil and vegetation displacement off trail/road
- 2 = moderate use, frequent soil and vegetation displacement off trail/road
- 3 = light use, little sign of activity off trail/road

Recreation Use Primary Type

- 1 = wheeled
- 2 = hoofed
- 3 = pedestrian
- 4 = combination of above
- 5 = other

Hydrology

- 1 = unaltered
- 2 = altered; dams, dikes, ditches, culverts, etc
- 3 = not assessed

Descriptions of Plant Communities

PLANT ASSOCIATION (PA) = list all PAs encountered in polygon survey, in comments list source of name if not on provided key. NOTE: Contractor is required to consult with the WNHP to obtain the most current classification and condition ranking information available.

Existing Vegetation Community – Write down the major tree/shrub/grass-forb-fern community type. Pay attention to indicator species. Alien species may be included in community description.

Ecological Condition Rank of PA in key or estimate. (The condition of each plant vegetation community polygon shall be rated using the codes listed in Appendix B.)

% of Polygon = your estimate of % of polygon covered by this plant community. (PA1 is the matrix and a greater % than PA2, if there is a PA2; PA2 is a greater % than PA3, if there is a PA3.)

Pattern = how PA is distributed in stand

1 = matrix (most of polygon)	3 = small patches	5 = scattered, more or less evenly repeating	7 = other
2 = large patches	4 = clumped, clustered, contiguous	6 = linear	

Appendix B – Ecological Condition Ranking System

Ecological Condition Ranks

When assessing conservation priorities and management decisions, it can be useful to rank natural communities into levels of ecological condition. For example, an unfragmented area with high native species diversity, absence of non-native species and little soil erosion often has greater conservation value than another area in the same habitat type that is fragmented, infested with weeds or has erosion problems. Likewise, areas with a lower ecological condition rank may be targets for restoration activities.

The following ecological condition ranks were applied to vegetation polygons that were surveyed in this project:

■ Excellent Ecological Condition

Areas in this class have very few non-native plants. The composition and structure of native vegetation in this condition class correspond to the natural range of variation characteristic to this habitat type. Old-growth conditions often exist. Species diversity of native plants and animals is often high relative to the natural community under consideration. Wildlife habitat conditions are optimal for species of conservation concern. Soil compaction, accelerated erosion and hydrologic alteration are absent. Direct signs of human-induced ecological stress are absent. Many rare plant and animal species may only exist within this condition class.

■ Good Ecological Condition

Areas in this class have few non-native plants. The composition and structure of native vegetation in this condition class correspond to the natural range of variation characteristic to this habitat type. Old-growth conditions may exist, but have been subject to some human-induced stress. Species diversity of native plants and animals is moderately high relative to the natural community under consideration. Wildlife habitat conditions are adequate for species of conservation concern. Soil compaction, accelerated erosion and hydrologic alteration do not significantly influence the area. Direct signs of human-induced ecological stress are infrequent. Some rare plant and animal species may exist within this condition class.

■ Fair Ecological Condition

Areas in this class often have both native and non-native plants. The composition and structure of native vegetation in this condition class is altered from the natural range of variation characteristic to this habitat type. Old-growth conditions are absent. Species diversity of native plants and animals is lower than the two higher condition classes. Wildlife habitat conditions may be adequate for some species of conservation concern, but not adequate for many. Soil compaction, accelerated erosion and hydrologic alteration may influence the area. Direct signs of human-induced ecological stress are frequent. Most rare plant and animal species are only infrequently encountered within this condition class.

■ Poor Ecological Condition

Areas in this class are often dominated by non-native plants. The composition and structure of native vegetation in this condition class is often dramatically altered from the natural range of variation characteristic to this habitat type. Old-growth conditions are absent. Species diversity of native plants and animals is often low. Wildlife habitat conditions are not adequate for most species of conservation concern. Soil compaction, accelerated erosion and hydrologic alteration often influence the area. Direct signs of human-induced ecological stress are frequent. Rare plant and animal species are seldom encountered within this condition class.

■ **Developed**

Developed portions of the park property: campgrounds, offices, facilities, infrastructure, etc.

■ **Ownership Issue**

Areas within the GIS boundary of the park that appear to be owned or controlled by another entity other than the Washington State Parks Commission.

Appendix C – Definitions of Vegetation Community Conservation Status

The following table defines the ranking system for plants and plant communities used by the Washington State Natural Heritage Program.

Code	Definition
G1	Critically imperiled throughout its range; extremely rare with five or fewer occurrences or very few remaining acres.
G2	Imperiled throughout its range; rare with six to 20 occurrences or few remaining acres.
G3	Either very rare and local throughout its range or found locally in a restricted range; uncommon with 21 to 100 occurrences.
G4	Apparently secure throughout its range, though it may be quite rare in some parts of its range, especially at the periphery; many occurrences.
G5	Demonstrably secure in its range, though it may be quite rare in some parts of its range, especially at the periphery; ineradicable under present conditions.
S1	Critically imperiled in Oregon; extremely rare with five or fewer occurrences or very few remaining acres.
S2	Imperiled in Oregon; rare with six to 20 occurrences or few remaining acres.
S3	Either very rare and local in Oregon or found locally in a restricted range; uncommon with 21 to 100 occurrences.
S4	Apparently secure in Oregon, though it may be quite rare in some parts; many occurrences.
S5	Demonstrably secure in Oregon, though it may be quite rare in some parts; ineradicable under present conditions.
U	Unknown
NA	Natural Heritage Rank not available
NR	Not Ranked

Appendix D – Vegetation Survey Data

Polygon Number 1

ParkName:

Lake Chelan

Survey Intensity 3
 Observer GW
 Date 8/11/2008
 Total Vegetation 5
 Trees Total 3
 Dominant Trees PIPO
 emergent 2
 maincanopy 3
 subcanopy 2
 Shrubs Total 3
 Dominant Shrubs CRDO2
 > 1.5' tall 3
 < 1.5' tall 1
 Graminoids Total 4
 Dominant Graminoids POPR
 Graminoids Perennial 3
 Graminoids Annual 1
 Forbs Total 2
 Dominant Forbs TRRE3, PLMA2
 Forbs Perennial 2
 Forbs Annual 1
 Ferns Total 0
 Ferns Evergreen 0
 Ferns Deciduous 0
 ExoticsTotal 4
 Exotics Perennial 4
 Exotics Annual 1
 Water 0
 Rock Outcrop 0
 Gravel 5
 Logging 0
 Fire: 0
 Stand Age 0
 Agriculture 0
 Livestock 0
 Development D
 Wildlife 2
 Recreation Severity 1
 Recreation Type 4
 Hydrology 1

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

POPR

Water: 0
Rock: 0
Talus: 0
Gravel: 5
Bare Ground: 2
Moss Lichen: 0
Litter: 93

Vegetation Types

Vegetation Types	Percent	Pattern	Rank
Existing Veg1: developed campground	100	Matrix	DEVELO
Veg Community1: developed			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes: Developed campground; swings, kids, balls.

Polygon Number 10

ParkName:

Lake Chelan

Survey Intensity	1
Observer	GW
Date	8/11/2008
Total Vegetation	5
Trees Total	3
Dominant Trees	PIPO, PSME
emergent	0
maincanopy	2
subcanopy	2
Shrubs Total	5
Dominant Shrubs	AMAL2, PUTR2, ACGLD4, SANIC5, HODI, PREM
> 1.5' tall	5
< 1.5' tall	1
Graminoids Total	4
Dominant Graminoids	PSSP6, ELGL, BRIN2, POPR, BRTE
Graminoids Perennial	4
Graminoids Annual	2
Forbs Total	2
Dominant Forbs	HECYG, ACMI2, LIRU4, LUSE4, LASE, BASA3
Forbs Perennial	2
Forbs Annual	1
Ferns Total	1
Ferns Evergreen	0
Ferns Deciduous	1
ExoticsTotal	2
Exotics Perennial	1
Exotics Annual	2
Water	0
Rock Outcrop	0
Gravel	1
Logging	1
Fire:	0
Stand Age	2
Agriculture	0
Livestock	0
Development	0
Wildlife	3
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

CEDI3, PUTR2

Other Exotic Plants

BRTE, BRIN2, LASE

Water:	0
Rock:	0
Talus:	0
Gravel:	1
Bare Ground:	4
Moss Lichen:	5
Litter:	90

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/PUTR2-AMAL2/PSSP6	100	Matrix	GOOD
Veg Community1: PIPO/PUTR2/PSSP6			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes:

Polygon Number 11

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	6
Trees Total	5
Dominant Trees	PIPO, PSME
emergent	3
maincanopy	4
subcanopy	1
Shrubs Total	5
Dominant Shrubs	SYAL, MAAQ2, PHLE4, ROWO, ACGLD4, TORY
> 1.5' tall	5
< 1.5' tall	2
Graminoids Total	0
Dominant Graminoids	
Graminoids Perennial	0
Graminoids Annual	0
Forbs Total	1
Dominant Forbs	LASE
Forbs Perennial	0
Forbs Annual	1
Ferns Total	1
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	1
Exotics Perennial	0
Exotics Annual	1
Water	0
Rock Outcrop	0
Gravel	0
Logging	1
Fire:	0
Stand Age	3
Agriculture	0
Livestock	0
Development	3
Wildlife	3
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

LASE

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	1
Moss Lichen:	0
Litter:	99

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO-PSME/SYAL-ROWO	100	Matrix	GOOD

Veg Community1: PSME/SYAL

Existing Veg2:	0
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Veg Community3:

Existing Veg3:	0
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Veg Community3:

Notes: CLOSED FOREST; SOME PIPO TREES; BEAR SCAT AND RACCOON

Polygon Number 13

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	5
Trees Total	3
Dominant Trees	PIPO, PSME, ULPU
emergent	0
maincanopy	1
subcanopy	3
Shrubs Total	5
Dominant Shrubs	PUTR2, PHLE4, RICE, AMAL2, PREM, SPBEL, SASC, SYAL, CEVE
> 1.5' tall	5
< 1.5' tall	1
Graminoids Total	1
Dominant Graminoids	CARO5, SPCR, PSSP6, DAGL, THIN6, POBU, LOPE, BRTE, SILAA3
Graminoids Perennial	1
Graminoids Annual	1
Forbs Total	1
Dominant Forbs	LIRU4, PSCAT, COCA5, HYPE
Forbs Perennial	1
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	2
Exotics Perennial	0
Exotics Annual	2
Water	0
Rock Outcrop	0
Gravel	4
Logging	1
Fire:	0
Stand Age	2
Agriculture	0
Livestock	0
Development	5
Wildlife	3
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

BRTE, HYPE, VETH, THIN6, POBU

Water:	0
Rock:	0
Talus:	0
Gravel:	4
Bare Ground:	5
Moss Lichen:	0
Litter:	91

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/PUTR2-SYAL	100	Matrix	GOOD
Veg Community1: PIPO/PUTR2/PSSP6			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes:

Polygon Number 14

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	6
Trees Total	4
Dominant Trees	PIPO, PSME
emergent	0
maincanopy	4
subcanopy	2
Shrubs Total	5
Dominant Shrubs	SYAL, CRDO2, PUTR2, ROWO, ACGLD4, HODI, SANIC5
> 1.5' tall	5
< 1.5' tall	3
Graminoids Total	3
Dominant Graminoids	ACNED, POPR, ELGL
Graminoids Perennial	3
Graminoids Annual	0
Forbs Total	1
Dominant Forbs	LIRU4, ACMI2, LUSE4, BASA3, CEDI3
Forbs Perennial	1
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	1
Exotics Perennial	1
Exotics Annual	0
Water	0
Rock Outcrop	0
Gravel	0
Logging	1
Fire:	0
Stand Age	2
Agriculture	0
Livestock	0
Development	3
Wildlife	3
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

CEDI3

Other Exotic Plants

POPR

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	1
Moss Lichen:	0
Litter:	99

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/SYAL/ELGL	100	Matrix	GOOD
Veg Community1: PIPO/SYAL			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			
Notes: OPEN FOREST, YOUNG PIPO ESTABLISHED. 15 YEARS AGO, BUT NO OBVIOUS DISTURBANCE			

Polygon Number 15

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	6
Trees Total	5
Dominant Trees	POBAT, PSME, PIPO, AIAL, JURE80, ALIN2
emergent	3
maincanopy	4
subcanopy	2
Shrubs Total	5
Dominant Shrubs	COSE16, CRDO2, SYAL, MAAQ2, SANIC5, PHLE4
> 1.5' tall	5
< 1.5' tall	2
Graminoids Total	0
Dominant Graminoids	
Graminoids Perennial	0
Graminoids Annual	0
Forbs Total	1
Dominant Forbs	URDI, NECA2
Forbs Perennial	1
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	3
Exotics Perennial	3
Exotics Annual	0
Water	1
Rock Outcrop	0
Gravel	0
Logging	1
Fire:	0
Stand Age	2
Agriculture	0
Livestock	0
Development	5
Wildlife	3
Recreation Severity	2
Recreation Type	3
Hydrology	2

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

AIAL, ROPS, JURE80

Water:	1
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	1
Moss Lichen:	0
Litter:	98

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: POBAT-ROPS/COSE16	50	Large patch	FAIR
Veg Community1: POBAT/COSE16			
Existing Veg2: PSME/SYAL	50	Large patch	POOR
Veg Community3: PSME/SYAL			
Existing Veg3:	0		
Veg Community3:			

Notes:

Polygon Number 2

ParkName:

Lake Chelan

Survey Intensity	3
Observer	GW
Date	8/11/2008
Total Vegetation	6
Trees Total	4
Dominant Trees	PIPO, POBAT, PSME, JURE80
emergent	0
maincanopy	4
subcanopy	1
Shrubs Total	6
Dominant Shrubs	SYAL, COSE16, PHLE4, CRDO2, MAAQ2, ROSA, MAPU, AMAL2,
> 1.5' tall	6
< 1.5' tall	2
Graminoids Total	1
Dominant Graminoids	BRIN2
Graminoids Perennial	1
Graminoids Annual	0
Forbs Total	1
Dominant Forbs	ARM12, URDI, SODU, VETH, TRDU, ACMI2, LASE, COCA5, PODO4,
Forbs Perennial	1
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	2
Exotics Perennial	2
Exotics Annual	0
Water	1
Rock Outcrop	0
Gravel	0
Logging	1
Fire:	0
Stand Age	2
Agriculture	0
Livestock	0
Development	3
Wildlife	3
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

CIVU, CEDI3

Other Exotic Plants

JURE80, ROSA, SODU, TRDU, VETH

Water:	1
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	1
Moss Lichen:	1
Litter:	97

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/SYAL-CRDO2-COSE16	60	Matrix	GOOD
Veg Community1: PIPO/SYAL			
Existing Veg2: PIPO-POBAT-JURE80/COSE16	40	Large patch	POOR
Veg Community3: POBAT/COSE16			
Existing Veg3:	0		

Veg Community3:

Notes: LIMITED TO TRAILS AND LOOKING ABOVE VEGETATION. STREAM THROUGH PLOT IS POSSIBLE RUNOFF.

Polygon Number 3

ParkName:
Lake Chelan

Survey Intensity 1
Observer GW
Date 8/11/2008
Total Vegetation 2
Trees Total 1
Dominant Trees PIPO, PSME
emergent 1
maincanopy 1
subcanopy 1
Shrubs Total 1
Dominant Shrubs CRDO2
> 1.5' tall 1
< 1.5' tall 0
Graminoids Total 2
Dominant Graminoids BRTE
Graminoids Perennial 1
Graminoids Annual 1
Forbs Total 1
Dominant Forbs LASE
Forbs Perennial 1
Forbs Annual 1
Ferns Total 0
Ferns Evergreen 0
Ferns Deciduous 0
ExoticsTotal 2
Exotics Perennial 2
Exotics Annual 1
Water 0
Rock Outcrop 0

Gravel 90

Logging 0
Fire: 0
Stand Age 0
Agriculture 0
Livestock 0
Development 2
Wildlife 2
Recreation Severity 1
Recreation Type 1
Hydrology 2

Exotic Species

Noxious Exotic Plants

Other Exotic Plants
BRTE, LASE

Water: 0
Rock: 0
Talus: 0
Gravel: 90
Bare Ground: 5
Moss Lichen: 0
Litter: 5

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: road	100	Matrix	DEVELO
Veg Community1: developed			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes: Road

Polygon Number 4

ParkName:
Lake Chelan

Survey Intensity	1
Observer	GW
Date	8/11/2008
Total Vegetation	3
Trees Total	2
Dominant Trees	PIPO, PSME
emergent	2
maincanopy	0
subcanopy	2
Shrubs Total	2
Dominant Shrubs	HODI, ACGLD4, CLLI2
> 1.5' tall	2
< 1.5' tall	1
Graminoids Total	2
Dominant Graminoids	PSSP6, BRTE, POBU, PHAR3
Graminoids Perennial	2
Graminoids Annual	1
Forbs Total	2
Dominant Forbs	HECYG, ANMI3
Forbs Perennial	2
Forbs Annual	1
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	1
Exotics Perennial	1
Exotics Annual	1
Water	85
Rock Outcrop	1
Gravel	1
Logging	0
Fire:	0
Stand Age	0
Agriculture	0
Livestock	0
Development	6
Wildlife	3
Recreation Severity	2
Recreation Type	5
Hydrology	2

Exotic Species

Noxious Exotic Plants

PHAR3

Other Exotic Plants

BRTE, POBU

Water:	85
Rock:	1
Talus:	2
Gravel:	1
Bare Ground:	1
Moss Lichen:	0
Litter:	10

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: water	90	Matrix	GOOD
Veg Community1: water			
Existing Veg2: PSME/SYAL	10	Linear	GOOD
Veg Community3: PSME/SYAL			
Existing Veg3:	0		
Veg Community3:			

Notes: Lake level was down >20 feet on first visit.

Polygon Number 5

ParkName:

Lake Chelan

Survey Intensity	2	
Observer	GW	
Date	8/11/2008	
Total Vegetation	6	
Trees Total	3	
Dominant Trees	PIPO, PSME	
emergent	0	
maincanopy	3	
subcanopy	2	
Shrubs Total	4	
Dominant Shrubs	PUTR2, AMAL2, HODI, ERHE2	
> 1.5' tall	4	
< 1.5' tall	2	
Graminoids Total	5	
Dominant Graminoids	PSSP6, FEID, BRTE	
Graminoids Perennial	5	
Graminoids Annual	1	
Forbs Total	4	
Dominant Forbs	BASA3, HISC2, LIRU4, ACMI2, CALY, ANMI3, POBU, EPMI	
Forbs Perennial	4	
Forbs Annual	1	
Ferns Total	0	
Ferns Evergreen	0	
Ferns Deciduous	0	
ExoticsTotal	1	
Exotics Perennial	0	
Exotics Annual	1	
Water	0	
Rock Outcrop	0	
Gravel	0	
Logging	1	
Fire:	0	
Stand Age	2	
Agriculture	0	
Livestock	0	
Development	0	
Wildlife	2	
Recreation Severity	3	
Recreation Type	3	
Hydrology	1	

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

BRTE

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	3
Moss Lichen:	0
Litter:	97

Vegetation Types

Existing Veg1:	Percent	Pattern	Rank
PIPO/PUTR2/PSSP6-BASA3	100	Matrix	EXCELLE
Veg Community1: PIPO/PUTR2/PSSP6			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes:

Polygon Number 6

ParkName:

Lake Chelan

Survey Intensity	2	
Observer	GW	
Date	8/11/2008	
Total Vegetation	6	
Trees Total	3	
Dominant Trees	POBAT, PIPO, PSME, JURE80, ACMA3	
emergent	1	
maincanopy	3	
subcanopy	2	
Shrubs Total	4	
Dominant Shrubs	SYAL, ACGLD4, PUTR2, ROWO	
> 1.5' tall	4	
< 1.5' tall	1	
Graminoids Total	4	
Dominant Graminoids	ELGL, POPR, BRIN2	
Graminoids Perennial	4	
Graminoids Annual	0	
Forbs Total	3	
Dominant Forbs	LOTUS, CIVU, VETH, COCA5, GADI2, MEOF, ASOF, ASCLE,	
Forbs Perennial	3	
Forbs Annual	1	
Ferns Total	0	
Ferns Evergreen	0	
Ferns Deciduous	0	
ExoticsTotal	3	
Exotics Perennial	3	
Exotics Annual	1	
Water	0	
Rock Outcrop	0	
Gravel	0	
Logging	1	
Fire:	0	
Stand Age	1	
Agriculture	0	
Livestock	0	
Development	3	
Wildlife	3	
Recreation Severity	3	
Recreation Type	3	
Hydrology	1	

Exotic Species

Noxious Exotic Plants

CIVU

Other Exotic Plants

LASE, POPR

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	1
Moss Lichen:	0
Litter:	99

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1:	PIPO-POBAT-ACMA3/SYAL-ROWO/POPR-ELGL 100	Matrix	GOOD

Veg Community1: PSME/SYAL

Existing Veg2: 0

Veg Community3:

Existing Veg3: 0

Veg Community3:

Notes: OLD FIELD WITH SHRUB, TREE INVASION, MESIC STAND

Polygon Number 7

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	5
Trees Total	3
Dominant Trees	PIPO, PSME
emergent	0
maincanopy	0
subcanopy	3
Shrubs Total	4
Dominant Shrubs	PUTR2, AMAL2, ROWO
> 1.5' tall	4
< 1.5' tall	1
Graminoids Total	5
Dominant Graminoids	PSSP6, CARU, VULPI
Graminoids Perennial	5
Graminoids Annual	1
Forbs Total	3
Dominant Forbs	ANMI3, CALY, HISC2, LUSE4, DELI3, ACMI2, BASA3, PHSP
Forbs Perennial	3
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	0
Exotics Perennial	0
Exotics Annual	0
Water	0
Rock Outcrop	0
Gravel	0
Logging	1
Fire:	0
Stand Age	1
Agriculture	0
Livestock	0
Development	0
Wildlife	1
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	0
Moss Lichen:	0
Litter:	100

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/PSSP6-CARU	100	Matrix	GOOD
Veg Community1: PIPO/PUTR2/PSSP6			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			
Notes: SHRUB-STEPPE W/ PIPO REGEN			

Polygon Number 8

ParkName:

Lake Chelan

Survey Intensity	2
Observer	GW
Date	8/11/2008
Total Vegetation	5
Trees Total	3
Dominant Trees	PIPO, PSME
emergent	0
maincanopy	0
subcanopy	3
Shrubs Total	4
Dominant Shrubs	PUTR2, AMAL2, ROWO
> 1.5' tall	4
< 1.5' tall	1
Graminoids Total	5
Dominant Graminoids	PSSP6, CARU, VULPI
Graminoids Perennial	5
Graminoids Annual	1
Forbs Total	3
Dominant Forbs	ANMI3, CALY, HISC2, LUSE4, DELI3, ACMI2, BASA3, PHSP
Forbs Perennial	3
Forbs Annual	0
Ferns Total	0
Ferns Evergreen	0
Ferns Deciduous	0
ExoticsTotal	0
Exotics Perennial	0
Exotics Annual	0
Water	0
Rock Outcrop	0
Gravel	0
Logging	0
Fire:	0
Stand Age	1
Agriculture	0
Livestock	0
Development	0
Wildlife	1 (many deer)
Recreation Severity	3
Recreation Type	3
Hydrology	1

Exotic Species

Noxious Exotic Plants

Other Exotic Plants

Water:	0
Rock:	0
Talus:	0
Gravel:	0
Bare Ground:	0
Moss Lichen:	0
Litter:	100

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PIPO/PSSP6/CARU	100	Matrix	GOOD
Veg Community1: PIPO/PUTR2/PSSP6			
Existing Veg2:	0		
Veg Community3:			
Existing Veg3:	0		
Veg Community3:			

Notes: Shrub-steppe w/ PIPO regen & fire exclusion; CARU very high - 40%!

Polygon Number 9

ParkName:

Lake Chelan

Survey Intensity	2	
Observer	GW	
Date	8/11/2008	
Total Vegetation	6	
Trees Total	5	
Dominant Trees	PSME, ACMA3, PABAT, ALIN2, PIPO	
emergent	4	
maincanopy	4	
subcanopy	2	
Shrubs Total	4	
Dominant Shrubs	MAAQ2, SYAL, RUPA, HODI, ACGLD4, SANIC5, AMAL2, PHLE4,	
> 1.5' tall	4	
< 1.5' tall	1	
Graminoids Total	3	
Dominant Graminoids	BRVU, ELGL, POBU, FEOC	
Graminoids Perennial	3	
Graminoids Annual	0	
Forbs Total	2	
Dominant Forbs	EQHY, EQAR, MAST4, MARA7	
Forbs Perennial	2	
Forbs Annual	1	
Ferns Total	1	
Ferns Evergreen	0	
Ferns Deciduous	1	
ExoticsTotal	1	
Exotics Perennial	1	
Exotics Annual	0	
Water	2	
Rock Outcrop	0	
Gravel	2	
Logging	1	
Fire:	0	
Stand Age	4	
Agriculture	0	
Livestock	0	
Development	5	
Wildlife	3	
Recreation Severity	3	
Recreation Type	3	
Hydrology	1	

Exotic Species

Noxious Exotic Plants

CED13

Other Exotic Plants

Water:	2
Rock:	0
Talus:	2
Gravel:	2
Bare Ground:	1
Moss Lichen:	5
Litter:	88

Vegetation Types

	Percent	Pattern	Rank
Existing Veg1: PSME/SYAL	60	Matrix	EXCELLE
Veg Community1: PSME/SYAL			
Existing Veg2: POBAT-ALIN2/RUPA-ROWO/EQAR	40	Linear	EXCELLE
Veg Community3: POBAT-ALIN2			
Existing Veg3:	0		

Veg Community3:

Notes: CLOSED CANOPY RIPARIAN OLD GROWTH UPPER BANKS ARE MORE TYPICAL
PSME/SYAL. 1796358, 319674