LAND STEWARDSHIP PLAN

SUNCADIA MASTER PLANNED RESORT

SUNCADIA
RESORT · COMMUNITY · LEGACY

Report To:	**Suncadia Management Company** 141 Firehouse Road Cle Elum, WA 98922
Title:	**Land Stewardship Plan** *Suncadia Master Planned Resort*
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Date:	Original: December 2008 Revised: February 2018

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1.0 INTRODUCTION

The Suncadia Master Planned Resort (MPR) was first conceived in the late 1990s following purchase of nearly 6,000 acres of land formerly owned by Plum Creek Timber Company near the town of Roslyn, Washington by Trendwest Resorts, Inc. Since that time, purchase of additional adjacent small parcels by Trendwest's successor, Suncadia L.L.C., has brought the total to over 6,824 acres (Figure 1, Table 1). Originally known as the MountainStar Project, plans for the Suncadia Master Planned Resort were approved by Kittitas County on October 10, 2000 with the understanding that construction and additional planning would evolve over a 20-30 year period.

The mission statement for the MPR is "To develop a major destination resort which will include a variety of accommodations and recreational opportunities. Suncadia will maintain a forested environment with emphasis on outdoor living and recreation. The resort is dedicated to integrating the natural environment and local heritage within a resort community". The resort lies within an important wintering area for elk, and initial discussions with the local wildlife community centered on preservation of elk wintering behavior in the resort area. The lower Cle Elum River and floodplain are important habitat for five salmonid species including ESA listed Mid-Columbia River Steelhead and Bull Trout.

Negotiations between Suncadia LLC and Kittitas County, The Confederated Tribes and Bands of the Yakama Nation (Yakama Nation), the Washington Department of Fish and Wildlife (WDFW), and local community groups, have led to several agreements, resulting in preservation of 80 percent open space within the MPR as required in the development agreement with Kittitas County Easements conveying the right to protect the Cle Elum River Corridor, natural and managed open space were granted by Suncadia LLC to the Kittitas Conservation Trust (KCT). The KCT is a non-profit land trust with board members from the Washington Department of Fish and Wildlife (WDFW), the Yakama Nation, and Suncadia LLC. Specific goals and techniques on how this open space will be managed within Suncadia Master Planned Resort (MPR) Development areas (Phases 1 through 3), the Cle Elum River Corridor, and the Cle Elum Bullfrog Property are the purpose of this document.

1.0.1 The Cooperative Agreement and KCT's Role

On December 4, 2000, the Washington Department of Fish and Wildlife (WDFW), the Yakama Nation, and Trendwest Resorts, Inc., entered into a binding agreement regarding the development of the MountainStar Master Planned Resort. WDFW and the Yakama Nation sought to protect and conserve fish and wildlife habitat and to pursue a "no net loss" policy of productive fish and wildlife habitat in connection with the development of the Trendwest Property. Additionally, the Yakama Nation has treaty-protected interests and other contemporary concerns about development of the Trendwest property. The three parties had a desire to establish a cooperative relationship to accomplish mutual objectives for the Trendwest Property in general, and the Cle Elum River corridor and entire floodplain in particular. The Cooperative Agreement addresses cumulative environmental impacts associated with the development of the Trendwest Property for.

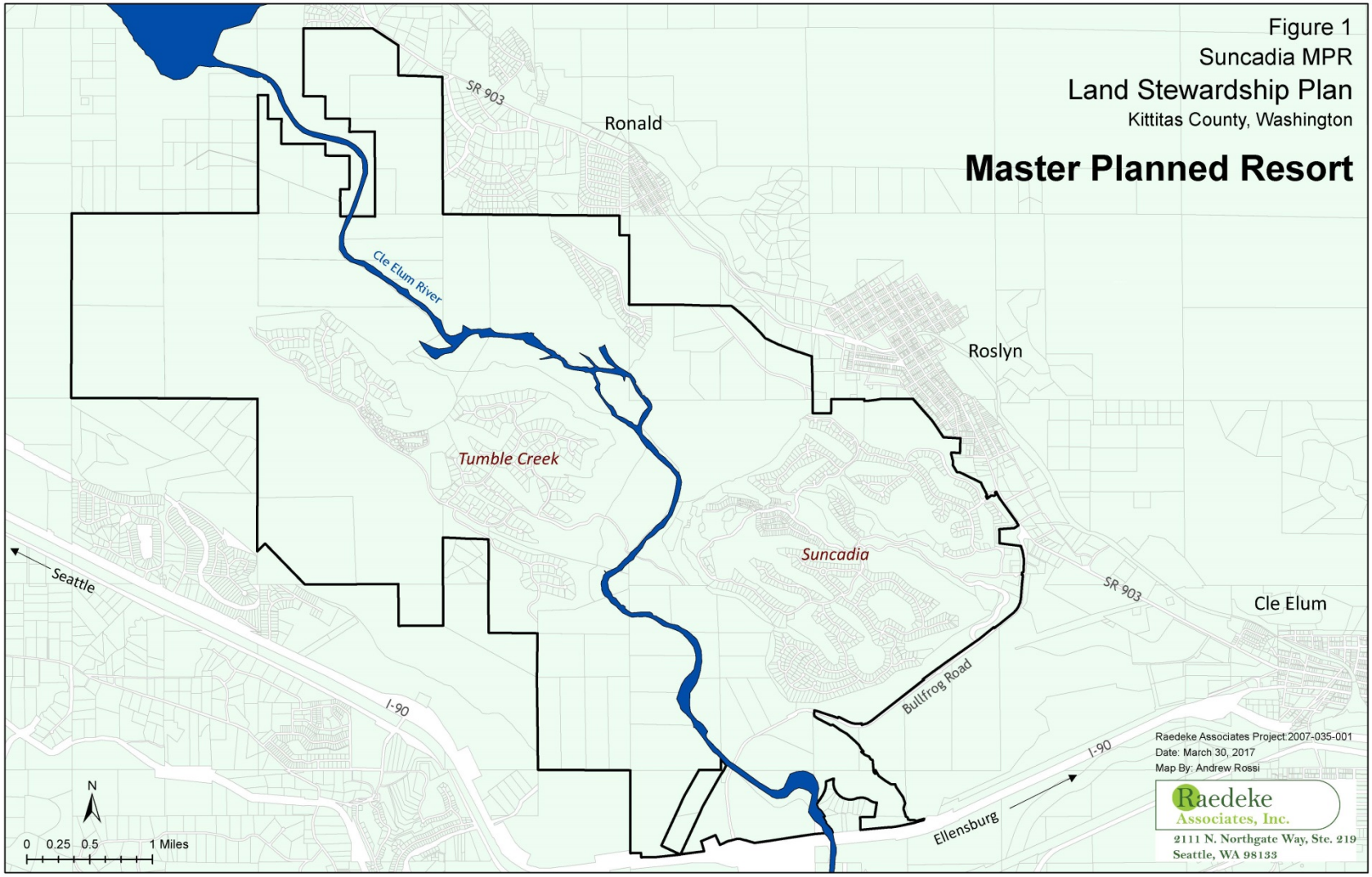
Figure 1
Suncadia MPR
Land Stewardship Plan
Kittitas County, Washington
Master Planned Resort
SR 903
Ronald
Cle Elum River
Roslyn
Tumble Creek
Suncadia
Seattle
SR 903
Cle Elum
Bullfrog Road
I-90
I-90
Ellensburg
N
0 0.25 0.5 1 Miles
Raedeke Associates Project 2007-035-001
Date: March 30, 2017
Map By: Andrew Rossi
Raedeke Associates, Inc.
2111 N. Northgate Way, Ste. 219
Seattle, WA 98133

both on-site preservation of open space and habitat restoration and off-site actions and enhancements

The Cooperative Agreement established the MountainStar Conservation Trust (now Kittitas Conservation Trust) to be governed by a three-member Board of Trustees that consists of one member from each of the parties. KCT was created for the purpose of holding conservation easements in the Cle Elum River Corridor and in Managed and Natural open spaces within the Trendwest Properties.

KCT monitors and enforces compliance with restrictions contained in the conservation easements in perpetuity. KCT also undertakes additional activities to protect and enhance natural resource and recreation values within the upper Yakima basin including owning land, holding conservation easements, and restoring and enhancing critical open space that support fish and wildlife habitat.

1.0.2 Conservation Easements

KCT holds three conservation easements within the Suncadia Resort: the Cle Elum River Corridor easement, Natural Open Space easement, and Managed Open Space easement that cumulatively cover approximately 3,400 acres (Figure 2). These acres are to be forever managed predominately for their wildlife habitat and compatible recreational opportunities. The easements prohibit use of the conservation easement lands that would significantly impair or interfere with these stated objectives. The terms of the easements also include the requirement for KCT approval of Land Stewardship Plans developed for these areas, and any changes and revisions to these land stewardship plans. This also includes approval of forest management activities occurring on easement lands.

1.0.3 Role of Suncadia Community Associations in Open Space Management

The Suncadia Community Council, Tumble Creek Village Association, and the Suncadia Residential Association Boards of Directors authorize not only the forest health and fire-wise activities but also provide budgets for the expense of these activities within the open spaces that have been assigned to these Associations by their Declarations. In addition, the Associations also take on the above responsibilities for any open space, currently held by the Developer, which has not been formally assigned to the Association but is designated to be assigned once the plats of future development have been recorded. The Suncadia Community Council maintains a forestry department that oversees any and all work for all Associations and distributes the costs out accordingly.

1.1 Stewardship Principles

1.1.1 Goals

General goals and guidelines for land stewardship planning on the property have been outlined in a Land Stewardship Planning report produced for the MountainStar MPR (now the Suncadia MPR) by Raedeke Associates, Inc. (2000). In that conceptual Land Stewardship Plan, the objective was:

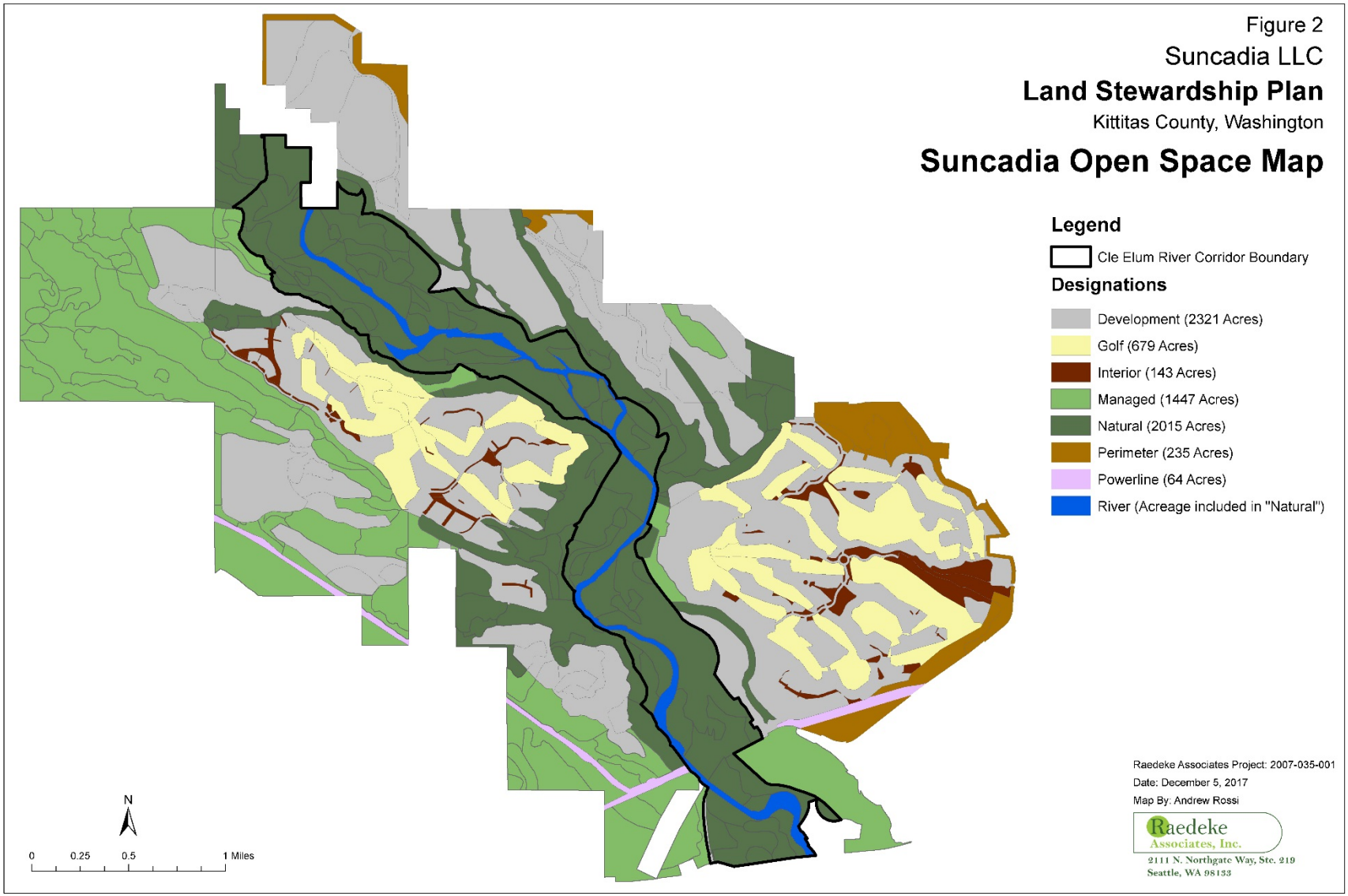
Figure 2
Suncadia LLC
Land Stewardship Plan
Kittitas County, Washington
Suncadia Open Space Map
Legend
Cle Elum River Corridor Boundary
Designations
Development (2321 Acres)
Golf (679 Acres)
Interior (143 Acres)
Managed (1447 Acres)
Natural (2015 Acres)
Perimeter (235 Acres)
Powerline (64 Acres)
River (Acreage included in "Natural")
N
0 0.25 0.5 1 Miles
Raedeke Associates Project: 2007-035-001
Date: December 5, 2017
Map By: Andrew Rossi
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Seattle, WA 98133

"… to provide a surrounding and intertwining forest that is, in perpetuity, visually attractive, healthy, and capable of supporting diverse native wildlife populations. This objective will be reached by simultaneously achieving objectives for visual quality, forest health, and wildlife."

The requirement of a Land Stewardship Plan for Suncadia was ensconced in Exhibit F-1 of the Kittitas County **Conditions of Approval** for the resort dated **December 2, 2008**. Condition B-29 states: "The applicant shall prepare and submit to Kittitas County for approval a Land Stewardship Plan which identifies an overall management framework and wildlife habitat goals and objectives…".

Overall the goal of this land stewardship plan, as stated in several legal agreements under which Suncadia is operating, states:

" It is the purpose of this easement to ensure that …Open Space will be retained forever predominantly for its wildlife habitat and for recreational opportunities compatible with wildlife objectives…" .

The three major aims of this local land stewardship plan, specifically: (1) maintaining a visually attractive forest environment with environmentally sensitive recreation opportunities(2) maintaining healthy, native plant-dominated, low fire-risk forest stands, and (3) maintaining valuable, interconnected wildlife habitat, are echoed in the MPR Development Permit, Kittitas County Ordinance No. 2000-15, Section A-5:

"Open space lands shall be managed to buffer sensitive environments from intensive development or activities; to retain and restore native plant communities and to maintain and enhance habitat; and, for developed areas, to provide an aesthetically pleasing landscape, provide habitat connections, and minimize risk of fire."

The original WDFW/Yakama Nation agreement called for achieving three specific ecological objectives:

1) Retain and restore aquatic and upland ecosystems, including native plant and animal communities.
2) Maintain and enhance forest health, including species and age diversity and reducing fire hazards and risk of catastrophic fire.
3) Protecting and enhancing fish and wildlife habitat, focusing specifically on species of special concern such as elk, T & E (threatened and endangered) species and anadromous fish.

In addition, objectives important to the MPR include:

4) Access roads to Tumble Creek with a bridged Cle Elum river crossing.
5) Visually attractive landscapes within and as viewed from a distance.
6) Control visitor use with specified trails and types of trails.
7) Enhance visitor experience with interpretive signage.

All of these objectives are inter-connected and include the essential element of managing vegetation to minimize the risk of stand replacement wildfire. Implementation of the land stewardship plan will achieve a balance of forest fuel levels, wildlife habitat features, and other objectives across the range of vegetation types.

The following goals summarized here form the integral part of this LSP:

1. Maintain healthy forest, shrub, and meadow habitats; and plant and animal species diversity.
2. Prevent and control presence of non-native and invasive plant and animal species.
3. Provide the most wildlife-friendly landscape possible for wildlife.
4. Enhance habitat connectivity and wildlife migration corridors.
5. Promote and demonstrate a more holistic approach to land use planning and development in the Upper Kittitas Valley.

1.1.2 Goal Achievement

Because forest ecosystems are dynamic, achieving stated goals will require management. Simply allowing natural forest development may not be the best course of action in all environments. In the Cle Elum Valley, natural sources of disturbance, such as forest fires (caused by lightning), windstorms, insect and fungal infestations, plant diseases, etc., can alter the makeup and character of any patch of forest. Controlled burns may or may not be allowed as a management tool in the MPR, therefore, completely natural forest development is not practicable. Therefore other management practices that mimic low level ground fires will be required.

The current forest environment on the Suncadia property is the result of years and even centuries of disturbance by man and nature. Native Americans in the region were known to set forest fires to open up large meadows and other areas where big game (primarily deer and elk) could forage for grass, and where they were more vulnerable to hunting Beginning in the late 19th century, mining interests altered the landscape as well as forest habitats in their quest for coal. Through the 20th century, timber harvesting and fire exclusion occurred throughout the property, resulting in the mosaic of forest seral stages one sees today.

The “natural” state of the forests in the area includes constant change and disturbance. Even under “natural” conditions in the absence of man, disturbances such as floods, insect outbreaks, and wildfires altered habitats on the property to a point where they are not what many people now view as a desired “natural” condition (e.g., old forest). Disturbance is a normal and critical function of a healthy forest. The structure of forest habitats change over the years depending on the time interval since the last disturbance. Many species of wildlife depend on such disturbances. For example, deer and elk often feed in grass- and herb-dominated openings created by forest fires. Many songbirds are adapted to living in shrubby habitats that develop after fires, and cannot live in dense forest habitats.

Enough is currently known about forest health, fire ecology, and local wildlife populations to have a high assurance of success in providing as natural a forest environment within the MPR as can be expected. The science of forest restoration and rehabilitation to meet the burdens of a changing climate has also made major strides in recent years, and cannot be ignored. Climate change is altering the way forest ecosystems, particularly in dry climates, are managed. While the goal of current forest prescriptions tends to push back the clock to pre-European settlement conditions, this may not produce desirable results given the climate change now occurring (Hanberry *et al*. 2015, Hart *et al.* 2015).

1.2 AGREEMENTS

A series of agreements between New Suncadia LLC and various local jurisdictions and interested parties have helped guide the overall stewardship planning process. A part of the stipulations set forth in these agreements included acceptance of a conceptual land stewardship plan for the entire resort, and specific plans for various subunits. The land stewardship plans within the Suncadia MPR shall be in compliance with these agreements:

1. **MPR Development Agreement**: Development Agreement by and among Kittitas County, Washington, Trendwest Resorts, Inc., and Trendwest Investments, Inc. relating to the development commonly known as MountainStar Master Planned Resort; dated October 10, 2000.

2. **Cooperative Agreement**: Cooperative Agreement between the Washington Department of Fish and Wildlife, Yakama Nation, and Trendwest Resorts, Inc.; dated December 4, 2004.

As mentioned earlier, covenants and/or conservation easements have been granted for managed and natural open space areas on various portions of the Suncadia MPR property: (A map of open space areas and acreage of each is provided in Figure 2. and Table 1, respectively.)

Former Easements and Covenants:

1. Cle Elum River Corridor Grant of Conservation Easement; dated August 2, 2004. First Amendment to Cle Elum River Corridor; dated February 2005 and Second Amendment to Cle Elum River Corridor; dated August 11, 2005.

2. Declaration of Covenant for Perimeter Open Space (Phase 1); dated August 20, 2003.

3. Phase 2 Perimeter Open Space Grant of Conservation Easement; dated December 1, 2006. (Terminated December 11, 2015)

4. Stream "C" Open Space Conservation Easement, June 13, 2006 (Restated and included in Natural Open Space as of December 11, 2015)

5. Phase 2 Natural Open Space Grant of Conservation Easement; dated August 15, 2006. (Restated as Natural Open Space as of December 11, 2015)

6. Phase 3 Managed Open Space Grant of Conservation Easement; dated October 8, 2004, First Amendment to Phase 3 Managed Open Space; June 21, 2006. (restated now Managed Open Space as of December 11, 2015)

7. Phase 3 Natural Open Space Grant of Conservation Easement; dated October 8, 2004. (Restated now Natural Open Space December 11, 2015)

8. Bullfrog UGA Managed Open Space Grant of Conservation Easement; January 16, 2006. (Restated and included in Managed Open Space; December 11, 2015)

Current Easements:

1. Cle Elum River Corridor Grant of Conservation Easement; dated August 2, 2004**.** First Amendment to Cle Elum River Corridor; dated February 2005 and Second Amendment to Cle Elum River Corridor; dated August 11, 2005**.**

2. Managed Open Space Grant of Conservation Easement (Restated); dated December 11, 2015.

3. Natural Open Space Grant of Conservation Easement (Restated); dated December 11, 2015.

1.3 Previous Land Stewardship Plans

A foundation document, the conceptual Land Stewardship Plan (LSP) for the MPR(f.k.a. MountainStar Resort), was previously prepared by Raedeke Associates, Inc. in 2000 and submitted to Kittitas County with the MPR permit application. This plan introduced the objectives for the land stewardship planning process and, given the variety of situations likely to be encountered on the site, outlined general management treatments for stand types within the resort area.

Following acceptance of the various agreements listed above, Land Stewardship Plans for the Cle Elum River corridor portion of the Suncadia property, and the Stream "C" portion of the property were developed and submitted to the managing organizations (Hess 2004, Begley 2006). The 2008 version of this document represented the site-specific Land Stewardship Plan for the majority of the resort outside of the river and stream corridors; specifically, the Phase 1, 2, and 3 planning areas.

The Stream C Land Stewardship Plan was developed to inform management actions in the Stream C Corridor, and was the result of the 2001 RIDGE (a local conservation

community group) Agreement, which has since been nullified by the Kittitas County court in 2015. However, Suncadia and the Kittitas Conservation Trust have been collaborating to preserve some of the goals and habitat values expressed in the Stream C LSP to honor the wishes of the community. This document incorporates some of the ideals presented in previous LSPs that have endured through subsequent discussions between Suncadia and the KCT. In 2016, information from the Stream C and Cle Elum River Corridor LSPs were incorporated into an overall this combined LSP, and the City of Cle Elum Property (east of Bullfrog Road) was deleted, as this area is no longer managed by the resort (see Figure 1).

1.4 Open Space Definitions

In addition to the stipulations listed above to maintain the Cle Elum River Corridor, **Natural** and **Managed** Open Spaces at Suncadia, there are also open space areas that require some management or at least review to maintain wildlife habitat suitability and fire resistance within developed areas. Open space located within planned developments is generally termed **Interior Open Space**. Lands managed by the Golf Courses are termed **Golf Open Space**, and land along the perimeter of developments providing a buffer with adjacent landowners is termed **Perimeter Open Space**. All of the open space within developed areas is managed similar to Managed Open Space, primarily because of the close association with developed areas. A table of open space acreage at Suncadia as of 2017 is shown in Table 1 and a map of all open space categories is shown in Figure 2.

Table 1. Acreage of each open space/development designation at Suncadia.

Designation	Acreage
Managed Open Space	1420
Natural Open Space	2018
Cle Elum River Corridor	*1260*
Golf Open Space	679
Interior Open Space	143
Perimeter Open Space	320
Powerline	77
Developed	2179
Private Property	68
TOTAL	**6904**

2.0 THE SETTING

2.1 GEOLOGY

The Suncadia development occurs in an area of complicated geology. In much of western Washington State, former Pacific Ocean coastlines were uplifted by plate tectonics to form jumbled masses of ocean floor crustal basalt, aggregated and folded with former ocean floor sediment (now sandstone), also modified by continental intrusions of granitic crust, and mixed with more recent andesites and basalts that erupted from near-coast volcanoes. The coal seams that fed the economy of the Roslyn area came from organic material in coastal tropical swamps that eventually became coal once this material sank and was squeezed under high pressure between the offshore and continental plates. On top of this complex combination, massive glaciers filled the Cascades valleys in the most recent continental glaciation during the Pleistocene, forming the relatively straight upper Yakima and Cle Elum River valleys. These receding glaciers deposited layers of glacial till over bedrock as the earth eventually warmed.

Exposed rocky ridges in the area might be sandstone, basalt, granite, or andesite, depending on which fold or intrusion happened to be exposed above the glacial till. Soils of the area were formed from these base materials, reworked into sand and gravel by the Cascades glaciers and vegetative cover, and some transport to the site by rivers and streams. Soils are often relatively thin over most of the Suncadia development due to the dry climate of the region, a condition that has been present for many millennia.

2.2 CLIMATE

The climate of the MPR area is one of cool to cold winters with regular snowfall followed by warm to hot summers with temperatures often into the 80's and 90's, and even over 100 degrees Fahrenheit. Precipitation patterns in the area are largely regulated by a rain shadow effect of the high Cascade mountain range to the west. The rain shadow results from cool, cloudy marine air masses rising over the Cascades, dropping most of their rain on the western slopes with little precipitation remaining as the lower eastern slopes are reached.

The result is a significant difference in the amount of precipitation from west (wetter) to east (dryer) across the Cascades. For example, the city of Ellensburg receives on average only 12 inches of rain per year, while only 40 miles to the west at Snoqualmie Pass, at the crest of the Cascades, over 98 inches fall in an average year. The Suncadia resort, lying east of the Cascade crest, is in a precipitation zone that averages approximately 35 inches of precipitation (combined rainfall and snowfall) per year, with an average of 21 inches of snow per year.

2.3 VEGETATION

The MPR occurs in a relatively heavily forested region, although forest stands on the site are not the dense, wet forests typical of the western Cascades, but are slightly more open, drier coniferous stands. Suncadia pine and mixed conifer stands dominate the site, however cool north-facing slopes often hold more mesic types of forest vegetation. Historically, the forest species composition and structure was strongly influenced by regular, low intensity ground fires. This resulted in relatively open, park like stands dominated by large diameter ponderosa pine, western larch, and Douglas fir.

The complicated soil, topographic, and aspect patterns of the region result in three major vegetation series (and several minor series) converging on the resort site (see Figure 2). These vegetation zones have been most recently defined through the gap analysis project for Washington State (Cassidy 1997):

> (1) North-facing slopes on the MPR, with relatively deep accumulations of organic, loamy soils, are protected from the drying effects of the summer sun, mostly fall within the Grand Fir Series. This series is characterized by a variety of dominant tree species (Douglas-fir, grand fir, western larch, western hemlock, Ponderosa pine, lodgepole pine, western white pine, and western red cedar), and typically exhibit a dense undergrowth of shrubs and herbs (see Table 2).
>
> (2) Drier, south-facing slopes typically fall into the Interior Douglas-fir Series, where Douglas-fir and Ponderosa Pine dominate the stands. Understory shrubs are less dense but can be extensive, and herbs tend to be more ephemeral (lush in spring but drying by mid-summer).
>
> (3) The level 'flats' in the northern and eastern portions of the resort, fall within the Ponderosa Pine Series, the driest zone. These areas are characterized by very porous soils where undergrowth tends to be minimal and is composed of a sparse cover of highly drought-tolerant shrubs, with increased grass cover. Ephemeral herbs are present but tend to be scarce.

Although most forests are dominated by coniferous tree species, moist sites along the Cle Elum and Yakima Rivers often support almost pure stands of cottonwoods and willows. Wetlands away from the river typically support small aspen stands or cottonwood groves. One conifer species, western red cedar, is also found in areas with a high water table, such as seeps, springs, and wetlands.

Natural openings occur in the forest as a result of soil, frost, and moisture regimes, forming meadows where tree growth is limited. Historically, forest fires, either generated by lightning strikes or by indigenous peoples setting fires to create foraging habitat for big game, also resulted in patches of treeless areas in the region. Beyond human influence, however, meadows may form where soil is either seasonally too wet or dry for

tree seedling establishment, or where frost pockets occur, which can also limit establishment of young trees.

Many species of plants in the MPR are, and have been, important for practical reasons. Local tribes collected various plant parts (roots, bark, stems, leaves, and berries) in all major vegetation zones and this practice was historically important as a major source of food, clothing, and other materials. Beginning in the late 1800s, most of the MPR was logged at least once and typically multiple times, prior to the development of the forests present today. A few stands on the MPR do not show signs of logging and were not significantly altered after European settlement except for fire exclusion. Vegetation is also important as it forms the base of the food chain for wildlife species present in the area.

2.4 WILDLIFE

A major goal of this Land Stewardship Plan is to provide for the needs of wildlife in the MPR following development of homes, recreation facilities, and golf courses in an area that had formerly been industrial forest land. Because some physical displacement of animals from development areas will inevitably occur, enhancement of open space areas for wildlife habitat helps to mitigate for this loss of habitat. Habitat diversity will improve for many species of wildlife because the regular cycle of forest overstory removal and even-aged reforestation will have ended now that the site is no longer industrial forestland. The cessation of hunting and recreational motorized vehicle use on the property improved its value as a wildlife refugium. Habitat enhancement activities provide a greater density of denning, roosting, nesting, and refuge sites for animals, allowing many species to live within and immediately adjacent to the development area (see Section 5.0).

2.4.1 Wildlife Found in the MPR

Over 180 species of birds, over 40 species of mammals, and several species of reptiles, amphibians, and fish utilize habitats that occur on the Suncadia property. Large and noticeable bird species found on the site include great blue herons, mallards, common mergansers, wild turkeys, ruffed and sooty grouse, California quail, osprey, red-tailed hawks, turkey vultures, northern ravens, and common crows. Although these are the more noticeable bird species, many smaller species of birds make up the bulk of the bird population found on the property. Three species of chickadees, three nuthatch species, and several species of woodpeckers, thrushes, finches, and warblers are common residents and easy to see in all types of forest habitats.

Species popular with backyard feeders of birds and birders in general, such as mourning doves, calliope hummingbirds, black-billed magpies, house wrens, western bluebirds, Nashville and McGillivray's warblers, yellow-breasted chats, rufous-sided towhees, song sparrows, and lazuli buntings prefer more open sites and shrub fields. Lack of these habitat types on the property could lead to local elimination of these species.

Similarly, most of the mammals inhabiting the Suncadia property are small and often nocturnal and include several species of bats, rodents, flying squirrels and small insectivores such as moles and shrews. Larger mammals that may occur on the site include elk, mule deer, black bears, cougars, bobcats, coyotes, red foxes, striped skunks, snowshoe hares, beavers, and porcupines.

Lower elevations in the eastern Cascade Range, like Suncadia, provide good habitat for several reptiles, including a few lizard and snake species that are rare elsewhere in the state. These include the western fence lizard, southern alligator lizard, western skink, sharptail snake, rubber boa, and the ringneck snake. Amphibian presence is restricted to a few species of frogs and toads, which are found in a variety of habitats on the property, including the unique tailed frog, found in small, fast-running streams.

Small streams, such as Domerie Creek, provide habitat for resident fish, such as cutthroat trout, sticklebacks, and several sculpin species. In the mainstem of the Cle Elum River, several salmonid species can also be found, including spring-run Chinook salmon, Coho salmon, sockeye salmon, resident rainbow and threatened mid-Columbia steelhead trout, cutthroat trout, threatened bull trout, western brook lamprey, and non-native eastern brook trout.

2.4.2 Wildlife Corridors and Habitat Associations

The Suncadia property currently has a diverse array of habitats and wildlife species associated with it. Natural corridors such as the Cle Elum River, managed open space on the west side of the river, and other open space provide connectivity for wildlife species that migrate to/from the Yakima River/Easton Ridge to/from, Roslyn Ridge/Teanaway River areas. Common large mammal species that need natural habitat corridors in order to move through the resort area include deer, elk, black bear, cougar, bobcat, and coyote. Smaller wildlife, such as smaller mammals, amphibians, and reptiles need these corridors as well for more long-term dispersal to new territories.

The extensive forests of Suncadia provide foraging areas and potential nest sites for birds with large home ranges such as pileated woodpecker, Williamson's sapsucker, Cooper's hawk, and sharp-shinned hawk (all of which currently nest in the Roslyn and Suncadia vicinity). The diverse forested conditions provide an array of nesting habitat for many resident and migrating songbirds. Winter migrants, such as the northern goshawk, use the area for foraging on prey species such as ruffed grouse and snowshoe hare. Owls such as the great-horned, barred, and saw-whet owl commonly nest in this area in late winter. Even small patches of forest can be important as stepping stones for bird and mammals species foraging across the area.

Riparian zones and many wetlands provide habitat for amphibians and mollusks, as well as many mammal and bird species that require moist conditions. Moist soils in these areas provide important habitat in the form of fresh green vegetation in late summer in much of the MPR during seasonably dry conditions.

Beyond the primary habitats, some species are more specific to certain micro-habitats. The bushy-tailed woodrat prefers cool and moist areas, particularly riparian, that have rocks large enough to provide crevices for dens. The golden mantled ground squirrel prefers drier areas and burrows in the ground, normally in areas with abundant downed wood. The nocturnal northern flying squirrel and several bird species nest in dead trees and mistletoe brooms. Pocket gophers and many reptiles prefer dry meadows.

A more thorough discussion of the species, habitats, and numbers of wildlife on the property can be found in the Suncadia (f.k.a. MountainStar) Final Environmental Impact Statement, on reference at the MPR main office.

2.5 HUMAN HISTORY

Immediately prior to European settlement of the Roslyn/Cle Elum area in the late 1800s, the Kittitas band of the Yakama Nation occupied the region and followed a hunter-gatherer lifestyle, with activities strongly tied to the annual cycles of nature. In early spring, they dug for bitterroot, camas, and other roots, then gathered berries and other food and medicinal plants from mid-summer to early fall. They had temporary fishing camps on the major rivers of the area and hunting camps wherever big game concentrated. Natural river constriction points, such as the lower and upper parts of (the former, natural) Lake Cle Elum provided sites to establish fish traps when salmon were migrating. Big game was hunted throughout the year, typically in summer at high elevations and in winter near lowland meadows and other wintering sites in major river valleys.

European settlement occurred when ranchers discovered the lush grass of the Kittitas and upper Yakima valleys. Present-day Kittitas County was part of the land ceded by the Yakama Nation in 1855. Briefly part of (the now defunct) Ferguson County, it then became part of an expanded Yakima County. Present day Kittitas County was established on November 24, 1883.

In 1886, the town of Roslyn was platted and coal mining operations were begun the same year by the Northern Pacific Coal Company. Coal was needed to feed the Northern Pacific Railroad which traversed the region. By 1888, the town had grown to 1,000 inhabitants, consisting of mostly coal miners and their families. Miners were mostly immigrants, including workers from Eastern Europe, as well as African Americans from the southern U.S. The town reached its peak in population of around 4,000 inhabitants by the 1920s. With the advent of alternative fuel sources, the coal mines were closed in the 1960s, with 80% of their lode still underground.

The historic Roslyn cemetery reflects this long mining history and is apportioned among the various ethnic groups and fraternal lodges, and is still arranged by these associations today. From the 1960s onward, timber production, agriculture, and tourism became the area's major industries. During the early 1990s, the television series *Northern Exposure* chose Roslyn as its outdoor filming location, bringing some notoriety and additional tourism to the area.

2.6 EXISTING COMMUNITIES

Today, the cities of Cle Elum, Roslyn, and South Cle Elum are centered in a fast-growing portion of Kittitas County. Service industries, tourism, and other local sources of employment provide incomes for most of their citizens. Some residents commute daily to jobs in the Puget Sound Region. Forest products and agriculture, while still important local industries, have declined in comparison to other sources of employment. Plentiful sunshine and recreational opportunities also attract new residents to the area. With an increasing human population come challenges to maintain natural habitats in their most productive conditions for native species of fish and wildlife, to provide habitat connectivity to adjacent regions, and to control invasive species of both plants and animals.

3.0 METHODS

To document the current conditions of wildlife habitat, fire risk, and plant associations present within the various open space tracts on the Suncadia resort, all areas were apportioned into management stands. Stands were based on significant breaks between major habitat types. Aerial photographs of the resort were initially assessed to identify obvious vegetation or habitat breaks. In the field, maps and photos were used to adjust the stands based on field conditions. Aerial photographs are limited in their usefulness in any habitat assessment, and management stands were adjusted based on recent habitat alterations, major plant species shifts noted within stands, and changes in the development footprint.

For each management stand, the following procedures were conducted:

- took a representative photograph and GPS coordinates, and gathered data on the following parameters (either in the field or based on references and mapping determinations):
- size (acres)
- legal location
- slope (steep, moderate, or level)
- aspect (north-facing, south-facing, etc.)
- soils (NRCS soil types)
- open space designation

- location (in reference to other stands and adjacent private or public lands) and overall stand description
- plant association (U.S. Forest Service, Wenatchee National Forest Plant Association)
- overstory (% canopy cover), understory (% cover), and ground vegetation (% ground cover)
- forest disease, insect, or noxious weed presence
- notable wildlife habitat features
- an assessment of fire risk
- proposed management time frames

These parameters were assembled into Appendices A through D in this report, in which the above characteristics are provided for each habitat stand. These stand characteristics were used to develop habitat management guidelines for this report. Information from the appendices helped us develop recommendations for fire prevention, noxious weed control, wildlife habitat enhancement, photo-point locations, recreational and interpretive opportunities, and other features of the land stewardship planning effort.

The Suncadia Land Stewardship Plan makes use of the **Plant Association** system of forest vegetation classification as described in *"Field Guide to Forested Plant Associations of the Wenatchee National Forest, Lillybridge, et al, 1995.* This system classifies plant communities based on their climax species; those species that, in the absence of disturbance, are self-perpetuating with no evidence of replacement by other species. Classifying existing forest cover by Plant Associations as described herein will help us with determining vegetation management objectives consistent with site resources to support the vegetation there or proposed for the site, e.g. tree stocking levels.

Forest scientists define a plant community type as a seral or successional stage of a plant association. Disturbance is a part of the natural cycle of forest ecosystems. The Climax plant community is only awaiting a disturbance to restart the forest succession cycle, but disturbance is not a necessarily a negative thing, rather just a periodic change in the forest community.

In other words, Plant Associations are named according to their projected climax species *even if those species may not be currently present* due to periodic disturbance events. A climax community that will rarely, if ever, develop is immaterial. What is important is that the Plant Association, as defined, provides a useful reference end-point for plant succession and is an indicator of a particular environment, and helps inform the management goals for the site.

On Suncadia, climax plant communities are rare because of years of natural and human caused disturbance events. Even prior to European settlement, periodic fires constrained plant succession from evolving to a climax condition. Some ecologists have referred to this condition as a "fire climax" since species composition was maintained in a *semi-steady state* because of relatively frequent natural fire return intervals. In these situations, the conifer species compositions are described as "seral" species that have evolved to be resilient with the frequent fire return intervals. These seral species occupied the sites for centuries and evolved to co-exist with endemic pest complexes.

Suncadia LSP stand examinations identified Plant Associations according to what species appear to be successfully regenerating in the understory (Figure 2). This means conifer, shrub and herbaceous species. For example, if the conifer understory is regenerating grand fir then it is likely the plant association will be in the grand fir series. The same can be said for the Douglas-fir series.

All plant associations capable of supporting a given climax tree species comprise a **Series.** Then within a series, plant associations are organized in Plant Association Groups (**PAG's**). The 2004- 2008 Suncadia LSP field work identified plant associations and this identification carried over into the 2014-2016 stand update field work. Organized plant associations grouped into PAG's are presented in Figure 3, and aid the forestry crew in making decisions on thinning strategies, stocking levels and other important aspects of stand management. A table of stands within PAGs is presented in Table 3.

4.0 Current Conditions

Suncadia MPR occurs in a portion of the eastern Cascade Range that has historically been mostly forested. Open space areas on the MPR are, for the most part, forested stands that will now be removed from a harvest rotation and allowed to mature into older forests. While it may seem easy to manage such stands (i.e., "just let the trees grow") the effect of this strategy would likely result in an undesirable future condition for many of the stands.

In the eastern Cascade Range of Washington, once a stand of trees is harvested , the site is replanted to ensure rapid regeneration of a new forest. Plantations of young trees are often augmented by seedlings generated by tree seeds carried by the wind from nearby forests. The resulting stand of young trees is often more densely spaced than are natural stands. Even in some natural stands resulting from forest fires, young trees can become densely packed during their first year or two if seed germination conditions are favorable. As these trees mature, some are crowded out as they compete for light and nutrients. These dead or 'suppressed' trees can remain standing for years, creating unsafe fire situations as discussed in the following section. Crowded young trees also take much longer to mature into large trees. Large trees are generally more valuable to wildlife as they will eventually contain various individual defects such as dead tops and large cavities, which are useful for nesting, roosting, and denning sites.

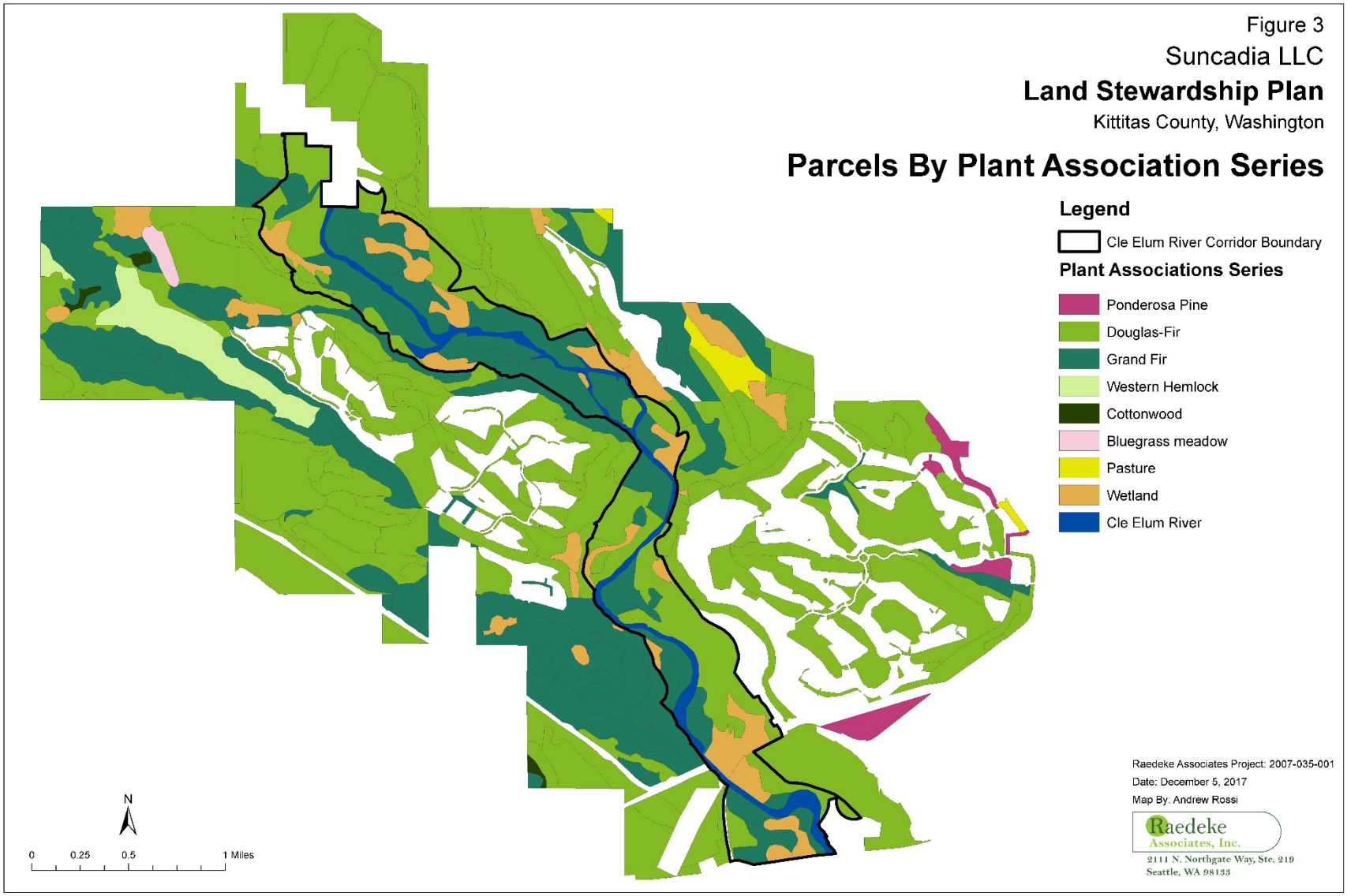
Figure 3
Suncadia LLC
Land Stewardship Plan
Kittitas County, Washington
Parcels By Plant Association Series
Legend
Cle Elum River Corridor Boundary
Plant Associations Series
Ponderosa Pine
Douglas-Fir
Grand Fir
Western Hemlock
Cottonwood
Bluegrass meadow
Pasture
Wetland
Cle Elum River
N
0 0.25 0.5 1 Miles
Raedeke Associates Project: 2007-035-001
Date: December 5, 2017
Map By: Andrew Rossi
Raedeke Associates, Inc.
2111 N. Northgate Way, Ste. 219
Seattle, WA 98133

Overall, forest health challenges on the Suncadia property are not currently major or insurmountable. Forest management by Plum Creek Timber Company in the decades prior to Suncadia ownership has left the area in a relatively good condition in many aspects. Tree species in plantations were for the most part appropriate to the site conditions. In the most recent decades prior to Suncadia ownership, lessons had been learned by forest managers that were based on mistakes made in the 1960s-1980s. For example, undesirable practices such as planting a dry-site species like Ponderosa pine in high-elevation, cool sites, or forcing Douglas-fir plantations onto hot, dry sites did not occur on Suncadia lands. Some plantations are more of a monoculture than would naturally occur, but in general, some natural regeneration has taken place in these young stands, providing a mix of tree species at most sites.

An important forest management tool that was not implemented by previous land managers was thinning of all ages of stands to densities more appropriate to the site conditions, and more typical of historic conditions. Historically, ground fires that were either set by Native Americans or ignited naturally by lightning strikes, kept the trees more widely spaced than what is currently present over much of the region. These conditions were noted and written down by early European explorers. One explorer in the inland Northwest noted that during the summer, "seemingly everywhere one could smell smoke", as low-intensity ground fires occurred over wide areas. Early aerial photography of the Suncadia property from the 1950s, shows a generally more widely spaced forest canopy than what is present today.

Some stands on the Suncadia property had been altered by mining and early logging operations from the 1880s to the 1950s. These early logging operations could not access the steeper slopes and higher elevations of the property given the harvesting technology at the time. Forests on steep sites, if not harvested after the 1950s, have been affected by fire suppression activities for many decades and may be overly dense compared to truly natural conditions.

Forest management goals of the former land owner, a large timber company, are necessarily different than the goals that should now be placed on the site by a resort owner and community steward. Higher tree density was desired and encouraged in an industrial forest. Given the dry site conditions, more open forests, should become the desired state over much of the property for improved forest health. Patches of dense forests can remain, and can be found in natural forests of the area, particularly on moist, north-facing slopes and in riparian zones. A variety of forest types and densities should be the goal in balancing the needs of wildlife and the need to prevent wildfires.

The following sections will address specific objectives but it should be recognized that these objectives are closely inter-connected and are not mutually exclusive. Addressing one objective will necessarily impact another. The overall LSP implementation goal is to work with nature to create and maintain a desired forest structure well into the future utilizing adaptive management principles. In this discussion, "forest structure" refers to the forest ecosystem – the soils, wildlife, and all vegetation layers: herbaceous, shrub, and tree canopy.

4.1 FOREST HEALTH

A major objective of the land stewardship plan is to promote and maintain a forest relatively free of catastrophic disturbance potential. Specifically, it is important to prevent loss or extensive damage to any large portions of the forest in the open space areas due to outbreaks of disease or insects, a severe windstorm, climate change, drought, or a catastrophic forest fire. Should any of these events occur, a maintained, healthy forest is better able to withstand the extent of any such damage. Forest Health is defined as a forest that can:

> *"…renew itself vigorously across the landscape, recover from a wide range of disturbances, and retain its ecological resilience…"*

Forest health, forest restoration, and wildlife habitat management (ecological restoration) are closely interconnected and can be linked with a common goal statement, for example:

> *To create and maintain stands of trees resilient to insects, disease, wind, and severe wildfire, and at the same time maintain and enhance wildlife habitat features.*

Suncadia MPR forests, like all Pacific Northwest forests, have been significantly altered since pre-European settlement, primarily because of intensive timber harvest and fire exclusion. They have also been affected by the loss of water in adjacent streams to agriculture, and a lack of ocean-based nutrients provided by great numbers of migrating salmon. Forest science research has documented that pre-settlement periodic ground fires maintained a forest structure resilient to high-severity wildfires and insect disease attacks. Coniferous tree species found on Suncadia that were more tolerant of these low-level fires include Ponderosa pine, Douglas-fir, western larch, lodgepole pine, and western white pine. Trees species more likely to have been historically minimized by low-level fires included grand fir, western red cedar, and western hemlock. These species undoubtedly still persisted in moist situations however, such as cool north-facing slopes and adjacent to seeps, streams, and other waterbodies.

There is a large body of scientific literature concerning forest health in relatively dry climates, such as the Suncadia MRP site. Some of the salient features of forest health initiatives in the eastern Cascade Range as they apply to the MPR include the following:

1) Tree Density. Trees compete with one another for moisture, sunlight, and nutrients. In dry climates, soil moisture is probably the key limiting factor for a growing tree for many months of the year, although soil depth and nutrient content can also be limiting. If trees are crowded to a point that each is taking valuable soil moisture or nutrients from its neighbor, many trees in the stand may be in poor condition. This prohibits the trees from producing sufficient amounts of secondary chemical compounds and subjects them to attacks by insects and disease. Secondary compounds are those chemicals that insects and other herbivores find distasteful or even toxic, and which may be toxic to disease

pathogens as well. Trees with sufficient moisture, light, and nutrients are better able to resist damaging agents than are crowded, unhealthy trees. Crowded forest trees often self-prune their lower branches, conserving energy for the leaves in the canopy, which are gathering more sunlight. Some severely crowded trees (suppressed trees) die from a lack of sufficient moisture and nutrients. This condition (a crowded forest with frequent dead trees and the remaining trees with dead lower branches) produces a stand that is highly susceptible to fire. Ground fires moving into the stand may more easily spread to the canopy, causing torching and crown fires that can burn large areas.

2) Microclimate. There are approximately a dozen species of coniferous trees native to eastern Washington, and each is adapted to specific microclimates. Ponderosa pines, for example, live in some of the driest, hottest portions of the eastern Cascades, and are present farther east than other species into the very dry, open sagebrush country of the Columbia Basin. In contrast, grand fir is a common tree in the cooler, shaded, north-facing hillsides around Suncadia. This species can establish itself in a shady understory, and is subject to overcrowding. Planting the wrong species of forest tree on a given site often leads to poor health and the possibility that insects or diseases could damage the stand. Sometimes, improper forestry practices in the past have resulted in an unsuitable tree species planted on a site that would not naturally support it, often developing an unhealthy forest stand.

3) Shrub Layer. In stands of trees that have been clear-cut or overly-thinned in microclimates where dense-canopied forests predominate, shrubs may invade the site, competing with seedling trees for water, nutrients, and light. These dense shrub fields can prevent the rapid establishment of a new forest and often present an increased fire danger. Resinous-leaved shrubs with evergreen leaves, such as snowbrush and Oregon-grape are examples. Shrubs are an important part of the forest ecosystem and convey much benefit to wildlife, but in artificially open situations such as recently logged areas, they can inadvertently spread wildfires.

4) Human/Forest Interface. When people come into close contact with dry, eastern Cascades forests, the possibility exists for intentional or accidental fires to occur. The proximity of roads and houses to unhealthy forest stands increases the risk that a fire could occur. Managing stands for fire-resilient conditions (fuels management) adjacent to areas of vehicle traffic, construction, or recreational activities that could unintentionally spark a fire, is a priority on the Suncadia MPR. Fuels management however, is only a step in reducing fire risk. Managing people is a critical component that also must be considered when this heightened anthropogenic fire potential exists, and this must complement healthy forest management activities. Altering trail use, implementing trail closures, and conducting fire watches during dry weather periods are important actions toward this end.

Disease and insect outbreaks, invasive plants, and other concerns are also important facets of forest health, and will be discussed in later sections.
Forest health and forest restoration (ecological restoration) has gained much interest and research in recent years. Key Points from this research applicable to Suncadia Forests:

1) A comparison of historical to current forested plant communities reveals significant species mix shifts from early and mid seral to late seral conifer species in many forests *and* average stand density was 173% of 1860 levels by 2000. (Everett et al. 2007).

2) From 1899 t0 1999, overall stand density has increased 307% for Douglas-fir, 81% for Ponderosa pine whereas western larch has decreased in density by 48%. Also, average basal area has increased by 81%. (Ohlson & Schellhass 2010).

3) The historical forests of the central eastern Cascades were not a solid block of late successional or old growth forests. Rather they represented a complex mosaic patches and structures that resulted from disturbance patterns, namely fire (Agee 2003). This mosaic pattern varied by plant association groups.

4) This shift in tree density and species composition came about because our 20th century management sought to remove natural disturbances from the landscape but actually only altered the frequency of natural disturbances; reduced frequency of fire whereas insect and diseases increased frequency due to shift in tree density and species shift. Forest fires, insects, and to some extent disease were the natural managers of the landscape prior to human influence (Agee 2003).

5) Historic disturbance frequency and intensities varied by series and plant association groups in central eastern Cascades (Agee 2003).

6) With frequent fire return intervals, fire intensities were low in dry forests and maintained open and park-like landscapes. Historic mesic forests exhibited a wider range of fire severities, with moderate and occasional high severity or crown fires because of longer fire-free intervals which resulted in greater fuel accumulation.

7) Fire frequency and size declined dramatically about 1900, coincident with timber harvesting and fire suppression (Wright and Agee, 2004)

8) There was a significant establishment of Douglas-fir in all plant association groups after cessation of fire. (Everett et al, 2007)

9) Mean fire return intervals were 7 to 8 years in dry forest types during pre-settlement period and lengthened intervals of 39 to 44 after fire suppression (1910: Everett et al. 2000)

10) Studies on the surrounding national forests have shown historical fire-free intervals ranged from 6 to 24 years and by the mid 1990's these forests were already 4-7 fire intervals out of synchrony with their inherent fire disturbance regime (Ohlson, et al, 2010)

4.1.1. Management Implications for Suncadia Forest Stands

Forest Ecology research suggests that although knowledge of the historic range of variability may be a valuable baseline, attempting to mimic historic conditions, may or may not produce conditions that will be more resilient to future disturbances and other stresses, such as drought (Hart, et al, 2015).

Key Points:

- There is no question that with few exceptions tree stocking in forest stands on Suncadia is well outside site resources to support healthy stands of trees growing in association with shrub/herbaceous layers. Furthermore, in many stands, species mix is frequently out of balance with site conditions, which in turn can trigger tree health-related pest complexes.
- Future management oriented towards biodiversity concerns should focus on moving plant communities back towards the historical range of variability, and customized to site conditions. (Agee, 2003).
- Stand managers should recognize that there a large number of organisms that rely on dead and down wood and that this component is a necessary element of a healthy forest ecosystem but should be kept in balance with forest fuels concerns.
- Forest managers should customize prescriptions that will set stands on a succession trajectory that simulates the estimated species mix, tree density and stocking level for the site.
- Management should focus on managing toward desired future stand conditions that favor resilience even if historical conditions are not precisely restored. In other words, desired future conditions may not be a re-creation of a historical condition but rather consider the future range of variability when climate change is taken into consideration.
- Woody biomass for energy generation may be an alternative use (market ?) for excess wood fiber material that is being generated from construction clearing or open space stocking control adjustments.

On Suncadia forest stands there is a wide range of current conditions variations from the historic range of variability. The extremes are: The 30-35 year old forests that were created following clear-cut logging, site preparation and seedling planting. In these stand it will be most difficult to identify plant associations and predict the historic range of variability and the fire return interval. On the other extreme; stands where historic disturbance regimes have been the least significantly modified since European settlement. There have been periodically partially cut and fire has been excluded since the early 1900's.

4.2 FOREST FIRES AND FUELS*

**(Dr. James K. Agee, University of Washington, reviewed the stands on the MPR property in fall 2007 and contributed heavily to this section).*

Forest fuels management is generally referred to as the control of those highly combustible vegetative components of a forest. Ground surface fuels such as fine dead wood (slash piles, fallen limbs, dead or dying suppressed shrubs, and highly combustible understory vegetation such as evergreen broadleaf shrubs and dense, dry grass), ladder fuels (fine dead and dry tree branches and dead needles), and recently dead trees resulting from insect attack or disease (with dead needles still attached), if present in high quantities and within a dense forest with interconnected canopies, can result in a forest stand with an elevated risk of a wildfire. Open forest stand with heavy underbrush, particularly with a high component of evergreen broadleaf shrubs, also presents an elevated fire risk.

In a regime of frequent understory fires (the historic situation), large buildups of forest fuels did not occur because fuel-reducing ground fires burned off accumulations of fine forest fuels on a regular basis. In today's managed forests, fire has been essentially eliminated for many decades, and forest fuels build up over time. On the Suncadia property, controlled, understory burns are not a practical or advised management tool to control the buildup of forest fuels. In a resort environment, mechanical removal of fuel sources should occur in an attempt to simulate ground fires and protect adjacent forest from wildfire. Large down logs and patches of dense shrubs or young trees are important wildlife habitat features and should be maintained during mechanical fuels management operations. These habitat features are often retained in natural forest situations where ground fires burn in mosaic patterns across a landscape.

As outlined in Agee and Skinner (2005), forest fuels reduction can be categorized under 5 principles, in order of application: (1) reduce surface fuels; (2) reduce ladder fuels; (3) keep the big trees, (4) maintain wildlife habitat features, and; (5) reduce canopy density.

Forest fire behavior is characterized by 3 types of fire: (1) surface fire, (2) torching, and (3) crown fire. A surface fire burns along the ground and its intensity is measure by flame length. The flame length is a function of fuel type, amount and arrangement. Reducing surface fuels will reduce flame length. Torching marks the vertical transition of a surface fire to a crown fire. In torching, a group of trees will combust, and then the fire either transitions back to a surface fire or develops into an active crown fire. Torching is enabled when ladder fuels (dead pine and fir needles and/or fine dead branches) are close to the ground and continue upwards on some trees to canopy level. Active crown fire is sustained by heat and flame lengths that reach the canopy. Crown fires can be maintained if winds are strong and/or crown density is too high.

Managing a forest to reduce fire risk therefore depends on reducing surface fuels to reduce surface fire flame length. Removing some small trees and brush (where appropriate) and/or pruning larger trees (ladder fuels) help to prevent torching. Reducing

the density of the stand will reduce crown fuels. If the surface and ladder fuels are adequately treated, there is less need to reduce the crown fuels, because fire is not likely to move into the crown. Managing for fire resistance can be overdone, however. At some point, if the canopy is reduced too much, surface fuels will be drier and mid-flame wind speeds will increase due to the more open conditions. In general, maintaining canopy cover between 40-50% (in drier vegetation zones) and basal area in the range of 80-120 ft^2/acre for mature stands should be sufficient to minimize fire risk.

Management stands that initially posed a high fire risk were illustrated in Figure 4 in red. Figure 5 shows an updated map revealing management polygons that have been mechanically treated to reduce fire risk. In most cases, high fire risk has resulted from overly dense stands with abundant surface and/or ladder fuels in dry vegetation zones (Douglas-fir and Ponderosa Pine-dominated plant associations). Any remaining areas in illustrated in red should be first priority for fuel reduction treatments.

Although forest fuels reduction will be important over the entire Suncadia open space lands, forests will be managed for multiple benefits. Even if every stand could be treated under these fire-resistant principles, it may not be desirable to do so. Managing for wildlife habitat will result in stand structures containing patches with multiple tree layers. Fragmenting the fuel matrix will provide fire suppression forces defensible space to suppress wildfires if the fire enters fuel reduction areas. The plan for variable density thinning, as outlined in the wildlife habitat chapter will achieve both goals of improved wildlife habitat and minimize fire risk. Intensive application of increased fuels management treatments will be necessary along major road corridors because of the increased risk of fire starts and the need for safe evacuation routes. Application of the full suite of fire-wise actions is recommended for a 2-tree-length distance (200 ft.) on both sides of major roads.

Even a well-managed forest can support a wildfire if weather conditions become extreme (e.g., high wind situations during late summer when forest fuels are dry and human activity levels are high). While Suncadia has a detailed fire management and evacuation plan and enforced building codes that minimize the risks of fire, management of forest stands on the interface between development areas and wildlands will be an important part of a comprehensive fire management plan.

4.3 DISEASE AND INSECTS

In general, review of the forested stands on the MPR lands in 2007 revealed few dire insect or disease occurrences. Field visits included inspection of weakened and recently fallen trees for signs of insect outbreaks or disease problems in the stands investigated. Insect and disease infestations, unless large and geographically extensive, usually become a problem only in crowded forests or forests on poor soils. Most healthy forest stands are adapted to local insect and disease vectors and resist major damage. On MPR lands, where wood production is no longer a goal, insects and disease pathogens should be monitored, but usually do not affect the wildlife habitat quality or visual aesthetics of the forest as a whole, unless major outbreaks occur.

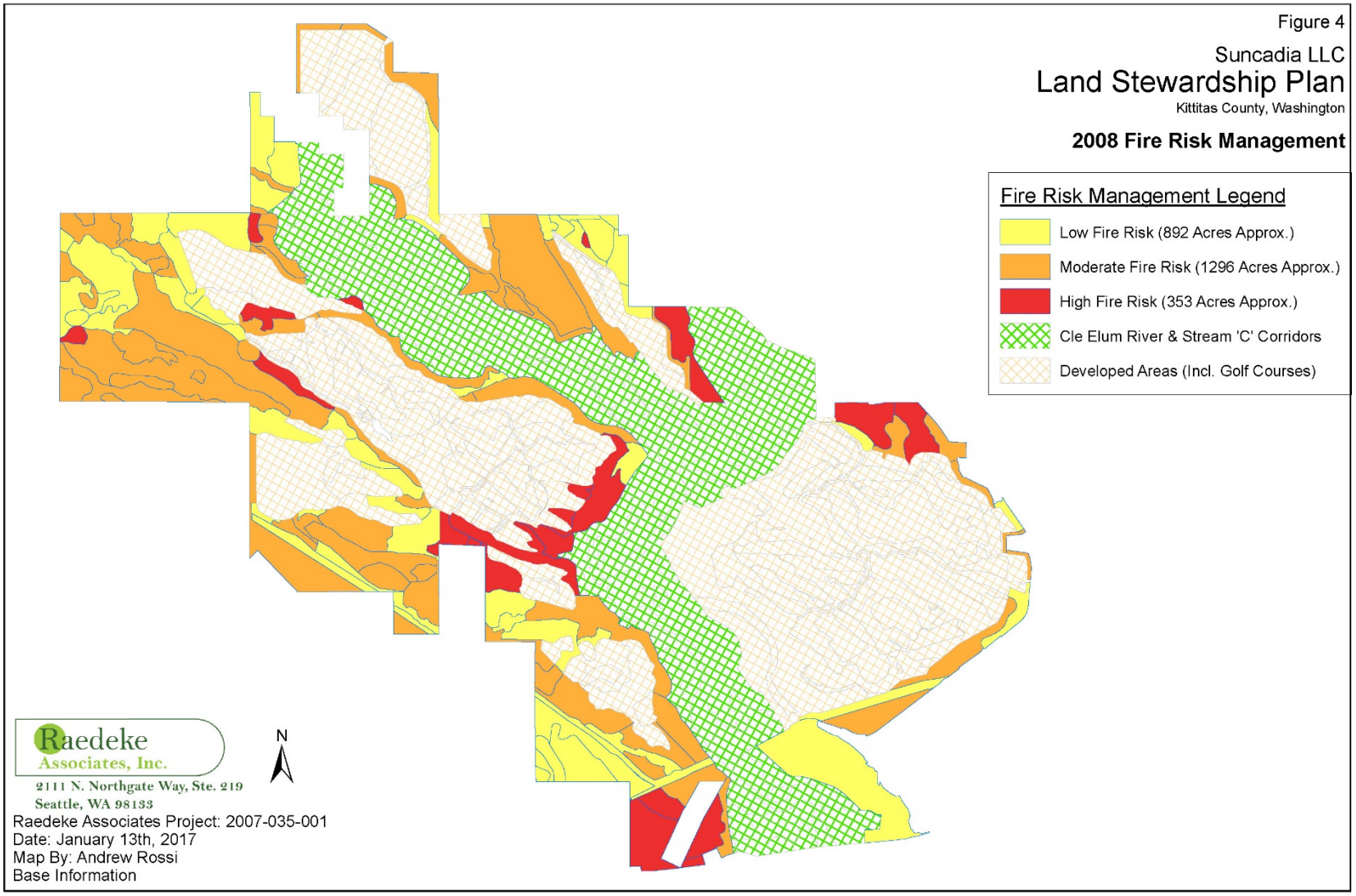
Figure 4
Suncadia LLC
Land Stewardship Plan
Kittitas County, Washington
2008 Fire Risk Management
Fire Risk Management Legend
Low Fire Risk (892 Acres Approx.)
Moderate Fire Risk (1296 Acres Approx.)
High Fire Risk (353 Acres Approx.)
Cle Elum River & Stream 'C' Corridors
Developed Areas (Incl. Golf Courses)
Raedeke Associates, Inc.
2111 N. Northgate Way, Ste. 219
Seattle, WA 98133
N
Raedeke Associates Project: 2007-035-001
Date: January 13th, 2017
Map By: Andrew Rossi
Base Information

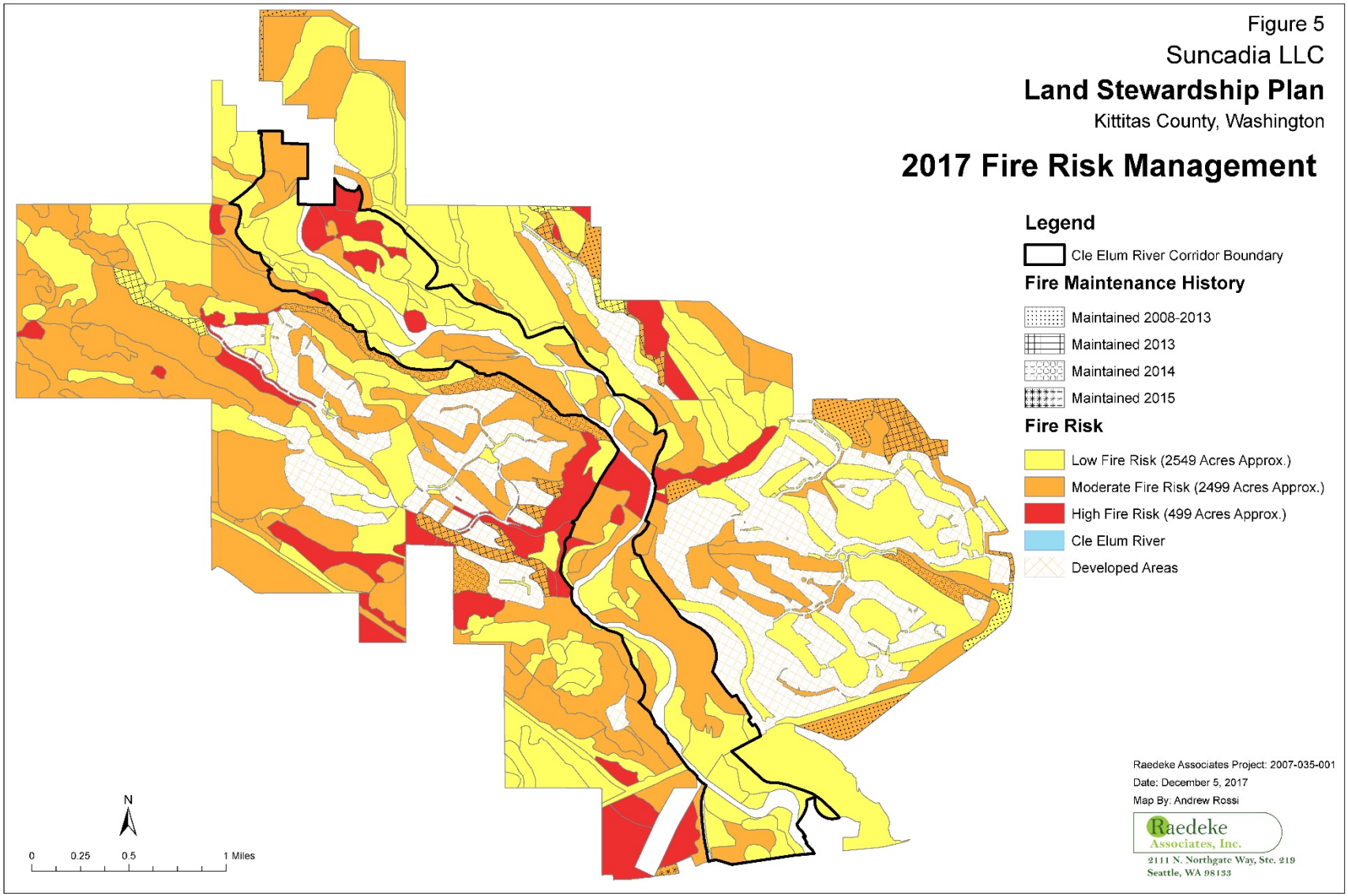
Figure 5
Suncadia LLC
Land Stewardship Plan
Kittitas County, Washington
2017 Fire Risk Management
Legend
Cle Elum River Corridor Boundary
Fire Maintenance History
Maintained 2008-2013
Maintained 2013
Maintained 2014
Maintained 2015
Fire Risk
Low Fire Risk (2549 Acres Approx.)
Moderate Fire Risk (2499 Acres Approx.)
High Fire Risk (499 Acres Approx.)
Cle Elum River
Developed Areas
N
0 0.25 0.5 1 Miles
Raedeke Associates Project: 2007-035-001
Date: December 5, 2017
Map By: Andrew Rossi
Raedeke Associates, Inc.
2111 N. Northgate Way, Ste. 219
Seattle, WA 98133

In 2007, a spruce budworm outbreak became noticeable in the conifer forests of western Kittitas County. Between 2007 and 2015, large areas of annual defoliation of Douglas-fir and grand fir trees occurred on Suncadia MPR lands. Defoliation was most apparent in stands of fir trees already moisture stressed by overcrowding. In 2014 and 2015, application of the pesticide BT (a bacterium, *Bacillus thuringiensis*) by ground and aerial spraying was approved by the Suncadia Association Board outside of the Cle Elum River Corridor, because of the extent of the outbreak. The action had limited localized impact on the defoliation of individual stands of trees. The recent outbreak is on the decline in all areas of western Kittitas County as of 2017.

4.4.1 Disease

What are generally referred to as disease vectors for forest trees are parasitic infections by other vascular plants or fungi. During the review of forest stands on the resort, evidence of various forest diseases, including dwarf mistletoe, and fungi such as tip blight, white pine blister rust, Indian paint fungus, and various root-rot fungi were noted. Disease vectors are usually host-specific, but closely related species of vectors may be found on several conifers.

Some trees on the MPR were found to be suffering from various diseases. Several groves of grand firs affected by root rot disease were seen, mostly on north-facing slopes along Easton Ridge or on the south side of the Cle Elum River. These patches, usually only affected Douglas-firs and grand firs, with species such as western red cedar already filling in between trees. Another common disease on the property was dwarf mistletoe. This tiny plant starts from seeds which are eaten by birds and then adhere to branches when defecated. The mistletoe plant causes its host tree to begin to form a dense branching pattern called a “witch’s broom”.

Additional energy expended to produce these extra branches will stunt its growth and if extensive, can kill the tree. Dwarf mistletoe infections were found on a number of trees. Infected trees are scattered throughout the property and do not seem to be causing widespread mortality. The dense witch’s brooms are often a benefit for wildlife, Threatened spotted owls commonly utilize this habitat for nesting and rearing of young. Other wildlife species will create nest sites in these well-protected niches.

Monitoring forest stands regularly for disease outbreaks is an important part of forest management in the MPR. Patches of root rot disease, particularly in highly visible portions of the property should be controlled if dead and dying trees become too numerous. Heavily mistletoed trees should be monitored where they extend over roadways for safety concerns as these trees are more likely to break under heavy snow loads or during wind events. Trees should always be checked for raptor nests prior to removal. If nesting raptors or other wildlife are present, trees should be scheduled for removal following the breeding and rearing season. Dead trees may also be retained to provide additional wildlife habitat.

Dwarf Mistletoe (infections in Douglas-fir are common on Suncadia).

1) It is a parasitic plant depending on a tree host for water and nutrients.
2) It is specific to each species of tree. It only survives on living trees. When the tree or branch dies, so does the mistletoe.
3) The spread is relatively slow in single layer stands. The spread is usually downward.
4) Mistletoe survives by stealing water and nutrients from the tree. By itself, it is rarely a tree-killer but it does weaken the tree and it will be more susceptible to bark beetle attacks in overstocked stands.
5) Mistletoe "brooms" are a branching deformity providing nesting and hiding cover for birds and small mammals. The fruiting body of the plant is also a food source.

Complete eradication is impossible nor is it desirable because of the habitat value provided by the brooms. If spread of this parasite is called for, it can be controlled by cutting or girdling heavily infected trees during thinning. The girdled tree will die and the broom will persist for several years and the tree will become a wildlife tree.

Left: Dwarf mistletoe in Douglas-fir. Right: Fading crowns indicate root-rot disease.

Root-rot Fungus and Disease

Root-rot diseases are evident throughout Suncadia and are caused by several species of fungi. In 1998 a consulting forest pathologist conducted a root-rot disease survey of the Phase I planning area. This report and map is available only in a hard copy in the Suncadia forestry files.

Research has confirmed that root-rot fungi are native and a natural part of a healthy forest ecosystem. In a healthy forest there is a balance between the fungus and trees. The trees and the fungus have evolved with each other and pre-settlement periodic low intensity fires they lived in balance with each other.

There are three primary root-rot fungi in the area: Armellaria, Laminated and Annosus types. Root-rot pockets are easy to identify in the forest. There will be patches of dead trees, some broken off or fallen with the root-wad exposed. Often there will be a heavy patch of vine maple, oceanspray, hazelnut, or alder which have responded to more sunlight reaching the forest floor.

Selective harvest will aggravate the spread of root-rot because fresh stumps are quickly colonized by the fungus. The roots of these stumps in contact with roots of adjacent green trees allows the fungus to spread to these green trees and the tree is often killed within a year or two. In other words a “flush” of infection and mortality usually follows colonization of stumps created by selective harvesting of infected trees. In any event, it is safe to say the fungus once present on a site, will always be present. Normally, the fungus spreads very slowly from infected trees to adjacent trees, which may take years.

In areas that have been clear-cut and planted, it is common to see pockets of dead young trees or just an individual dead tree. This is an indication that the fungus is surviving in old stumps. If Douglas-fir and grand fir trees with weak or fading crowns are common, then root-rot disease is the likely cause.

Host species vary in their susceptibility but all coniferous species are moderately to highly susceptible until they are 12-15 years old. After this age, some species become less susceptible to mortality, especially pines and western larch. In most situations on Suncadia, root disease patches in natural, or managed open space and in some cases perimeter opens space will be left “as is” except in cases where fuels reduction is necessary. The standing dead trees become wildlife trees, the fallen trees become decaying coarse woody debris and the developing hardwood shrub layer all provide habitat diversity.

In the Interior open space and private open space root disease will likely create danger trees and a safety issue that will eventual have to be dealt with. The Snowberry loop neighborhood is an example of serious root-rot disease.

A root-rot disease pocket could be ¼ acre and up to 2 acres in size. Cutting what appear to be infected trees will only aggravate the spread of the fungus to adjacent healthy trees,

unless all of the susceptible trees in the pocket (firs) are cut, leaving only pines, western larch, and hardwoods, if present. If there are no resistant species to leave, then creation of a grassy opening, planting of pine and western larch, or allowing the site to naturally regenerate to deciduous and shrub species are options.

4.4.2 Insects

Field visits included investigations for evidence of pine beetles, bark beetles, Douglas-fir beetles, engravers and any other insect pests such as tussock moths and spruce budworms in 2007. Numerous trees had beetle infestations, but in no cases were there large numbers of weakened trees throughout a stand, or large patches of dead or dying trees that showed signs of insect-caused mortality.

Tree mortality is often the result of multiple factors or agents. Inciting factors can compromise tree defense mechanisms. Examples would include non-lethal fire injury, root disease, mistletoe, or defoliation. Contributing factors are opportunistic agents, such as bark beetles that subsequently kill compromised trees.

Pine Bark Beetles

Recent pine bark beetle mortality is evident in pine stands throughout Suncadia. Bark beetle populations fluctuate year-to-year depending on stress causing conditions in a stand of forest trees. The most common stress problem is available moisture. During normal precipitation years, beetle populations tend to decline because vigorous trees are better able to resist beetle attacks. During drought years, such as during the late 1980's- early 1990's, beetle populations tend to increase, especially in over-stocked stands. Bark beetle outbreaks can last for several years depending on weather and forest conditions.

Right: Pine bark beetles evidenced by dying crowns.

Pine Bark Beetle Facts:

1) Bark beetles only infest living trees or damaged and down trees that are still green.
2) Beetles will seek out moisture stressed trees because these trees produce less resin.
3) A vigorous tree can repel beetles with an abundance of resin flooding the entrance holes and galleries.
4) Once beetles find a suitable host tree, they release a chemical (called pheromones) to attract other beetles.
5) Bark beetles develop through 4 life stages: egg, larva, pupa, and adult. There is usually only one live cycle per year.

6) Beetles spend almost their entire life beneath tree bark. The female will excavate an egg gallery.
7) The eggs hatch within a few weeks and the larvae feed on the inner bark of the tree, pupate and then emerge as an adult.
8) The adult beetle spends only a few days outside the bark and then will fly to locate a new host tree.
9) Bark beetle attacks often leave plainly visible evidence outside the bark such as pitch tubes, resin streams, and a reddish brown boring dust in bark crevices. Under the bark, distinctive egg galleries are specific to each kind of beetle.
10) Normal populations of bark beetles are kept in check by woodpeckers and other insect-eating birds.
11) The green needles will begin to fade in the fall and sometimes not turn brown until the following year.
12) Birds can act as a natural control mechanism, and it is a good thing to create and maintain bird habitat in a forest stand.

There are four major groups of beetles common to central Washington pine forests. They are native and a natural part of a forest ecosystem. They all have characteristic gallery patterns and preferred host tree types.

1) ***Mountain Pine Beetle*** is generally associated with stands of ponderosa pine larger than 8" DBH in older, overstocked stands. They make long J-shaped egg galleries under the bark of trees. This is the most damaging beetle in our area. It often begins in weakened trees and may spread to healthy trees.
2) ***Western Pine Beetle*** will most likely attack large, old ponderosa pine with low vigor, usually in clumps. They make winding, crisscrossed egg galleries under the bark of trees.
3) ***Pine Engraver Beetle*** attack pine 5" to 8" DBH, logging slash, pre-commercial thinning slash, wind throw, or top portions of larger trees which have been weakened by drought. Outbreaks are usually associated with spring and early summer drought. Their egg galleries radiate out from a central chamber under the bark of trees. It is recommended not to create green pine slash from Dec-July unless it is disposed of as cut. Green pine slash invites pine engraver beetles which may invade living pine trees.
4) ***Red Turpentine Beetle*** attacks the lower trunk of weakened or stressed pole-sized and larger pine. Look for conspicuous globular reddish pitch masses about 1 inch across on the lower trunk. The egg galleries are irregular shaped; can be up to 1" wide and about 12" long. These beetles are rarely lethal by themselves, but they will weaken the tree and make it more susceptible to MPB or WPB attacks.

Douglas-fir Bark Beetles

1) Douglas-fir bark beetles, like pine bark beetles, attack trees that are under stress. This can mean lack of moisture, root disease, or defoliated trees caused by other insect pests.
2) Foliage will turn yellow and then fade to a reddish brown by late summer or fall.
3) There will be red or yellow boring dust in bark crevices. No pitch tube, but with resin streamers on upper stem. This is where pitch has seeped out through the beetle entry hole.
4) Egg galleries are straight, similar to Mountain Pine Beetle.

Western Spruce Budworm (affects Douglas-fir and grand fir)

1) They are defoliating moths (eat the needles) that does not usually kill the tree.
2) It will weaken trees and make them more vulnerable to bark beetles.
3) Needles will appear blighted or scorched on the tips. Needles will be bound together with webbing at branch tips.
4) The caterpillars are about 1" long with green markings and white spots on the sides. Moths are small and pale in color. Caterpillars are active in spring or early summer.

This defoliating caterpillar has been present in Kittitas County forests since the early 1980's, and no doubt even before then. Populations build-up in cycles, usually during periods of low precipitation. Sampling traps set out in 2015 indicated the population was declining at that point.

In 2015, Suncadia completed a spruce budworm aerial spray project (Btk) targeting areas most heavily infected. Prior to 2015 there was on-going ground spraying on individual lots requesting Btk treatment.

Forest stands will be regularly monitored for major insect infestations. The current spruce budworm situation will be watched carefully, particularly in areas where forest views could be compromised or wildlife habitat affected. Spraying with BT, a pesticide, could be considered if forest aesthetics, health, or fire safety become compromised. Control of this and other serious forest insect infestations over large areas will be coordinated with the KCT, local neighborhood citizen groups, and county and state agencies.

5.0 WILDLIFE HABITAT

To improve forested habitats for wildlife in areas that were largely plantations of young trees, some management is desirable. Although dense stands of young trees (plantations left to grow on their own) provide habitat for a few species of wildlife, mature forest stands generally have improved habitat conditions for more species. Mature forests contain higher densities of wildlife trees (dead trees), nest cavities, large down logs, shrubs, herbs, and other features that provide structure and food plants, providing a more diverse environment in which more species of wildlife will flourish. Management objectives on the Suncadia open space lands are to guide many of the younger forest stands into a condition that will support a greater diversity of wildlife species.

Managers will not overlook those species for which a mature forest is not the ideal habitat condition. Other habitats, including natural meadows, shrub fields, and young forest stands will be maintained on the site, to ensure that a diverse community of wildlife will continue to utilize the resort property. Species of shrubs common to Suncadia and which may want to be planted or otherwise encouraged are provided below:

Scientific Name	Common Name	Notes
Acer spp.	Vine and Douglas Maples	Provides structural habitat for many nesting birds and some cover for larger wildlife species.
Arctostaphylos uva-ursi	Kinnikinnick	Berries are of limited utility as a food source to ground-dwelling birds and smaller mammals.
Amelanchier spp.	Serviceberry	Fruits are important food sources for many birds species.
Ceanothus spp.	Red-stem Ceanothus and Snowbrush	Red-stem Ceanothus is an important winter forage species for deer and elk. Snowbrush provides year-around hiding cover for deer and elk.
Chrysothamnus vicidiflorus	Rabbitbrush	Provides some hiding cover in dry disturbed areas.
Cornus spp.	Dogwood	Can provide limited winter browse for deer and elk, also summer cover.
Holodiscus discolor	Oceanspray	Common shrub that provides summer hiding cover but little else.
Mahonia spp.	Oregon-Grape	Several wildlife species forage on the fruit, including grouse and thrushes.
Philadelphus lewisii	Mock-Orange	Provides some summer hiding cover but little else.
Potentilla spp.	Cinquefoil	Some smaller birds may eat the seeds, but does provide forage for deer and elk. Of limited value as summer hiding cover.
Prunus spp.	Choke Cherry and Bitter Cherry	Fruits are important food sources for many bird species.
Purshia tridentata	Bitterbrush	Provides cover for smaller mammals and winter forage for deer and elk.
Ribes spp.	Currants and Gooseberries	Fruits are important summer foods for bears and birds.

Rosa spp.	Wild Rose	Larger birds and some mammals forage on the fruit.
Rubus spp.	Raspberries and Blackberries	Fruits are important summer foods for bears and birds.
Sambucus caerulea	Blue elderberry	Fruits are important food sources for many bird species.
Spiraea spp.	Spireas	Larger species in wetlands can provide important hiding cover for many birds and mammals.
Symphoricarpos spp.	Snowberry	Small shrub of limited utility as a food source, but provides low cover for smaller wildlife.
Vaccinium spp.	Blueberry, Huckleberry	Fruits are very important summer foods for bears and birds.

An example of a species for which old forest does not provide the full suite of habitats is the elk, an important game species and one of the target species for which habitat improvement is required in the Cooperative Agreement. Elk forage predominantly on grasses and low shrubs to obtain the bulk of their dietary requirements. Grass is easily shaded out by dense-canopied mature forest overstories, resulting in little food for elk. While elk may use mature forest as hiding cover to elude hunters and natural predators, they also require open areas nearby where grass cover is heavy, to obtain food. Transitioning over-dense forest stands to open, pine-dominated stands which meets several fire management goals, will also result in more grass cover within forest stands. In denser stands, creating openings would be beneficial to many other desirable birds and mammals, such as deer, turkey, quail, bluebirds, and many other passerine species; these wildlife prefer forest edges or open habitats.

As mentioned in a previous section, wildlife corridors are important habitat features, particularly for deer and elk, moving from winter to summer feeding areas through developed areas with in the MPR. Large predatory mammals such as bears, cougars, wolves, and bobcats, utilize such features as they traverse their large territories. The primary feature of such habitat is freedom from disturbance by humans. Maintenance of undisturbed habitat corridors through development areas will be considered during all development and recreation planning. Corridors will maintain a sufficient width and consistent pass-through capability to allow large mammals to move through the area while allowing access to adequate hiding cover and relief from human disturbance.

Providing a mix of mature forest stands (both open-canopied and closed-canopied), young forest stands, small brushy openings, wetlands, and meadows will provide a varied environment that will sustain a high density and diversity of wildlife species. This type of environment happens to also be the most desirable from the viewpoint of two other major considerations for this plan, that of (1) creating a mostly forested environment that is resistant to the rapid spread of wildfires, and (2) an environment that is aesthetically pleasing and conducive to human enjoyment.

5.1 FOREST HEALTH AND MANAGEMENT

In order to improve the quality of wildlife habitat in the Phase 1 through 3 and Bullfrog planning areas, an individual management strategy for each stand has been recommended (provided in Appendices A through D). For each, one or more eventual target vegetation communities were selected (e.g., meadow, shrubland). Considerations included the wide range of forest stand structures found on the MPR, the likelihood of success for the establishment of these communities, and aesthetics and wildfire management considerations related to whether the stand is in or near a developed area. Within these parameters, a set of management guidelines were created to maximize the value of each stand for wildlife.

The purpose of the recommended management guidelines is to provide for more structural complexity within each stand, while simultaneously taking into account the other stated goals of this Land Stewardship Plan. Techniques are aimed at diversifying the available habitats, which will increase the number and diversity of species that could inhabit the area throughout the year. This section provides a description of the purpose and method of implementation for the management practices recommended in Appendices A through D.

5.1.1 Thinning

As described in other sections, many forest stands now present in the MPR have been allowed to grow too dense. Thinning operations are key to managing for long-term goals as identified in this LSP. Figure 6 presents the stands in which an open forest canopy (pale green areas) would be most appropriate, given the proximity to developed areas, fire history, plant association, aspect, and ecology of the tree species present. KCT will be involved in management planning, prescription drafting, and approval of such work on all conservation easement lands.

In all forest thinning and restoration projects at Suncadia, it will be important to remember to provide key habitat features that benefit wildlife. These features can be recalled using the acronym “SLLOPPS”; **S**nags (dead standing trees), down **L**ogs (larger = better), **L**egacy trees (“wolfy”, irregular, old, and/or cavity-ridden trees), **O**penings (small or large and free of significant tree and shrub cover), **P**iles (of logs and branches built for wildlife cover), **P**atches (of dense living trees), and **S**hrub cover. Figures 7 and 8 illustrate some of these features in the depicted stands. Each of these features is discussed in more detail below and in other portions of this document. All large stands (> 10 acres) should provide all of these features following fire or restoration management actions.

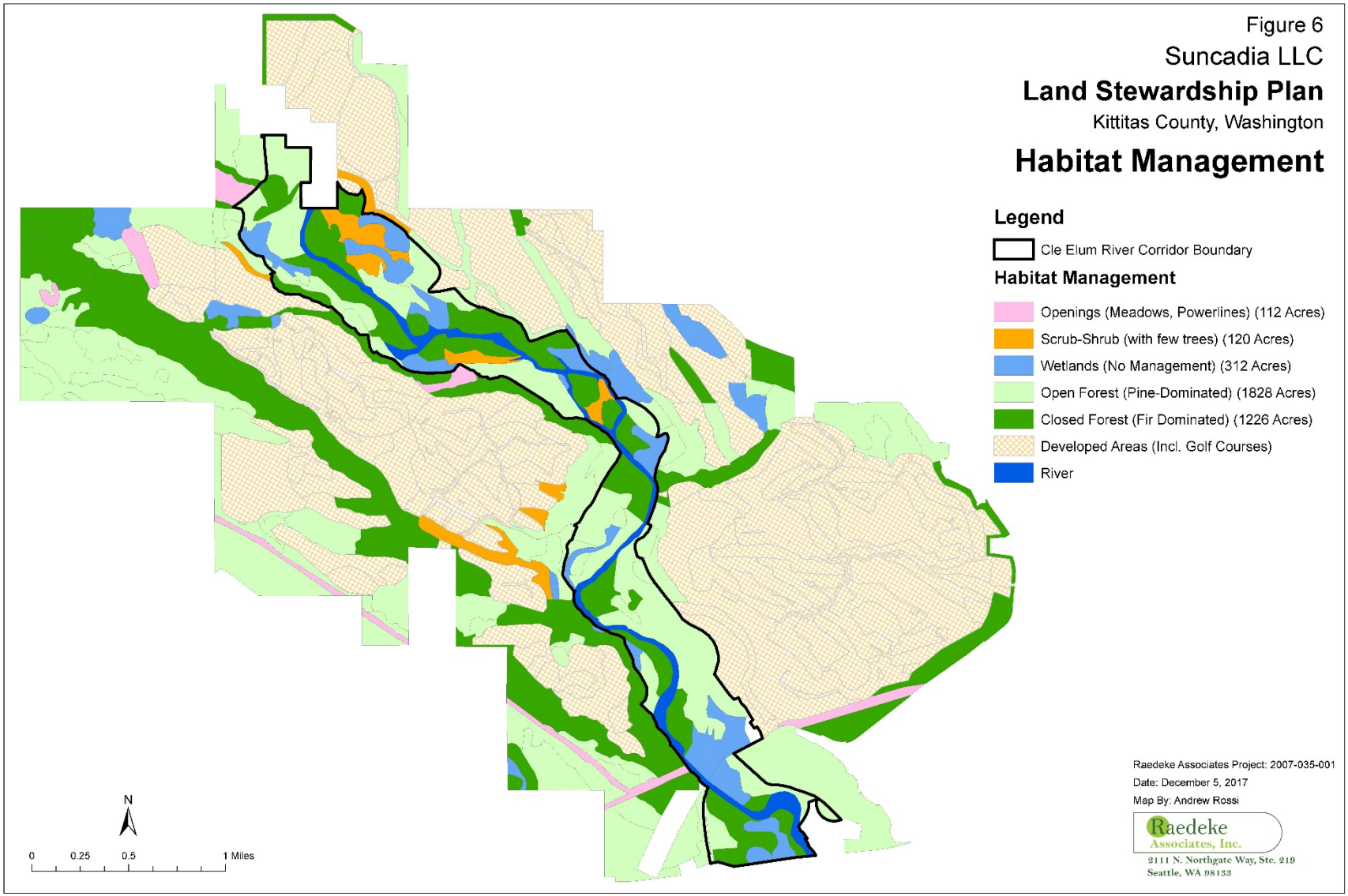
Figure 6
Suncadia LLC
Land Stewardship Plan
Kittitas County, Washington
Habitat Management
Legend
Cle Elum River Corridor Boundary
Habitat Management
Openings (Meadows, Powerlines) (112 Acres)
Scrub-Shrub (with few trees) (120 Acres)
Wetlands (No Management) (312 Acres)
Open Forest (Pine-Dominated) (1828 Acres)
Closed Forest (Fir Dominated) (1226 Acres)
Developed Areas (Incl. Golf Courses)
River
N
0 0.25 0.5 1 Miles
Raedeke Associates Project: 2007-035-001
Date: December 5, 2017
Map By: Andrew Rossi
Raedeke Associates, Inc.
2111 N. Northgate Way, Ste. 219
Seattle, WA 98133

Open-canopied Forests

Open-canopied forests were the most prevalent forest type in the Roslyn/Cle Elum area pre-European settlement. Open-canopied forests in this area are typified by coniferous trees (mostly Ponderosa pine and Douglas-fir) with canopies that marginally touch one-another. Rather than dictating tree density goals, it may be best to describe and illustrate a general condition and allow forest managers to reach this condition without strict adherence to trees/acre or square feet/acre guidelines. Trees targeted for thinning goals can be used for wildlife management objectives.

Figure 7 shows a model for the desired mature, open-canopied forest situation in the MPR. Most of the stand is open-canopied, though scattered small openings can be maintained, and small, dense patches of trees can be allowed to develop. Small openings allow grasses and herbs that cannot tolerate shade to develop, and encourage fruit and mast-producing shrubs to grow. Dense patches of trees can serve as roost sites for owls and bats, hiding cover for deer and other mammals, and provide sites with cool, shady conditions for all species during very hot weather. Care should be taken in these dense patches to not allow high accumulations of ladder fuels to develop.

Closed-canopied Forests

For stands that occur on north-facing and some east-facing slopes in the MPR (dark green areas in Figure 6), higher tree density will naturally occur due to conservation of moisture on these slopes that do not face the hot sun in summer. In these forests, a high diversity of conifers is currently present and should be maintained. Grand fir has a tendency to dominate these types of stands over time, as this species is shade-tolerant, and establishes in the shaded understory quite readily. In the absence of occasional low-intensity ground fires (which historically killed grand fir seedlings), thinning operations to remove some of the grand fir and to open up small openings in the stands will also be needed.

Tree species composition and density in closed-canopied forests are typified by coniferous trees (Douglas-fir, grand fir, Ponderosa pine, lodgepole pine, western white pine, western hemlock, western larch, and western red cedar) with canopies that intertwine over most of the stand. This does not mean that small gaps in the forest cannot occur. In fact, such gaps are beneficial to wildlife by producing small patches of grasses and mast- and berry-producing shrubs. Thinning will be needed in closed-canopied stands to produce and maintain small openings, as well as to create wildlife trees, large down logs, and brush piles, and to keep ladder fuels and ground fuels from becoming overly dense (see Section 5.2). Figure 8 provides a simulated aerial view of a desired mature, closed-canopied forest patch. Note the small openings, wildlife habitat features such as wildlife trees and down wood, and tree diversity. The thinning interval is dictated by current conditions and desired future conditions. Additional thinning actions will be needed over time as forest stands mature, however beyond 20 years it is difficult to predict which stands will need thinning actions. By using the desired future conditions shown in Figures 7 and 8, forest managers in the future should be able to manage for these conditions along with a program of annual monitoring of forest stand development.

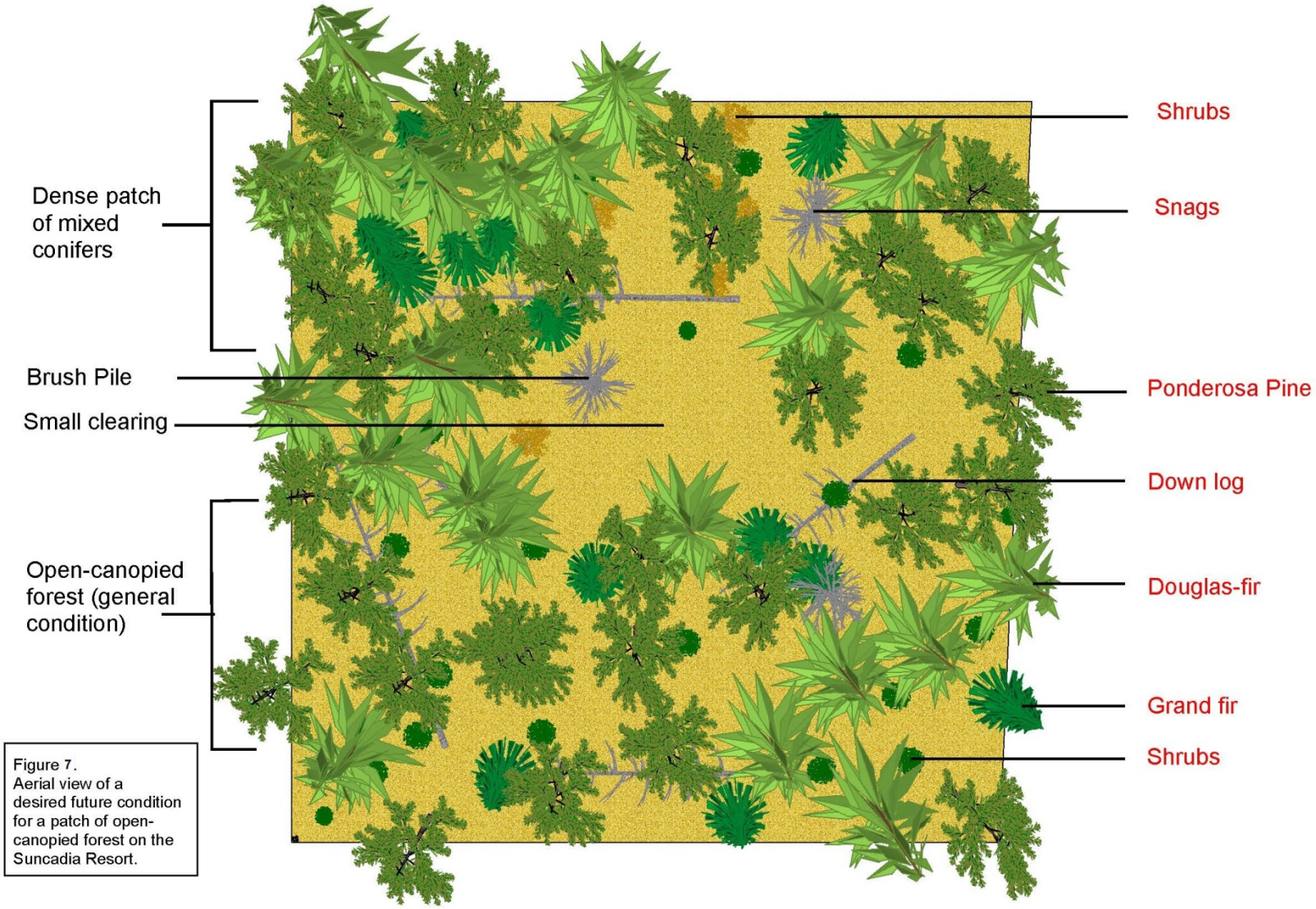

Figure 7.
Aerial view of a desired future condition for a patch of open-canopied forest on the Suncadia Resort.

5.1.2 Wildlife Trees

A legacy of past timber management on the Suncadia property is the general lack of (particularly large) standing dead or partly dead standing trees (a.k.a. snags) scattered over the landscape. Dead standing trees provide a food source (e.g., wood-boring beetles and ants) for woodpeckers and other birds and nest and den sites for a host of wildlife species as diverse as flying squirrels, bats, chickadees, nuthatches, bluebirds, and even ladybugs.

Commercial foresters often view a dead tree as simply wasted wood and blocked growing space for more trees, but wildlife trees are among the most important sources of food, cover, and home sites for many species of wildlife, particularly for species that have become rare in highly managed forest landscapes. Wildlife trees have several natural decay stages, and each is used by a different suite of wildlife. Woodpeckers can carve a nest hole in a hard wildlife tree, but chickadees and nuthatches need a softer, more decayed dead tree in which to excavate. Insects and rodents may tunnel into a dead tree during its last stages of decay, when only a pile of soft wood remains.

Woodpeckers are primary cavity excavators, meaning that they create cavities for nesting and roosting that are subsequently used by other birds (such as wrens, bluebirds, nuthatches, and chickadees) and mammals (bats and flying squirrels). Wildlife trees may also contain natural cavities that can be used by larger birds (such as owls and even some waterfowl) and mammals (such as martens, bats, and porcupines) for nesting, roosting, and denning sites. Even the loose bark found on wildlife trees provides nest sites for brown creepers, roost sites for bats, and overwintering sites for many moths and butterflies.

As a rule of thumb, a large wildlife tree (created from a mature or old-growth forest tree) is more valuable to more species of wildlife than a small wildlife tree. In young forest stands produced following a clear-cut harvest, large wildlife trees are often not present, and creation of such a wildlife tree cannot occur for many decades due to the lack of large trees. In other stands, it may be necessary to create wildlife trees from living trees to speed up the wildlife tree recruitment process. This process has failed to occur "naturally" for many decades, partly due to exclusion of fire and other disturbances.

For wildlife tree creation, selection of a living tree that is over 12 inches in diameter is most appropriate. Target those trees that are already diseased or severely deformed, or ones that are crowding out other healthy trees. A goal of 2 wildlife trees/acre is recommended by the WDFW in commercial forests; however, an average of 6/acre have been counted in natural pine stands, and could easily be sustained in Suncadia forest stands without compromising aesthetics. Useful references for wildlife tree creation are Bull and Partridge (1986; Link1999;www.dnr.wa.gov/htdocs/rp/stewardship/bfs /WESTERN/tipsforcreatingwildlife trees.html).).

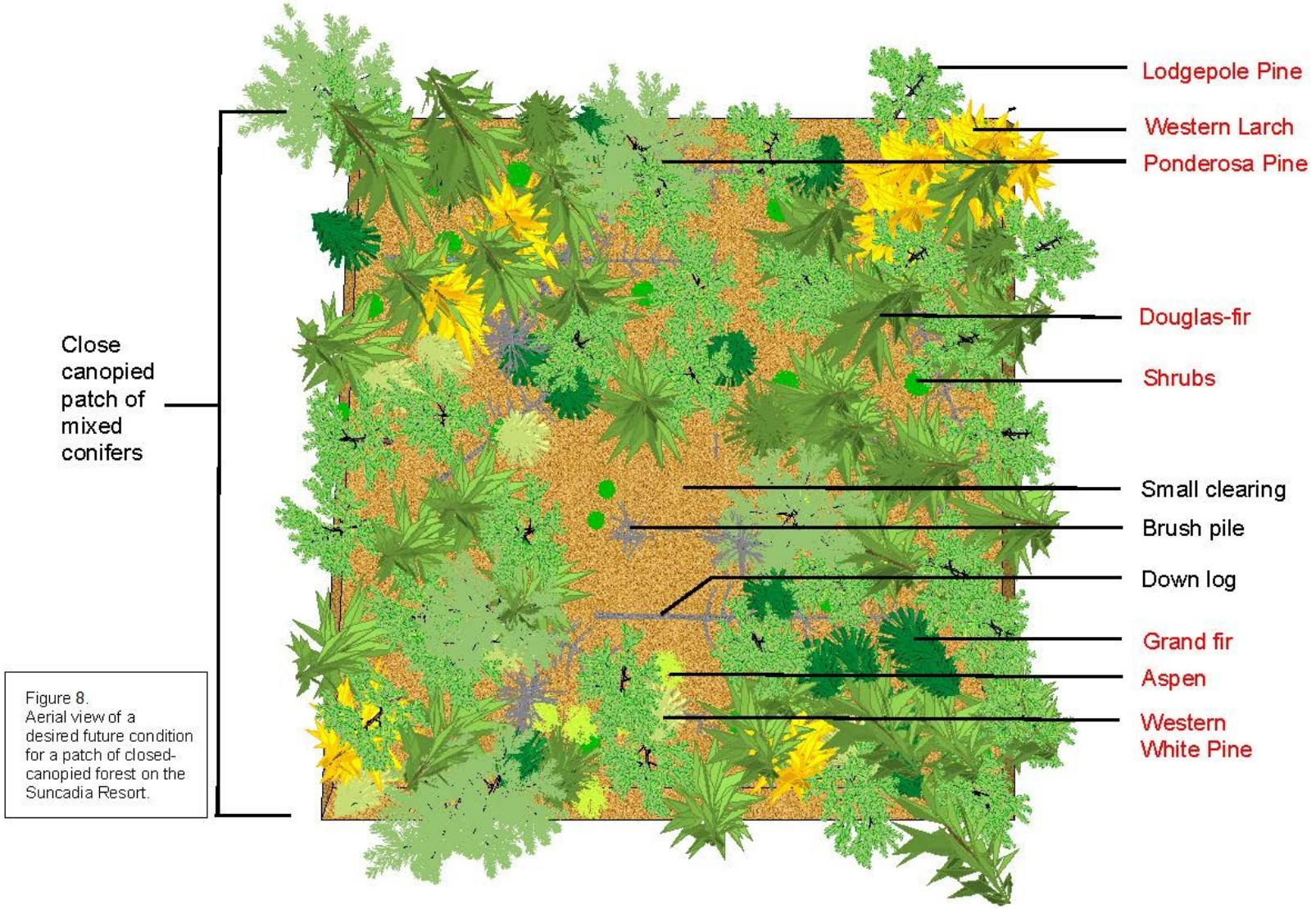

Figure 8.
Aerial view of a desired future condition for a patch of closed-canopied forest on the Suncadia Resort.

5.1.3 Down Wood

Other important wildlife habitat features missing from much of the current and former commercial forestlands in Washington are large down logs. Because most trees of any size are removed from forests during harvests, few large down logs remain in second-growth or third-growth stands. Large down logs provide cover and denning sites for a number of small mammals (such as chipmunks, voles, and deer mice) and cover for several snake and lizard species. As with wildlife trees, a larger down log is usually better. Larger logs can provide den sites for mammals up to the size of black bears.

Large logs can also provide a moist substrate for the regeneration of future forest trees. Such "nurse" logs can be important substrates for regeneration of several forest tree species, such as western red cedar.

Large down logs, similar to wildlife trees, progress through recognizable stages of decay. When the decay status changes, the wildlife assemblage that use the log also changes. Logs in the early stages of decay provide lookout sites and movement or escape cover for ground squirrels, chipmunks, and other rodents. Ruffed grouse use them as a breeding display platform, and western fence lizards and some species of snake use them to sunbathe. Raccoons, skunks, and foxes use hollow logs as dens. Woodpeckers obtain insects from logs in all stages.

As a log begins to settle into the ground, small mammals such as shrews search for food, such as beetles and other insects, in the loose bark. The contact point with the ground creates a cool, moist environment, preferred by reptiles and voles during hot weather. When a log becomes soft enough, shrews and small rodents dig burrows and tunnels into it for cover and den sites. These dens are subsequently used by toads, lizards, and gopher snakes. Finally, the log becomes soft and powdery, providing a moist microclimate for insects to tunnel in (though some insects are able to bore into the log prior to this stage of decay). Insect-eating animals tear apart logs at this stage to find food. Eventually, the remains of the log are further broken down by fungi and bacteria and incorporated into the soil, enhancing its nutrient content and productivity.

Down wood, in the form of large logs on the ground, can be easy to create if stands are found to be deficient in these features. If the trees in a stand are overstocked, thinning

operations become a prime opportunity to create large down logs from larger trees, possibly from other stands, and brush piles from smaller downed wood.

If thinning is done over time, at a rate of only a few trees per year, most thinned trees can be left as down wood, preferably as large logs or piles of smaller dead wood. More intensive thinning operations may require chipping or removal of a portion of the thinned trees. Small trees (between 3 and 12 inches diameter) thinned in young stands (10-25 years old) may be chipped, removed from the stand, or assembled into small brush piles in forest clearings. Fine dead tree branches and twigs less than 3 inches in diameter pose an increased fire hazard, which in many areas outweighs their importance as habitat for wildlife. Woody materials of this size should be chipped or removed from a given stand. It may also be important to educate resort residents and visitors that properly created brush piles need not present a fire hazard (see Link 1999).

5.2 WETLANDS, STREAMS, AND SPECIAL HABITATS

Wetlands provide essential functions of stormwater attenuation, sediment and pollutant trapping, and provide habitat for fish and wildlife. Streams collect surface water runoff, feed river systems, and provide essential habitat for a number of important fish and wildlife species. The entire Cle Elum River corridor is considered a special habitat due to its abundance of wetlands and its value to migrating salmon. Wetlands and streams on Suncadia will be protected, with wooded buffers, to ensure that their critical landscape functions and habitat values will be preserved. Encroachments by roads and trails into wetland buffers are mitigated according to county, state, and federal guidelines on an on-going basis on the property.

Outside of the Cle Elum River corridor, wetlands are generally small in size (a few acres) and support habitats that are relatively rare on the landscape. Features such as aspen groves, cottonwood stands, and scrub-shrub wetlands only exist in areas of high water tables. These are important for preservation as they are preferred habitat for a number of birds, mammals, and amphibians. These special habitats also provide some visual relief from the dominant coniferous forests, and bright fall leaf color only enhances the aesthetic qualities of the property at that time of year.

Wetlands and streams outside of the river corridor have been identified at Suncadia and a no-touch buffer of 20 and 25 ft., respectively, has been established around them. Wetland and stream buffers appear generally as separate management stands in Figure 2. Some past timber harvest has occurred in some wetland and stream buffers. Natural regeneration is occurring and should be allowed to proceed. In general, no special restoration efforts in wetland or stream buffers are recommended. Wetland buffer stewardship management will be in accordance and consistent with the plant association in terms of species composition and density.

Because the Suncadia property does contain a few stands with still-healthy western white pines (*Pinus monticola*), these trees should not be targeted for wildlife tree creation or thinning whenever possible. Some wild western white pine trees are resistant to white

pine blister rust, a deadly disease for this tree and one that can wipe out entire stands. If potentially resistant (live) trees are present, they should be retained for the provision of a seed source for future healthy stands.

Similarly, aspen (*Populus tremuloides*) stands are listed by the State of Washington as a special habitat that is rare across the landscape over most of the state. Aspen stands on the MPR will be treated similarly to wetlands and should remain undisturbed unless for some reason a lack of management were to threaten the existence of the stand (e.g., nearby coniferous forest growth shades out the aspen stand over time).

5.3 HUMAN/WILDLIFE INTERACTIONS

Whenever people move into the urban/wildland interface, the possibility of encounters with wildlife will likely increase. Encounters can be relatively benign and provide interest to rural property owners, but some wildlife may be viewed as problematic to property owners. Animals may depredate golf courses, parks, and garden plantings, injure or kill pets, or damage structures. Avoiding conflicts with wildlife is paramount and actions taken by property owners and Suncadia management to prevent such encounters should be implemented. The Washington Department of Fish and Wildlife has an excellent series of fact sheets entitled "Living with Washington's Wildlife". Topics span the range from preventing damage to buildings from woodpeckers, keeping deer away from shrubs and gardens, to avoiding injury from large predators such as coyotes, bobcats, cougars or bears, and are available at: http://wdfw.wa.gov/wlm/living/index.htm. Eventual techniques for dealing with any problem animals should first be approved by the Kittitas Conservation Trust and Suncadia, and coordinated with local WDFW representatives.

5.3.1 General Guidelines

Some general principles in the above wildlife information series, and those in Suncadia's own "Living with our Wildlife Neighbors" pamphlet are worth reiteration here, to emphasize actions for avoiding undesirable encounters with wildlife. Please refer to current governing documents and Design Guidelines list on the community associations website. www.suncadiacommunityassociations.org

Examples of successfully dealing with curious wildlife include: Feed pets indoors or move pet food and water containers indoors every night. Keep other potential food sources clean, such as barbecues, and clean up rotting fruit from fruit trees. Keep garbage cans locked and/or lids on tight. Keep pets indoors as much as possible.

5.3.2 Elk Management

Of all wildlife present on the Suncadia property, elk are probably the species most likely to come in conflict with humans on the resort. Elk can quickly habituate to human activities, even within residential developments. While elk habitat will be improved on portions of the property, elk may become a nuisance species on other portions of the resort (e.g., golf courses). The goal of the elk habitat management program will be to maintain a viable elk population on the site that will be an asset to the resort, while also presenting minimal conflict. The key to achieving this objective will be to provide attractive foraging habitat and hiding cover to replace habitats lost, and to make developed areas where elk are not welcome as unattractive to elk as possible.

The elk using the Suncadia property are considered to be a subherd of the larger Colockum herd (WDFW 1997). The ecology of the Colockum elk population is described by Bracken and Musser (1993). This herd has varied in numbers from 4,500 to 6,000 in the late 1900s, and ranges over 1,600 square-miles between the Columbia River to the east and the Cascade crest to the west, and U.S. Highway 2 to the north and I-90 to the south (WDFW 1997).

Elk in the MRP area were radio-tagged and tracked between 1995 and 1998 by Plum Creek Timber Company. This subherd, which number from in the low 100s annually, winters along the Cle Elum and Yakima Rivers, and east to the Teanaway River, including a portion of Suncadia. While a small number of elk use portions of Suncadia all year, most migrate to higher elevation areas to the north and west for the spring and summer. Elk that left Suncadia area in summer, spent time in each of 3 areas, south of Lake Kachess, north of lake Cle Elum in the Cooper River drainage, and in the upper Teanaway River drainage. Elk generally did not cross south of I-90.

Kittitas County Condition of Approval B-29(c) required that the amendment for managed open space considers the potential for achieving a goal of no net loss of elk forage habitat. Prescriptions for elk forage enhancement would include the following:

- Creation of permanent forage areas through small (< 80 acres) group-selection cuts or regeneration cuts, followed by scarification, slash burning, and planting of preferred native herbaceous and shrub forage and browse species.
- Pre-commercial and commercial thinning of regenerating forests to stimulate understory development.
- Partial-cuts to open forest canopy to stimulate understory development
- Periodic fertilization to increase forage value
- Forage openings should be screened from active open roads by approximately 100 ft. of forest vegetation. Forage is most readily used by elk if security cover is available adjacent to the forage area

As discussed in a previous section, management that allows for more open mature stands of pine with shrub and grass cover for food will benefit elk. Elk have recently been fed in severe winters on or near the MPR property to ensure a healthy herd is present.

6.0 VISUAL LANDSCAPE MANAGEMENT

A final goal of land stewardship at Suncadia is "*to provide an aesthetically pleasing landscape"* in a forest setting. The forested areas are intended to buffer sensitive wildlife habitat from developed areas. Therefore, forest stands serve multiple purposes, and maintenance of the forest for visual quality must be balanced with the need to provide wildlife habitat, to protect the health of the trees, and to keep the resort resistant to wildfire.

Fortunately, these goals should not be in conflict in most situations. Allowing a wide range of forest structure to develop over most of the property, while maintaining proper tree spacing and providing small clearings and occasional thickets, should provide a varied and visually attractive landscape. This type of forest is ideal for fuels management. Valuable wildlife habitat in a forested setting necessitates some variety of structural stages and tree densities. The method of variable density thinning ("skips and gaps") and allowing important wildlife structures to develop (such as wildlife trees and down wood, as well as dense patches of trees and shrubby areas) will provide this diversity in most settings and adds visual interest for the human visitor as well.

Several additional considerations for visual landscape and recreation management in open space areas will be important when considering aesthetics, and are discussed below:

6.1 VIEW CORRIDOR MANAGEMENT

[NOTE: View corridor management recommendations do not pertain to the Cle Elum River Corridor or other natural open space areas.]

In Figure 6, areas shown as shrub habitat correspond with view corridors that initial lot owners may wish to preserve. As young forest stands in the open space areas develop into mature forest, shrub-dominated habitats will decline on the property. A number of wildlife, but several bird species in particular, depend on and prefer open shrub habitats for nesting and feeding (see section 2.4.1). Deer and elk populations may suffer from lack of forage as well. By utilizing view corridors as areas to maintain a shrub-dominated community, wildlife diversity will be enhanced and property values can be protected.

Although shrubs of various species (e.g., common snowberry, baldhip rose, blue elderberry, serviceberry, redstem ceanothus, beaked hazelnut, black hawthorn, pin cherry, and various currants) will dominate, occasional individual Ponderosa pines or Douglas-firs should be allowed (1-2 per acre) to form an open-grown crown within the shrub stands. This will add visual appeal without shading too much of the habitat or obscuring views. The shrubs listed above also provide nuts, seeds, berries, and forage for other species of wildlife, particularly deer, elk, and various small mammals as well as many bird species. Snowbrush, although a native shrub, should be managed due to its flammability and its tendency to develop into extensive single-species stands, although not totally eliminated from the property.

6.2 MAINTAINING VISUAL APPEAL

The forests of Suncadia will be maintained as a mix of forest structures that provides better wildlife habitat than is currently present on the site, to mitigate for habitat altered by development. To address concerns of visual appeal, foreground views of forests from residential and community sites on the property may be managed in a different fashion than background views. It must be reiterated, however, that no property owners will be allowed to manage for view corridors in adjacent conservation easement lands. This includes influence on thinning operations as they occur adjacent to properties.

Foreground views of dry forests dominated by Ponderosa pine have been extensively studied, and positive visual character is associated with (1) large trees, (2) lack of dead and down debris, and (3) green understories. A green overstory and green understory visually connected by a line of yellow-brown pine trunks defines a desirable visual condition for these dry forests. Creating diversity by having large Douglas-firs mixed with the pine and an occasional small Douglas-fir or grand fir and some light shrub cover over a mostly grass-dominated understory is considered desirable. This general condition could apply to both the Douglas-fir and Ponderosa Pine series shown in Figure 3. In the Grand Fir zone (generally on cool north-facing slopes), tree density will tend to be higher naturally, and favoring a mix of species will provide a visually complex and interesting forest also beneficial to wildlife. Species now present in this zone include grand fir, Douglas-fir, Ponderosa pine, lodgepole pine, western white pine, western hemlock, western larch, and western red cedar.

Background views on the property include high ridges that can be viewed from vantage points around the Suncadia resort. Any straight-line harvest boundaries from past forest management should be feathered to break up the distinct boundary line. The trunks of larger trees removed during thinning should be left as down logs in the stand of origin or moved to nearby stands and scattered evenly, yet randomly, over the site. All over-stocked stands should eventually be thinned to fire-resistant levels depending on vegetation zone.

6.3 NOXIOUS WEED CONTROL

Noxious weeds are a major problem in Washington and throughout the U.S., overtaking pasturelands valuable for livestock, invading native wildlife habitat, and sometimes eliminating native plant species. Costs to agriculture can be staggering when considering the loss of productive lands. Noxious weeds fall under the jurisdiction of the State and County Noxious Weed Boards, and are ordered into 3 classes:

- Class A: Eradication of existing and new infestations are required by law
- Class B: Containment of already abundant weeds to prevent infestation of new areas

- Class C: Control already widespread species if desired by the county to protect agriculture

During field reconnaissance, several noxious weeds were identified on the resort property, all of which were listed as either Class B or Class C by Washington State Noxious Weed Board and selected for control by the Kittitas County Noxious Weed Board. The state and county weed lists change each year, and Suncadia managers will review these lists as they are published and update management plans.

Suncadia Community Council has an established noxious weed control program, aimed primarily at diffuse and spotted knapweeds, the major problem species on the property. This plan is a specific requirement of several operating agreements and has been implemented on the property since 1997. Mechanical removal, spraying with approved herbicides, and application of seed-head weevils (an approved introduced predator) have been and continue to be used against knapweeds. Knapweed is a particularly problematic introduced weed because it spreads quickly, competes with native grasses in openings, compromising deer and elk forage quality, and is unpleasant to walk through in late summer and fall when the prickly seed heads are present.

Knapweeds and other noxious weeds often become established in areas where native vegetation is cleared along roads and around buildings. Re-seeding disturbed sites with native grasses becomes important in minimizing the establishment of weeds in these areas. Balancing seed cost with the observed abundance of native grasses, the following native seed mix is preferred on Suncadia property

50% Idaho Fescue	*(Festuca idahoensis)*
50% Sandberg's Bluegrass	*(Poa secunda)*

These species are native to the property and appear to be well-adapted to many site conditions. Seed costs are now relatively low for this mix (source: Landmark Native Seeds, Spokane, Washington). These species will also tolerate some shading by native conifers. Seed from local sources is more likely to grow best on the site, depending on availability.

A wildflower seed mix should be added in minor quantities to the above grass seed mix to create a more diverse grass/wildflower area more conducive to pollinators. A recommended seed mix would include several of the following native species currently found on the property:

(white)	arrowleaf balsamroot	(*Balsamorhiza sagittata*)
(white)	sulphur lupine	(*Lupinus sulphureus*)
(red)	wild bergamot	(*Monarda fistulosa*)
(blue)	wild geranium	(*Geranium viscosissimum*)
(blue)	blue flax	(*Linum perenne lewisii*)
(yellow)	broadleaf arnica	(*Arnica latifolia*)

6.4 TRAIL SYSTEM CONSIDERATIONS

Trail system analyses were restricted to the anticipated effects of the trail system on wildlife and their habitats and effects on fire safety. The current Suncadia Path and Trail Map (Figure 9) and the master plan map was reviewed for this section.

6.4.1 Paved Trails

In general, the vast majority of the proposed paved trail system occurs adjacent to roads and golf courses within the major development areas. In Section 11 the paved trail follows the proposed northwest access road, thereby representing only minor additional disturbance of wildlife. Because most traffic on the paved trails will be pedestrians and bicyclists, disturbance of wildlife could occur as people stop to view large animals such as deer and elk. These species easily and rapidly become accustomed to humans as long as no threatening behavior occurs (such as hunting or chasing).

Mechanized traffic will be restricted to maintenance, security, and emergency vehicles and ski-track setting vehicles in winter. This level of traffic would probably not be noticed by wildlife as anything different from regular access road traffic, therefore, the paved trails, while allowing for some additional pedestrian and bicycle traffic, are unlikely to cause major additional disturbance to wildlife.

6.4.2 Equestrian Trails

Likewise, the equestrian trail, while not occurring adjacent to major roads, does occur on powerline right-of-ways and other areas that already sustain a low level of human use for maintenance and other activities required to keep the areas clear of trees and brush. The only exception is in the far west of the property in Section 15. Here the equestrian trail follows a major logging access road, and one that will be maintained as a drivable surface because of its routing through adjacent U.S. Forest Service land. Horses and riders are typically tolerated by most wildlife except for large predators such as bears, cougars, bobcats, and coyotes. Again, unless hunting or chasing is aimed at wildlife, including deer and elk, most of these animals will quickly become accustomed to the trails and horses. Smaller wildlife, such as smaller predatory mammals, hares, rodents, and birds, will tolerate horse and rider traffic better than humans on foot in most cases.

6.4.3 Unpaved and Nature Trails

These trail types are the trails most likely to produce additional disturbance of wildlife beyond the normal operations of the resort. Because these trails will most likely be used only on an irregular basis, they will represent a somewhat unpredictable disturbance source to wildlife. Most species of wildlife (birds and mammals) from the size of hares or quail and larger, regularly flush from approaching humans. While many of the unpaved trails parallel road systems, in a few areas they cut through open space that would otherwise provide refuge habitat for wildlife. The occasional trail user in these areas will likely disturb larger wildlife in the vicinity of the trail. While this provides some additional disturbance, use is expected to be light. Lacking threatening behaviors by

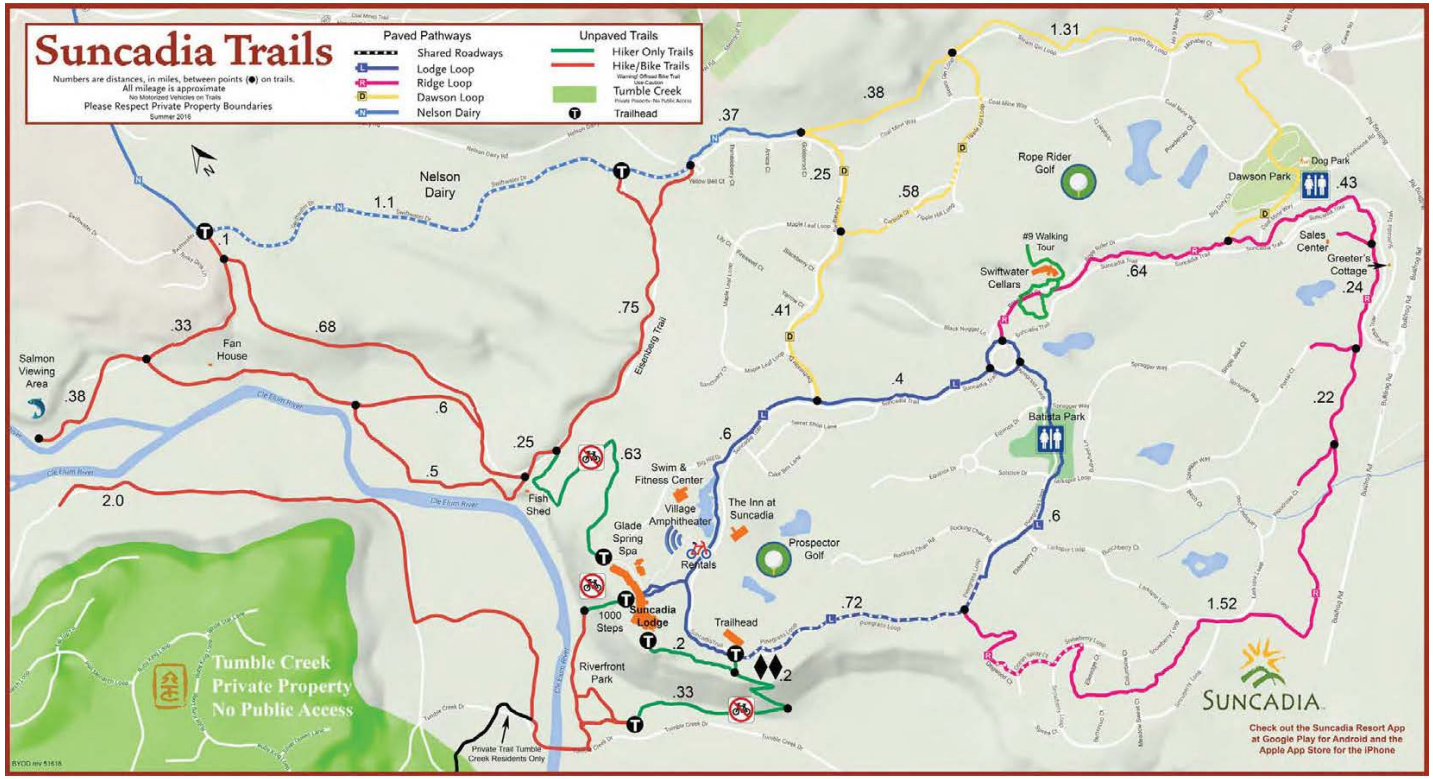

Figure 9. Current Suncadia trail system (2017).

people (such as hunting and chasing), wildlife will learn to avoid roosting or resting near these trails and should inhabit open space habitat at levels close to that of pristine habitat.

Overall, the proposed placement of trails at Suncadia, and the expected levels of use in remote regions where wildlife may congregate should work together to produce little additional disturbance of wildlife. Because of the eventual maturation of forest stands, meadow maintenance, thinning, and other activities, benefits to wildlife should increase rather than decrease on the resort, particularly with respect to its former status as industrial forest land.

Signage at major trailheads outlining respectful practices toward wildlife and habitat would discourage potentially threatening activities. Topics will include:

- No hunting, smoking, or campfires
- **NO MOTORIZED VECHILES, STRICTLY ENFORCED, VIOLATORS WILL BE PROCESCUTED.**
- Stay on the trail (no overland hiking or cutting between trails)
- Avoid loud talking and other noise that could disturb resting wildlife
- Do not chase or touch wildlife, particularly young animals such as deer fawns, which are often intentionally left alone for long periods while the doe is foraging
- Do not overturn dead logs or disturb brush piles; both provide homes for wildlife
- Do not pick wildflowers or collect plants
- Be respectful of black bears and cougars, do not run from them, hold arms high, talk in a loud voice, back away slowly if necessary

6.5 INTERPRETIVE OPPORTUNITIES

Because of the resort's location in a natural setting, with forests, rivers, and meadows in profusion, and a fascinating history of both mining, logging, and water management for agriculture, interpretive opportunities along trails and at overlooks are easy to find on the property.

Below are suggestions for interpretive topics to be used in conjunction with the trail system and planned activities on the resort:

- Early Native Americans – ethnography, dwellings, traditions, plant and wildlife use, local tribes today
- Mining History – original pioneers, coal deposits, how coal is formed, mining techniques, equipment displays, city and town development

- Growth of Agriculture – fruit and vegetable industry, dam building, aqueducts, fishery mitigation, instream flow management
- Logging History – original forests, early logging techniques, modern logging techniques, uses of major forest trees
- Geology and Weather – Plate tectonics and Cascades uplift, volcanic vs. metamorphic rocks, river dynamics, rain shadow weather
- Plants – major forest tree species and their biology, fruit-producing shrubs, common wildflowers, invasive plant control and management, role of fire
- Wildlife – large wildlife species and their biology, birding opportunities, finding amphibians and reptiles, butterfly guide, fish populations and biology, wildlife in winter

Paying attention to the most frequently asked questions by trail users and lodge residents will also generate additional interpretation topics. Placing interpretive signs along well-used trails and lookout points will ensure the interpretive efforts are successful.

7.0 ADAPTIVE MANAGEMENT AND MONITORING

In this document, recommendations have mostly avoided dictating exact quantities of wildlife habitat features (wildlife trees, down logs, etc.), because these features will develop naturally as time goes on, and some stands (e.g., regeneration or clearcut harvest units) may be incapable of providing large wildlife trees or large down wood for many decades. Likewise, too detailed thinning prescriptions are avoided, which will vary as trees mature and forest structure is altered. Managing a forest for wildlife benefit is part science, but a large part art. Course corrections, will occur along the way as fuels management issues arise, if disease outbreaks occur, and as thinning operations proceed. These course changes are acceptable and indeed, encouraged, as part of a proper adaptive management strategy.

Some monitoring of the open space lands should occur, however. Photo points have been provided (UTM coordinates and direction photo was taken), one per stand, which show the location that photos were taken in 2007-2008 and are provided in Appendices A through D. Reproducing these photos, over a regular period of years into the future, will help monitor progress of habitat, fuels, and visual aesthetics as they are managed over time. No substitute for on-the-ground monitoring exists, however. Therefore, regular field monitoring visits by KCT is required to monitor the progress of thinning operations, fuels management, and habitat structure development on the resort. Any problems with goal achievement by Suncadia will be discussed during monthly meetings and a cooperative plan for corrective actions, if needed, will be developed. Periodic review of fuels management issues, recreation trails, and wildlife habitat by local or regional experts on a as needed basis would offer the best of current scientific knowledge, and provide a model of resort management for similar properties in the Pacific Northwest.

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9.0 Glossary of Terms

Anthropogenic	An effect or disturbance caused or produced by humans.
Average basal area	The total cross-sectional area of all stems in an acre stand of trees as measured at breast height.
Basal area	Cross sectional area of a tree bole measured at breast height.
Biodiversity	The variety of life in a particular habitat or ecosystem.
Biomass	Collective term for organic matter of all plant types. Much of it is often used for fuel.
Broadleaf	A broad-leaved, or broadleaf tree is a tree which has flat leaves and produces seeds inside of fruits.
Btk	*Bacillus thuringiensis kurstaki* var. A naturally occurring bacterium found in soils that is toxic to most pupating insect species.
Canopy	Refers to the uppermost coverage of leaves in a stand of trees.
Climax community	Term for a community of trees which, through the process of species succession over time, has reached a steady state.
Climax species	A tree or shrub species which will dominate the site in the absence of disturbance,
Colonization	Biological process by which a species spreads to new areas.
Coniferous	Cone bearing
Crown	Term for leaves and branches at the top of a tree.
Crown fire	A forest fire in the upper reaches of trees that advances from crown to crown, often well in advance of a fire on the ground.
DBH	Diameter at Breast Height. Diameter of a tree measured at approximately 4.5 feet above ground level.
Deciduous	Term for a group of trees that lose all their leaves every year.
Ecology	The study of the complex interactive relationships between life forms in an environment.
Ecosystem	All plant and animal life living in a particular habitat and, to at least some extent, are dependent upon each other.

Egg gallery	Small tunnel-like excavations under the tree bark in which bark beetles have laid a mass of eggs. Excavation patterns are characteristic of each beetle species.
Ephemeral	A short life cycle, or appearing only briefly.
Fiber	Basic cellulose elements that are extracted from trees and vascular plants that are used to make paper and a host of other materials.
Forb	Any non-woody plant other than grass.
Glacial till	Unsorted glacial sediment. Till is derived from the erosion and entrainment of material by the movement of ice in a glacier
Habitat	Situation or environment in which a particular plant or animal lives.
Habituate	To become accustomed to an event or situation, such as human presence.
Herbaceous layer	Layer of low-growing plants composed of all vascular species that are one meter (m) or less in height.
Herbivore	Animal that feeds on plants.
Holistic	Encompassing the whole of a thing, and not just a part.
Indigenous	Native, occurring naturally in a particular place.
Insectivore	One whose diet is mainly insects.
Interior open space	Open space within development tracts that is managed in a similar fashion to managed open space.
KCT	Kittitas Conservation Trust
Ladder fuel	Low dry branches on a tree trunk or shrubs that support the progression of fire into the upper reaches or crown of a tree.
Legacy trees	Older trees, near maximum size and age, that have been spared during harvest or have survived stand-replacing natural disturbances.
Managed open space	Open space that will be managed to maintain a healthy, fire resistant, attractive forest and other habitats that promote a diversity of wildlife.
Mesic	Containing a moderate amount of moisture.
Microclimate	Localized weather conditions.
Monoculture	Stand of plants comprised of a single species, or nearly so.

Mosaic	An assemblage of several different types of plants or habitat types contained within a given area.
MPB	Mountain pine beetle.
MPR	Master Planned Resort.
Native species	Plant or animal indigenous to a given region or ecosystem if its presence in that region is the result of only natural processes.
Natural open space	Open space that will be managed to protect and enhance fish and wildlife habitat with compatible recreation allowed only during certain times of the year when wildlife are capable of tolerating limited human disturbance.
NRCS	Natural Resource Conservation Service
Nurse log	A downed and decaying log that serves as a base for support and nutrients for new tree growth.
Overstory	Upper level of foliage in a stand of trees.
Parasitic	Describes a relationship where an organism lives off or in another organism, obtaining nourishment and protection while offering no benefit in return.
Passerine	A passerine is any bird of the order Passeriformes. A notable feature of passerines compared to other orders of Aves is the arrangement of their toes, three pointing forward and one back, which facilitates perching.
Pathogen	A bacterium, virus, or other microorganism that can cause disease.
Perimeter open space	Open space within 100 ft. of the MPR perimeter and managed in a fashion similar to managed open space.
Pheromone	A chemical substance produced and released into the environment by an animal, especially a mammal or an insect, generally used to identify, attract, or repel others of its species.
Plant associations	A grouping of plant species, or a plant community, that recurs across the landscape and may be used as indicators of environmental conditions such as temperature, moisture, light, etc.
Pupate	In insects, a term for the metamorphosis from larval form to adult form.
Raptor	A bird of prey, including eagles, ospreys, hawks, falcons, and owls.

Refugium	An area in which a population of organisms can survive through a period of unfavorable conditions.
Riparian	A riparian zone is the land directly adjacent to a river or stream in which its physical and biological properties are affected by water.
Root rot	The fungus caused decay of a tree's root structure.
Seral stage	A phase in the sequential development of a climax community.
Shrub	A shrub or bush is a small to medium-sized woody plant. It is distinguished from a tree by its multiple stems and shorter height, usually under 20 ft. tall.
Snag	Refers to a standing, dead or dying tree, often missing a top or most of the smaller branches.
Stand density	A measure of the stocking of a stand of trees based on the number of trees per unit area and the dbh of the tree of average basal area.
Symbiotic relationship	Any type of a close and long term biological interaction between two different species.
Tectonic plate	Portions of the earth's surface that move in relation to each other.
Torching fire	A term for when a single or small group of trees go up in flames, creating the possibility of a crown fire in adjacent stands of trees.
Understory	A layer of vegetation beneath the main canopy of a forest.
UTM	Universal Transverse Mercator coordinate system. A newer method to identify the location of a site, similar to Latitude and Longitude.
Vascular	Plant tissues (xylem and phloem) that conduct water, sap, and nutrients in flowering plants, ferns, and their relatives.
Vector	A vector is an organism that does not cause disease itself but which spreads infection by conveying pathogens from one host to another.
WDFW	Washington Department of Fish and Wildlife
Weevil	A small vegetarian beetle with an elongated snout, the larvae of which typically develop inside seeds, stems, or other plant parts.
Wind Throw	Term used to describe downed trees that have been uprooted by winds.
WPB	Western pine beetle.

9.0 TABLES

Table 2. List of plants mentioned in the Land Stewardship Plan and the scientific name.

COMMON NAME	SCIENTIFIC NAME
American vetch	*Vicia Americana*
Annual bluegrass	*Poa annua*
Arnica	*Arnica spp.*
Arrowleaf balsamroot	*Balsamorhiza sagittata*
Arrowleaf coltsfoot	*Petasites sagittata*
Asters	*Aster* spp.
Baldhip rose	*Rosa gymnocarpa*
Baneberry	*Actaea rubra*
Beaked hazel	*Corylus cornuta*
Bedstraws	*Galium* spp.
Bentgrass	*Agrostis* spp.
Bigleaf maple	*Acer macrophyllum*
Bigleaf (large-leaved) sandwort	*Moehringia macrophylla*
Birchleaf spirea	*Spiraea betulifolia*
Bitter cherry	*Prunus emarginata*
Bitterbrush	*Purshia tridentate*
Black cottonwood	*Populus trichocarpa*
Black hawthorn	*Crataegus douglasii*
Blue elderberry	*Sambucus caerulea*
Blue wildrye	*Elymus glaucus*
Blueberry or Huckleberry	*Vaccinium* spp.
Bluebunch Wheatgrass	*Agropyron spicatum*
Bluegrasses	*Poa* spp.
Bracken fern	*Pteridium aquilinum*
Brome	*Bromus spp.*
Bulbous bluegrass	*Poa bulbosa*
Bull thistle	*Cirsium vulgare*
Bunchberry	*Cornus canadensis*
Buttercups	*Ranunculus* spp.
Canada goldenrod	*Solidago canadensis*
Canada thistle	*Cirsium arvense*
Cascade or dull Oregon-grape	*Mahonia nervosa*
Cat-tail	*Typha latifolia*
Cheatgrass	*Bromus tectorum*
Chickweed	*Stellaria media*
Chocolate lily	*Fritillaria affinis*

Choke cherry	*Prunus virginiana*
Clasping twisted-stalk	*Streptopus amplexifolius*
Columbia lily	*Lilium columbianum*
Common fireweed	*Epilobium angustifolium*
Common snowberry	*Symphoricarpos albus*
Common tansy	*Tanacetum vulgare*
Common yarrow	*Achillea millefolium*
Coralroot	*Corallorhiza* spp.
Currant	*Ribes spp.*
Dalmatian toadflax	*Linaria dalmatica*
Dandelion	*Taraxacum officinale*
Devil's club	*Oplopanax horridus*
Diffuse knapweed	*Centaurea diffusa*
Douglas maple	*Acer glabrum*
Douglas maple	*Acer glabrum*
Douglas spirea	*Spiraea douglasii*
Douglas-fir	*Pseudotsuga menziesii*
Elk sedge	*Carex geyeri*
False hellebore	*Veratrum* spp.
False lily of the valley	*Maianthemum dilatatum*
False Solomon's seal	*Smilacina racemosa*
Foamflower	*Tiarella trifoliate*
Fragile sourweed	*Rumex acetosella*
Fringecup	*Tellima grandiflora*
Geraniums	*Geranium* spp.
Geyer's willow	*Salix geyeriana*
Goat's beard	*Aruncus dioicus*
Grand fir	*Abies grandis*
Green bog-orchid	*Platanthera hyperborea*
Groundsels or butterweeds	*Senecio* spp.
Gumweed	*Grindelia* spp.
Hairy cat's ear	*Hypochaeris radicata*
Holly-leaved (Shiny) Oregon-grape	*Mahonia aquifolium*
Horsetails	*Equisetum* spp.
Idaho fescue	*Festuca idahoensis*
Kentucky bluegrass	*Poa pratensis*
Kinnikinnick	*Arctostaphylos uva-ursi*
Large-leaved avens	*Geum macrophyllum*
Lodgepole pine	*Pinus contorta*
Maidenhair fern	*Adiantum pedantum*

Mock-orange	*Philadelphus lewisii*
Monkeyflower	*Mimulus* spp.
Mountain boxwood	*Pachistima myrsinites*
Mullein	*Verbascum* spp.
Nodding wood-reed	*Cinna latifolia*
Northern wormwood	*Artemisia campestris*
Oceanspray	*Holodiscus discolor*
Orange hawkweed	*Hieracium aurantiacum*
Orange honeysuckle	*Lonicera ciliosa*
Orchardgrass	*Dactylis glomerata*
Oxeye daisy	*Leucanthemum vulgare*
Pacific dogwood	*Cornus nuttallii*
Pacific willow	*Salix lasiandra*
Palmate coltsfoot	*Petasites palmatus*
Pearly everlasting	*Anaphalis margaritacea*
Perennial ryegrass	*Lolium perenne*
Pin cherry	*Prunus pennsylvanica*
Pinedrops	*Pterospora andromedea*
Pinegrass	*Calamagrostis rubescens*
Pink pyrola	*Pyrola asarifolia*
Plantains	*Plantago* spp.
Ponderosa pine	*Pinus ponderosa*
Prince’s pine	*Chimaphilla* spp.
Purple peavine	*Lathyrus nevadensis*
Pussytoes	*Antennaria* spp.
Quackgrass	*Elymus repens*
Quaking aspen	*Populus tremuloides*
Queen’s cup	*Clintonia uniflora*
Rattlesnake-plantain	*Goodyera oblongifolia*
Red clover	*Trifolium pratense*
Red paintbrush	*Castilleja miniata*
Redosier dogwood	*Cornus sericea*
Redstem ceanothus	*Ceanothus sanguineus*
Redtop	*Agrostis gigantea*
Richardson’s sedge	*Carex richardsonii*
Rough fescue	*Festuca campestris*
Rush skeletonweed	*Chondrilla juncea*
Sagebrush	*Artemisia tridentata.*
Salal	*Gaultheria shallon*
Sandberg’s bluegrass	*Poa secunda*
Serviceberry	*Amelanchier alnifolia*

Showy aster	*Aster conspicuus*
Silky lupine	*Lupinus sericeus*
Silky phaceliea	*Phacelia sericea*
Sitka alder	*Alnus sinuata*
Skunk cabbage	*Lysichiton americanus*
Skunkweed	*Navaretta squarosa*
Small twisted-stalk	*Streptopus streptopoides*
Snow buckwheat	*Eriogonum niveum*
Snowbrush ceanothus	*Ceanothus velutinus*
Spotted knapweed	*Centaurea maculosa*
Spreading dogbane	*Apocynum androsaemifolium*
Squirreltail grass	*Elymus elemoides*
Starflower	*Trientalis borealis*
Starry Solomon's seal	*Smilacina stellata*
Stiff needlegrass	*Stipa occidentalis*
Sweetclovers	*Melilotus* spp.
Swordfern	*Polystichum munitum*
Tall fescue	*Festuca arundinaceae*
Tall silvercrown	*Luina nardosmia*
Thimbleberry	*Rubus parviflorus*
Timothy	*Phleum pratense*
Trailing blackberry	*Rubus ursinus*
Twinflower	*Linnaea borealis*
Vanillaleaf	*Achyls triphylla*
Vine maple	*Acer circinatum*
Waterleaf	*Hydrophyllum* spp.
Western crabapple	*Malus fusca*
Western fescue	*Festuca occidentalis*
Western hemlock	*Tsuga heterophylla*
Western larch	*Larix occidentalis*
Western redcedar	*Thuja plicata*
Western trillium	*Trillium ovatum*
Western white pine	*Pinus monticola*
White alder	*Alnus incana*
White clover	*Trifolium repens*
Whitebark raspberry	*Rubus leucodermis*
Wild ginger	*Asarum caudatum*
Willow	*Salix* spp.
Willowherbs	*Epilobium* spp.
Wintergreen	*Pyrola* spp.
Woodland strawberry	*Fragaria vesca*

Yellow hawkweed	*Hieracium caespitosum*
Yellow rabbitbrush	*Chrysothamnus vicidiflorus*
Yellow rattle	*Rhinanthus minor*
Yellow salsify	*Tragopogon dubius*

(By Scientific name)

TREES

Abies grandis	Grand fir
Acer glabrum	Douglas maple
Acer macrophyllum	Bigleaf maple
Alnus incana	White alder
Alnus sinuate	Sitka alder
Larix occidentalis	Western larch
Malus fusca	Western crabapple
Pinus contorta	Lodgepole pine
Pinus monticola	Western white pine
Pinus ponderosa	Ponderosa pine
Populus trichocarpa	Black cottonwood
Populus tremuloides	Quaking aspen
Prunus emarginata	Bitter cherry
Pseudotsuga menziesii	Douglas-fir
Salix geyeriana	Geyer's willow
Salix lasiandra	Pacific willow
Salix spp.	Willow
Thuja plicata	Western redcedar
Tsuga heterophylla	Western hemlock

SHRUBS

Acer circinatum	Vine maple
Acer glabrum	Douglas maple
Amelanchier alnifolia	Serviceberry
Arctostaphylos uva-ursi	Kinnikinnick
Ceanothus sanguineus	Redstem ceanothus
Ceanothus velutinus	Snowbrush ceanothus
Chrysothamnus vicidiflorus	Yellow rabbitbrush
Cornus canadensis	Bunchberry
Cornus sericea	Redosier dogwood

Cornus nuttallii	Pacific dogwood
Corylus cornuta	Beaked hazel
Crataegus douglasii	Black hawthorn
Gaultheria shallon	Salal
Holodiscus discolor	Oceanspray
Linnaea borealis	Twinflower
Lonicera ciliosa	Orange honeysuckle
Mahonia aquifolium	Holly-leaved or shiny Oregon-grape
Mahonia nervosa	Cascade or dull Oregon-grape
Oplopanax horridus	Devil's club
Pachistima myrsinites	Mountain boxwood
Philadelphus lewisii	Mock-orange
Prunus pennsylvanica	Pin cherry
Prunus virginiana	Choke cherry
Purshia tridentata	Bitterbrush
Ribes spp.	Currant
Rosa gymnocarpa	Baldhip rose
Rubus leucodermis	Whitebark raspberry
Rubus parviflorus	Thimbleberry
Rubus ursinus	Trailing blackberry
Sambucus caerulea	Blue elderberry
Spiraea betulifolia	Birchleaf spirea
Spiraea douglasii	Douglas spirea
Symphoricarpos albus	Common snowberry
Vaccinium spp.	Blueberry or Huckleberry
HERBS	
Achillea millefolium	Common yarrow
Achyls triphylla	Vanillaleaf
Actaea rubra	Baneberry
Adiantum pedatum	Maidenhair fern
Agropyron spicatum	Bluebunch Wheatgrass
Agrostis gigantea	Redtop
Agrostis spp.	Bentgrass
Anaphalis margaritacea	Pearly everlasting
Antennaria spp.	Pussytoes

Apocynum androsaemifolium	Spreading dogbane
Arnica spp.	Arnica
Artemisia tridentata.	Sagebrush
Artemisia campestris	Northern wormwood
Aruncus dioicus	Goat's beard
Asarum caudatum	Wild ginger
Aster conspicuus	Showy aster
Aster spp.	Asters
Balsamorhiza sagittata	Arrowleaf balsamroot
Bromus spp.	Brome
Bromus tectorum	Cheatgrass
Calamagrostis rubescens	Pinegrass
Carex geyeri	Elk sedge
Carex richardsonii	Richardson's sedge
Castilleja miniata	Red paintbrush
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Chimaphilla spp.	Prince's pine
Chondrilla juncea	Rush skeletonweed
Cinna latifolia	Nodding wood-reed
Cirsium arvense	Canada thistle
Cirsium vulgare	Bull thistle
Clintonia uniflora	Queen's cup
Corallorhiza spp.	Coralroot
Dactylis glomerata	Orchardgrass
Elymus elemoides	Squirreltail grass
Elymus glaucus	Blue wildrye
Elymus repens	Quackgrass
Epilobium angistifolium	Common fireweed
Epilobium spp.	Willowherbs
Equisetum spp.	Horsetails
Eriogonum niveum	Snow buckwheat
Festuca arundinaceae	Tall fescue
Festuca campestris	Rough fescue
Festuca idahoensis	Idaho fescue
Festuca occidentalis	Western fescue

Fragaria vesca	Woodland strawberry
Fritillaria affinis	Chocolate lily
Galium spp.	Bedstraws
Geranium spp.	Geraniums
Geum macrophyllum	Large-leaved avens
Goodyera oblongifolia	Rattlesnake-plantain
Grindelia spp.	Gumweed
Hieracium caespitosum	Yellow hawkweed
Hieracium aurantiacum	Orange hawkweed
Hydrophyllum spp.	Waterleaf
Hypochaeris radicata	Hairy cat's ear
Lathyrus nevadensis	Purple peavine
Leucanthemum vulgare	Oxeye daisy
Lilium columbianum	Columbia lily
Linaria dalmatica	Dalmatian toadflax
Lolium perenne	Perennial ryegrass
Luina nardosmia	Tall silvercrown
Lupinus sericeus	Silky lupine
Lysichiton americanus	Skunk cabbage
Maianthemum dilatatum	False lily of the valley
Melilotus spp.	Sweetclovers
Mimulus spp.	Monkeyflower
Moehringia macrophylla	Bigleaf sandwort
Navaretta squarosa	Skunkweed
Petasites sagittatus	Arrowleaf coltsfoot
Petasites palmatus	Palmate coltsfoot
Phacelia sericea	Silky phaceliea
Phleum pratense	Timothy
Plantago spp.	Plantains
Platanthera hyperborea	Green bog-orchid
Poa annua	Annual bluegrass
Poa bulbosa	Bulbous bluegrass
Poa pratensis	Kentucky bluegrass
Poa secunda	Sandberg's bluegrass
Poa spp.	Bluegrasses
Polystichum munitum	Swordfern

Pteridium aquilinum	Brackenfern
Pterospora andromedea	Pinedrops
Pyrola asarifolia	Pink pyrola
Pyrola spp.	Wintergreen
Ranunculus spp.	Buttercups
Rhinanthus minor	Yellow rattle
Rumex acetosella	Fragile sourweed
Senecio spp.	Groundsels or butterweeds
Smilacina racemosa	False Solomon's seal
Smilacina stellata	Starry Solomon's seal
Solidago canadensis	Canada goldenrod
Stellaria media	Chickweed
Stipa occidentalis	Stiff or western needlegrass
Streptopus amplexifolius	Clasping twisted-stalk
Streptopus streptopoides	Small twisted-stalk
Tanacetum vulgare	Common tansy
Taraxacum officinale	Dandelion
Tellima grandiflora	Fringecup
Tiarella trifoliata	Foamflower
Tragopogon dubius	Yellow salsify
Trientalis borealis	Starflower
Trifolium pratense	Red clover
Trifolium repens	White clover
Trillium ovatum	Western trillium
Typha latifolia	Cat-tail
Veratrum spp.	False hellebore
Verbascum spp.	Mullein
Vicia americana	American vetch

Table 3. Stands in Each Plant Association Group (PAG).

Stand	Plant Association Group
13W	Cool Mesic Shrub/Herb
16W	Cool Mesic Shrub/Herb
3-15-05	Cool Mesic Shrub/Herb
3-15-08	Cool Mesic Shrub/Herb
3-15-10	Cool Mesic Shrub/Herb
3-25-06	Cool Moist Shrub/Herb
E	Cool Dry Grass
B	Cool Dry Grass
1E	Cool Dry Grass
A	Cool Dry Grass
1W	Cool Dry Grass
4W	Cool Dry Grass
19W	Cool Dry Grass
1-20-03	Cool Dry Grass
1-20-04	Cool Dry Grass
1-20-07	Cool Dry Grass
1-20-10	Cool Dry Grass
1-20-13	Cool Dry Grass
1-21-03	Cool Dry Grass
1-28-01	Cool Dry Grass
1-29-01	Cool Dry Grass
1-29-05	Cool Dry Grass
1-30-01	Cool Dry Grass
2-11-Z06	Cool Dry Grass
2-11-Z07	Cool Dry Grass
2-11-Z08	Cool Dry Grass
2-13-Z16	Cool Dry Grass
2-13-Z17	Cool Dry Grass
2-18-Z04	Cool Dry Grass
3-11-01	Cool Dry Grass
3-14-01	Cool Dry Grass
3-14-02	Cool Dry Grass
3-14-05	Cool Dry Grass
3-14-15	Cool Dry Grass
3-14-G3	Cool Dry Grass
3-14-Z04	Cool Dry Grass
3-15-01	Cool Dry Grass
3-15-07	Cool Dry Grass
3-15-17	Cool Dry Grass
3-15-18	Cool Dry Grass
3-15-25	Cool Dry Grass
3-15-Z26	Cool Dry Grass
3-15-16	Cool Dry Grass
3-23-07	Cool Dry Grass

3-23-08	Cool Dry Grass
3-23-17	Cool Dry Grass
3-24-01	Cool Dry Grass
3-24-05	Cool Dry Grass
3-24-14	Cool Dry Grass
3-24-15	Cool Dry Grass
3-24-G4	Cool Dry Grass
3-24-G3	Cool Dry Grass
3-24-G4	Cool Dry Grass
3-25-09	Cool Dry Grass
3-30-04	Cool Dry Grass
3-31-02	Cool Dry Grass
3-31-03	Cool Dry Grass
UGA-30-01	Cool Dry Grass
3-15-21	Deciduous
3-15-24	Deciduous
3-25-11	Deciduous
6E	Warm Dry Shrub/Herb
9W	Warm Dry Shrub/Herb
14W	Warm Dry Shrub/Herb
15W	Warm Dry Shrub/Herb
17E	Warm Dry Shrub/Herb
19E	Warm Dry Shrub/Herb
1-20-08	Warm Dry Shrub/Herb
3-11-02	Warm Dry Shrub/Herb
3-11-04	Warm Dry Shrub/Herb
1-21-01	Pasture
2-13-Z05	Pasture
2-18-Z06	Pasture
3-15-02	Pasture
3W	Warm Mesic Shrub/Herb
7E	Warm Mesic Shrub/Herb
11W	Warm Mesic Shrub/Herb
14E	Warm Mesic Shrub/Herb
G	Warm Mesic Shrub/Herb
H	Warm Mesic Shrub/Herb
I	Warm Mesic Shrub/Herb
J	Warm Mesic Shrub/Herb
ZC	Warm Mesic Shrub/Herb
ZD	Warm Mesic Shrub/Herb
ZK	Warm Mesic Shrub/Herb
1-19-01	Warm Mesic Shrub/Herb
1-19-02	Warm Mesic Shrub/Herb
1-19-03	Warm Mesic Shrub/Herb

1-19-04	Warm Mesic Shrub/Herb
1-19-G1	Warm Mesic Shrub/Herb
1-19-G3	Warm Mesic Shrub/Herb
1-20-01	Warm Mesic Shrub/Herb
1-20-15	Warm Mesic Shrub/Herb
1-20-G2	Warm Mesic Shrub/Herb
1-20-G3	Warm Mesic Shrub/Herb
1-29-04	Warm Mesic Shrub/Herb
1-29-06	Warm Mesic Shrub/Herb
1-29-07	Warm Mesic Shrub/Herb
1-29-G1	Warm Mesic Shrub/Herb
2-11-Z09	Warm Mesic Shrub/Herb
2-11-Z10	Warm Mesic Shrub/Herb
2-13-09	Warm Mesic Shrub/Herb
2-13-11	Warm Mesic Shrub/Herb
2-13-Z12	Warm Mesic Shrub/Herb
2-18-07	Warm Mesic Shrub/Herb
3-11-03	Warm Mesic Shrub/Herb
3-14-03	Warm Mesic Shrub/Herb
3-14-04	Warm Mesic Shrub/Herb
3-14-12	Warm Mesic Shrub/Herb
3-14-13	Warm Mesic Shrub/Herb
3-14-14	Warm Mesic Shrub/Herb
3-14-17	Warm Mesic Shrub/Herb
3-15-06	Warm Mesic Shrub/Herb
3-15-20	Warm Mesic Shrub/Herb
3-15-22	Warm Mesic Shrub/Herb
3-15-Z27	Warm Mesic Shrub/Herb
3-15-Z28	Warm Mesic Shrub/Herb
3-15-Z29	Warm Mesic Shrub/Herb
3-23-04	Warm Mesic Shrub/Herb
3-23-05	Warm Mesic Shrub/Herb
3-23-19	Warm Mesic Shrub/Herb
3-23-Z12	Warm Mesic Shrub/Herb
3-23-Z21	Warm Mesic Shrub/Herb
3-23-Z25	Warm Mesic Shrub/Herb
3-23-Z26	Warm Mesic Shrub/Herb
3-24-03	Warm Mesic Shrub/Herb
3-24-07	Warm Mesic Shrub/Herb
3-24-08	Warm Mesic Shrub/Herb
3-24-08	Warm Mesic Shrub/Herb
3-24-10	Warm Mesic Shrub/Herb
3-24-13	Warm Mesic Shrub/Herb
3-24-16	Warm Mesic Shrub/Herb
3-24-16	Warm Mesic Shrub/Herb
3-24-G1	Warm Mesic Shrub/Herb
3-24-G2	Warm Mesic Shrub/Herb
3-25-10	Warm Mesic Shrub/Herb

3-25-13	Warm Mesic Shrub/Herb
3-25-Z16	Warm Mesic Shrub/Herb
3-26-01	Warm Mesic Shrub/Herb
3-26-02	Warm Mesic Shrub/Herb
3-26-04	Warm Mesic Shrub/Herb
3-31-04	Warm Mesic Shrub/Herb
2E	Warm Moist Shrub/Herb
2W	Warm Moist Shrub/Herb
3E	Warm Moist Shrub/Herb
4E	Warm Moist Shrub/Herb
5E	Warm Moist Shrub/Herb
5W	Warm Moist Shrub/Herb
6W	Warm Moist Shrub/Herb
7W	Warm Moist Shrub/Herb
8E	Warm Moist Shrub/Herb
8W	Warm Moist Shrub/Herb
9E	Warm Moist Shrub/Herb
10E	Warm Moist Shrub/Herb
10W	Warm Moist Shrub/Herb
11E	Warm Moist Shrub/Herb
12E	Warm Moist Shrub/Herb
12W	Warm Moist Shrub/Herb
15E	Warm Moist Shrub/Herb
16E	Warm Moist Shrub/Herb
17W	Warm Moist Shrub/Herb
18E	Warm Moist Shrub/Herb
18W	Warm Moist Shrub/Herb
20E	Warm Moist Shrub/Herb
20W	Warm Moist Shrub/Herb
F	Warm Moist Shrub/Herb
1-20-12	Warm Moist Shrub/Herb
2-13-03	Warm Moist Shrub/Herb
2-13-Z02	Warm Moist Shrub/Herb
2-13-Z04	Warm Moist Shrub/Herb
2-13-Z06	Warm Moist Shrub/Herb
2-13-Z07	Warm Moist Shrub/Herb
2-18-Z01	Warm Moist Shrub/Herb
2-18-Z02	Warm Moist Shrub/Herb
3-11-05	Warm Moist Shrub/Herb
3-13-02	Warm Moist Shrub/Herb
3-13-03	Warm Moist Shrub/Herb
3-14-07	Warm Moist Shrub/Herb
3-14-08	Warm Moist Shrub/Herb
3-14-09	Warm Moist Shrub/Herb
3-14-10	Warm Moist Shrub/Herb
3-15-04	Warm Moist Shrub/Herb
3-15-09	Warm Moist Shrub/Herb

3-15-12	Warm Moist Shrub/Herb
3-15-13	Warm Moist Shrub/Herb
3-15-14	Warm Moist Shrub/Herb
3-15-15	Warm Moist Shrub/Herb
3-15-19	Warm Moist Shrub/Herb
3-15-23	Warm Moist Shrub/Herb
3-23-14	Warm Moist Shrub/Herb
3-23-15	Warm Moist Shrub/Herb
3-23-16	Warm Moist Shrub/Herb
3-23-18	Warm Moist Shrub/Herb
3-23-Z22	Warm Moist Shrub/Herb
3-23-Z23	Warm Moist Shrub/Herb
3-23-Z24	Warm Moist Shrub/Herb
3-24-09	Warm Moist Shrub/Herb
3-24-11	Warm Moist Shrub/Herb
3-24-12	Warm Moist Shrub/Herb
3-25-01	Warm Moist Shrub/Herb
3-25-03	Warm Moist Shrub/Herb
3-25-04	Warm Moist Shrub/Herb
3-25-05	Warm Moist Shrub/Herb
3-25-07	Warm Moist Shrub/Herb
3-25-12	Warm Moist Shrub/Herb
3-25-Z17	Warm Moist Shrub/Herb
3-25-Z18	Warm Moist Shrub/Herb
3-25-Z19	Warm Moist Shrub/Herb
3-25-Z20	Warm Moist Shrub/Herb
3-30-01	Warm Moist Shrub/Herb
3-30-03	Warm Moist Shrub/Herb
3-30-06	Warm Moist Shrub/Herb
3-30-Z05	Warm Moist Shrub/Herb
1-19-G2	Hot Dry Shrub/Grass
1-20-05	Hot Dry Shrub/Grass
1-20-06	Hot Dry Shrub/Grass
1-20-09	Hot Dry Shrub/Grass
1-20-11	Hot Dry Shrub/Grass
1-20-14	Hot Dry Shrub/Grass
1-20-G1	Hot Dry Shrub/Grass
1-21-02	Hot Dry Shrub/Grass
1-29-03	Hot Dry Shrub/Grass
2-11-05	Hot Dry Shrub/Grass
2-11-Z01	Hot Dry Shrub/Grass
2-11-Z02	Hot Dry Shrub/Grass
2-11-Z03	Hot Dry Shrub/Grass
2-11-Z04	Hot Dry Shrub/Grass
2-13-08	Hot Dry Shrub/Grass
2-13-Z01	Hot Dry Shrub/Grass
2-13-Z10	Hot Dry Shrub/Grass

2-13-Z14	Hot Dry Shrub/Grass
2-13-Z15	Hot Dry Shrub/Grass
2-14-01	Hot Dry Shrub/Grass
2-18-Z10	Hot Dry Shrub/Grass
3-13-01	Hot Dry Shrub/Grass
3-14-G1	Hot Dry Shrub/Grass
3-14-G2	Hot Dry Shrub/Grass
3-14-G4	Hot Dry Shrub/Grass
3-14-G5	Hot Dry Shrub/Grass
3-15-11	Hot Dry Shrub/Grass
3-23-01	Hot Dry Shrub/Grass
3-23-02	Hot Dry Shrub/Grass
3-23-03	Hot Dry Shrub/Grass
3-23-04	Hot Dry Shrub/Grass
3-23-09	Hot Dry Shrub/Grass
3-23-13	Hot Dry Shrub/Grass
3-23-20	Hot Dry Shrub/Grass
3-23-G1	Hot Dry Shrub/Grass
3-23-Z10	Hot Dry Shrub/Grass
3-23-Z11	Hot Dry Shrub/Grass
3-24-02	Hot Dry Shrub/Grass
3-24-17	Hot Dry Shrub/Grass
3-24-18	Hot Dry Shrub/Grass
3-24-19	Hot Dry Shrub/Grass
3-30-02	Hot Dry Shrub/Grass
3-31-01	Hot Dry Shrub/Grass
3-31-05	Hot Dry Shrub/Grass