AN ECOLOGICAL CONTEXT FOR "WHOLE SYSTEM" CONSERVATION OF EASTERN WASHINGTON FORESTS

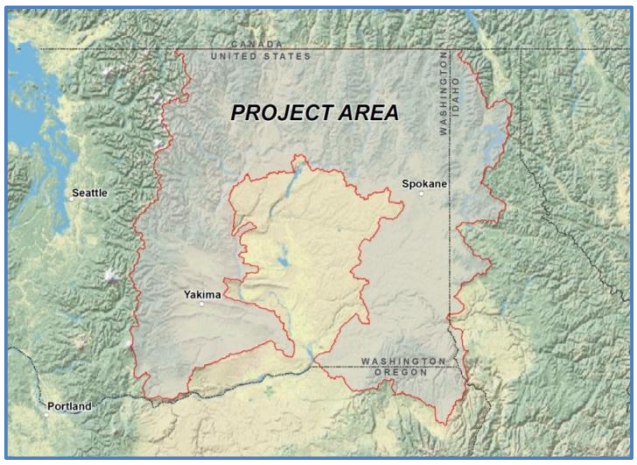
Liane Davis, Ryan Haugo, Darren Kavanagh. 2012. The Nature Conservancy. Seattle, Washington.

Overview and Objective

Many forested landscapes across western North America are in crisis today; at risk of uncharacteristic disturbances that threaten both natural and human communities. In eastern Washington, the Nature Conservancy is dedicated to the "whole systems" conservation of forest ecosystems[1]. Conservation across such vast areas cannot succeed with approaches that focus only on a single species or ignore the needs and values of people. The whole systems approach recognizes this by incorporating ecosystem-scale processes and the needs of human communities in an effort to build sustaining relationships between nature and people. Our objective in this project is to assess the current ecological condition of forests across the eastern Washington landscape, the necessary first step toward development of whole system forest conservation goals. This information provides a comprehensive assessment of current landscape context and ecological conditions that can be used to evaluate how well the ecosystem-scale processes that regulate these extremely diverse and valuable forests may be functioning.

Whole System: Pacific Northwest Inland Forests

Whole systems conservation requires a focus on large geographic areas defined by unifying ecological features. Whole systems are fully able to support key ecological processes such as large disturbances (e.g., fire). This assessment focuses on the **Pacific Northwest Inland Forests Whole System**, defined by a continental climate and bounded by the major geographic features of the Cascade Mountains, Continental Divide, and Great Basin. Fourth field watersheds[2] ("HUC 8") serve as the base geographic unit of assessment. Recognizing the management realities of political boundaries, this assessment considers all forested watersheds east of the Cascade Crest that are wholly or partially within Washington State.



Why ecological condition matters

In addition to the tremendous biological diversity supported by eastern Washington's Pacific Northwest Inland Forests, our society depends upon these forests for clean air and water, recreation, and a forest industry that is the economic base for many rural communities. These many values are regulated by key

[1] Ward, J., V. Agostini, M. Anderson, C. Burns, P. Doran, J. Fargione, C. Groves, L. Hanners, J. Hoekstra, R. Marshall, S. Morrison, S. Plamer, D. Shaw, and J. Smith. 2011. Stepping up to the challenge: A concept paper on Whole Systems Conservation. The Nature Conservancy, Arlington, VA. http://www.conservationgateway.org/node/1455

[2] A HUC is a hierarchical watershed classification developed by the US Geologic Survey (http://www.mowin.org/Pdf/HUCprimer.pdf). A HUC 8, also referred to as a 4th field watershed or "sub-basin" in this system, is a mid-size watershed, averaging ~700 square miles (approximately 450,000 acres).

Images 1 and 2: (1) historical (1930) photo of a low severity, interior PNW forest landscape; (2) the same landscape in (2011), where fire suppression has resulted in a high density of understory trees that can act as fuels and cause more severe fires than would have been common historically. (*Lookout Mountain, WA. 2011. Photo: John Marshall)*[3]

ecological processes, such as tree growth, disturbance (e.g., fire, insects, disease), wildlife movement, and water and nutrient cycling. An important assumption is that when these processes are functioning properly, forests are able to provide the greatest suite of values desired by society. A second important, well-documented assumption is that these processes have been substantially altered by human activities (wildfire suppression, grazing, logging, and development) over the last century, leaving forests more susceptible and less resilient to uncharacteristic disturbances and climate change. Historical conditions represent how forest landscapes were shaped by natural disturbances prior to European settlement and offer our best estimate as to what defines a "properly functioning condition" that is mostly likely able to tolerate the additional stresses of projected climate change. Understanding the current ecological condition of forests relative to their historic condition can inform where forests may or may not be functioning "properly" and where restoration may be needed.

Assessment Methods

We determined that the best source for consistent and continuous data on current forest conditions for our project area was provided by LANDFIRE (http://www.landfire.gov/). Using LANDFIRE data on the historic and current forest structure and composition, we calculated how departed current forest vegetation is from historic conditions in terms of vegetation structure and composition[4] (Images 1 and 2). For our purposes, we clipped the national dataset to our project boundaries and eliminated all non-forest vegetation types from the departure analysis. For more information on the LANDFIRE and our departure analysis, see the Appendix A. Within each fourth-field watershed we calculated and mapped:

- Forest Fire Regime Groups (Map 1; see side-bar)
- Forest ownership
- Ecological departure (Map 2)

[3] Courtesy of the Okanogan-Wenatchee National Forest and Wenatchee Forest Sciences Laboratory repeat photography project.

[4] Interagency Fire Regime Condition Class (FRCC) Guideboook, v3.0. September 2010. www.frcc.gov

We infer that ecological departure is a result of changes in disturbance regimes, partially explained by human actions over the last century[5]. It is widely recognized that within low severity fire regime forests, exclusion of fire, intensive grazing, and past high-grade timber harvests have resulted in an increase of high-density, closed-canopy forests relative to historic conditions. In contrast, fire suppression has had little influence on high severity fire regime forests. Departure in these forests is typically related to other causes such as clear-cut timber harvests and insect outbreaks. Within mixed severity fire regime forests, causes of departure may be similar to either low or high severity fire regime group forests.

FOREST FIRE REGIME GROUPS

These represent historical forest conditions

Low Severity: Forests where frequent surface fire was dominant, usually resulting in low mortality of overstory trees (examples: ponderosa pine and dry Douglas-fir forests)

High Severity: forests where fires were infrequent and usually severe, resulting in high mortality of overstory trees (examples: lodgepole pine forests)

Mixed Severity: forests where fires exhibited a mix of frequencies and severities, ranging from low to high

Ecological conditions alone, however, cannot dictate what conservation and restoration strategies are needed and where they can occur; landscape and forest management context are important factors to consider when evaluating viability of strategies. To understand landscape context, departure analyses were summarized by individual HUC 8 watersheds and by 5 geographically defined regions within the project area [Appendix B and C; Regions: (1) East Cascades-South; (2) East Cascades-North/Okanogan; (3) NE Washington/N Idaho; (4) Spokane/Coeur D'Alene; and (5) Blue Mountains]. Additionally, various forest management designations, in accordance with regulations and forest management objectives, influence where and what conservation and restoration strategies the Conservancy implements in pursuit of developing a whole systems vision and goals. To capture these differences, we adapted a relative categorization of management types across our project area from the Integrated Landscape Assessment Project (ILAP; http://oregonstate.edu/inr/ilap). ILAP provides six management categories[6] that reflect a gradient from least (e.g., wilderness) to greatest levels of active forest management typically permitted under existing regulatory and social constraints (e.g., USFS matrix lands, private industrial forestlands; see Appendix A for a category description). ILAP management data was only available for eastern Washington and Oregon.

Results / Discussion

This assessment demonstrates that forests across the project area are largely altered from historic ecological conditions, likely compromising their ability to provide a full suite of ecological services valued by society. In restoring forests that resemble historic conditions, we would expect fewer large high severity fire events, reduced levels of insects and disease, and greater resiliency to expected trends in a changing climate for low fire severity forest types[7]. Here we provide a high-level overview of our results

[5] Hessburg, P. F. and J. K. Agee. 2003. An environmental narrative of Inland Northwest United States forests, 1800-2000. Forest Ecology and Management **178**:23-59.

[6] ILAP management categories are derived from the Bureau of Land Management's Visual Resource Classes.

[7] North, M. P. and W. S. Keeton. 2008. Emulating Natural Disturbance Regimes: an Emerging Approach for Sustainable Forest Management. *In* R. Lafortezza, J. Chen, G. Sanesi, and T. R. Crow, editors. Patterns and Processes in Forest Landscapes. Springer.

that spatially illustrate the ecological context for setting whole systems goals and for developing conservation and restoration strategies in eastern Washington forests (readers should refer to Appendices B and C for more information summarized by HUC and region). Two key points critical to advancing whole systems conservation are underscored by this assessment: (1) establishment of forests that resemble historic conditions would require stewardship/restoration over large geographic areas in partnership with multiple land owners and managing entities; (2) developing the vision and goals for sustainable and resilient forests and communities now and into the future will require the continued engagement of many stakeholders.

- **Approximately 73% of all forests are moderately or severely ecologically departed from historic conditions** (Map 2).

- **Low severity fire regime forests are the most common forest type and are consistently highly departed.** Across our project area there are 5,866,229 acres of historically low severity forest, of which nearly 93% are moderately to severely departed from historic conditions. This high level of departure is consistent across watersheds and ownerships (Figure 1; Appendix B). Based on a long history of research conducted throughout the western US, there exists a solid understanding of stand-level ecology, management, and restoration in low severity forest fire regime groups[8].

- **Mixed severity fire regime forests are also very abundant and have widely varying levels of departure.** Mixed severity forests constitute nearly as much acreage (5,162,121 acres, Figure 1) as low severity forests, with 52% moderately to severely departed from historic conditions. However, levels of departure in mixed severity forests vary widely between regions and watersheds (see regional summaries in Appendix C). As these forests are more ecologically complex and have received less research attention than low severity forests, there is greater uncertainty surrounding the restoration of mixed severity forests[9].

- **High severity fire regime forests are a minor component.** High severity forests (1,379,529 acres, Figure 1) constitute less than 10% of forestland in 28 of 29 watersheds that we assessed (Map 1).

- **The US Forest Service is the largest individual land owner.** There are approximately 12,407,000 acres of forestland within the project area, with the majority held within three major ownership categories: US Forest Service (USFS; 44%), private (29%), and Native American tribal lands (13%). The remainder is managed by WA Department of Natural Resources (WDNR; 6%), WA Department of Fish and Wildlife (WDFW; 1%) and a mixture of other state (Idaho, Oregon) and federal agencies (6%) (Figure 2).

- **Low severity forests are the most common forest type for all ownership categories except the USFS and patterns of departure by forest fire regime groups do not differ dramatically among ownerships** (Figure 3).

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[8] Franklin, J. F., M. A. Hemstrom, R. Van Pelt, J. B. Buchanan, and S. Hull. 2008. The case for active management of dry forest types in eastern Washington: perpetuating and creating old forest structures and functions. Washington Department of Natural Resources, Olympia, Washington.

[9] Perry, D. A., P. Hessburg, C. N. Skinner, T. A. Spies, S. L. Stephens, A. H. Taylor, J. Franklin, B. McComb, and G. Riegel. 2011. The ecology of mixed severity fire regimes in Washington, Oregon, and Northern California. Forest Ecology and Management **262**:703-717.

- **Management designations will influence restoration strategies.** Within the project area, 35% of the forest land is within a Limited or Light management designation and an additional 30% is within a Moderate designation (Figure 4). However, these designations vary spatially across the project area and within separate regions (Appendix C), meaning that attention must be paid not only to the forest condition and ownership pattern, but also to the management designations when evaluating potential strategies and partnerships.

- **Departed forests do not necessarily require active treatment.** It must be emphasized that not every acre of departed forest must be actively treated. There are cases where forests may simply need time to recover from a disturbance rather than active restoration (e.g., mechanical thinning, prescribed burning) to reduce departure. The next step in this project will be to assess where active restoration may or may not be appropriate (see Other Considerations below).

Other Considerations

This project was the first step toward providing the science to support development of whole system conservation goals for eastern Washington forests. There are many additional considerations that were not included here, but will be part of additional future analyses, including:

- **Climate change**. This analysis presents a static view of past and current conditions. While research indicates that moving forests toward a condition that resembles historic conditions will increase their resiliency to climate change, this alone may not be sufficient everywhere and for all forest types. Additional work is needed to refine regional climate projections and determine the implications these have for the future of these forests.

- **"Active restoration footprint".** As stated previously, simply because a forest is departed does not necessarily imply that active restoration (e.g., prescribed fire, thinning) is needed. Discerning between areas of departed forests where active restoration is needed and where it may not be appropriate is a logical next step for this project.

- **Multiple Spatial Scales**. To achieve whole systems conservation of Pacific Northwest Inland Forests, individual stewardship / restoration projects must incorporate ecological and socio-economic values at stand and watershed scales.

- **Socio-economics**. Societal values for forestland differ, ranging from development to water storage and wildlife habitat, to timber products. Inclusion of these factors is difficult at the large spatial scale used for this project, but could be done using more sophisticated modeling tools at smaller landscapes. An extension of this project will likely be conducted in the Tapash Sustainable Forest Collaborative landscape, a priority landscape for the Collaborative Forest Landscape Restoration project (http://www.fs.fed.us/restoration/CFLR/index.shtml).

Figure 1. Forest fire regime groups and ecological departure for project area
(total acres = 12,406,949)
Forest Fire Regime Groups: *Low* = Low Severity; *Mixed* = Mixed Severity; *High* = High Severity

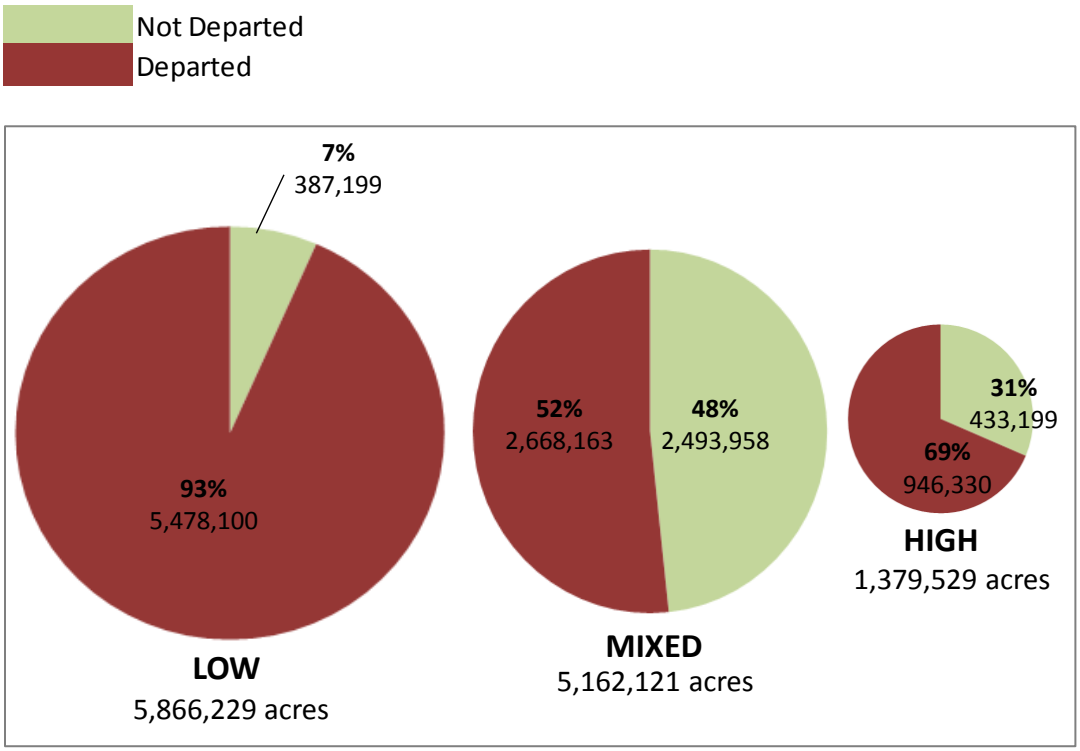


Figure 2. Forest ownership for project area (total acres = 12,406,949)

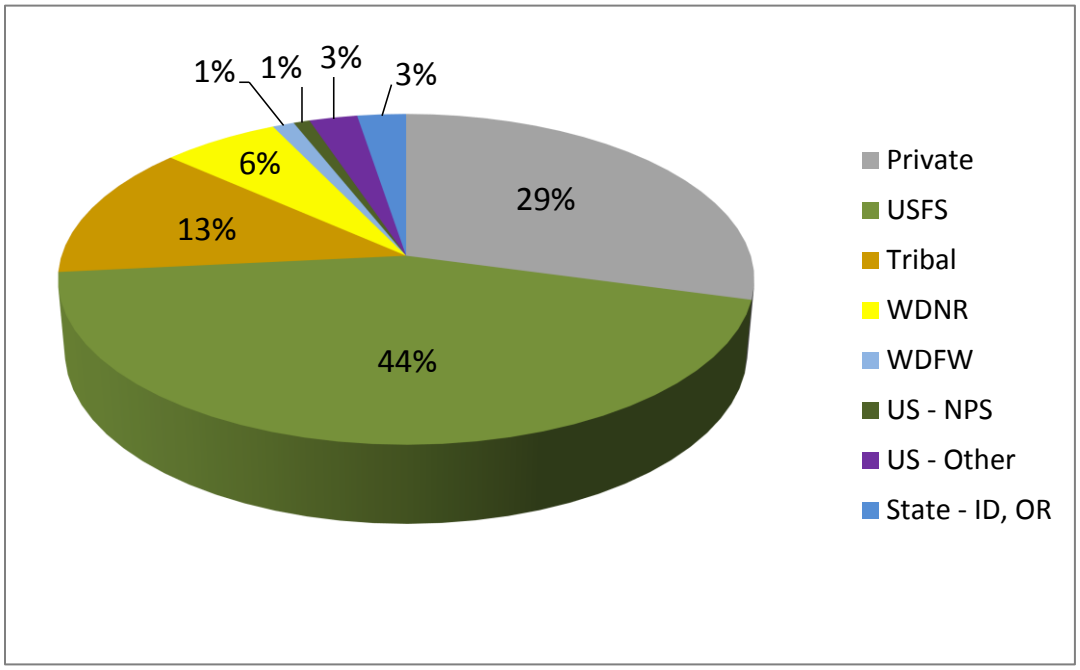


Figure 3. Major ownerships for project area with ecological departure by forest fire regime group.

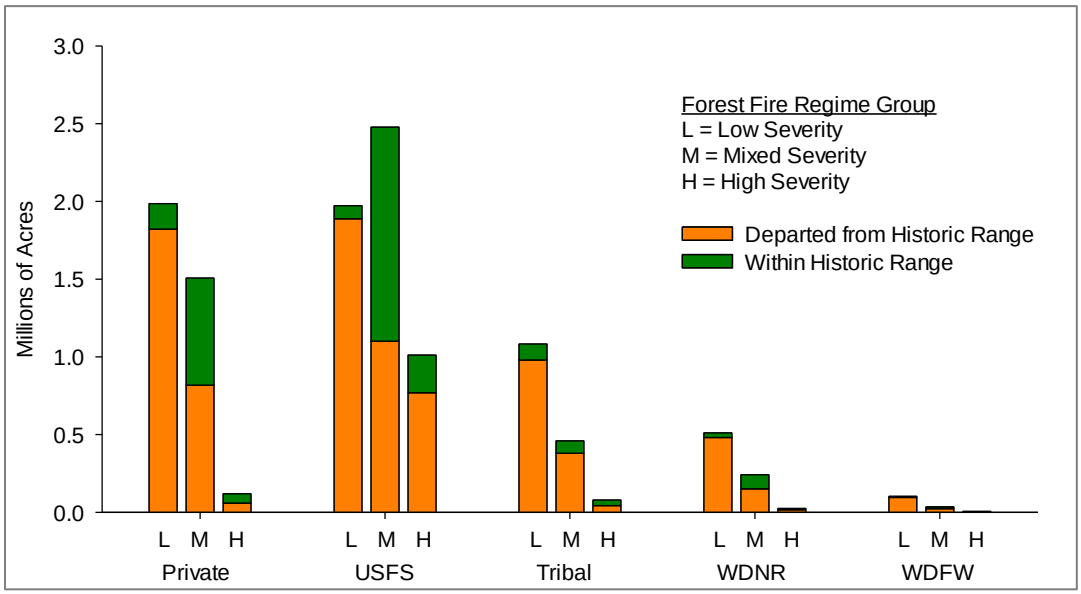
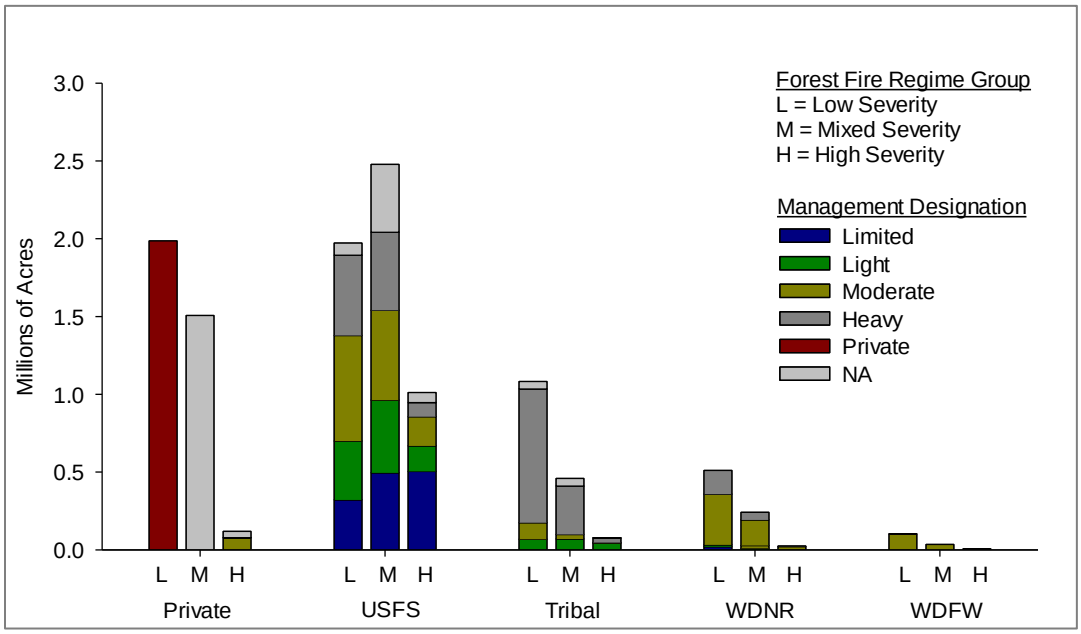
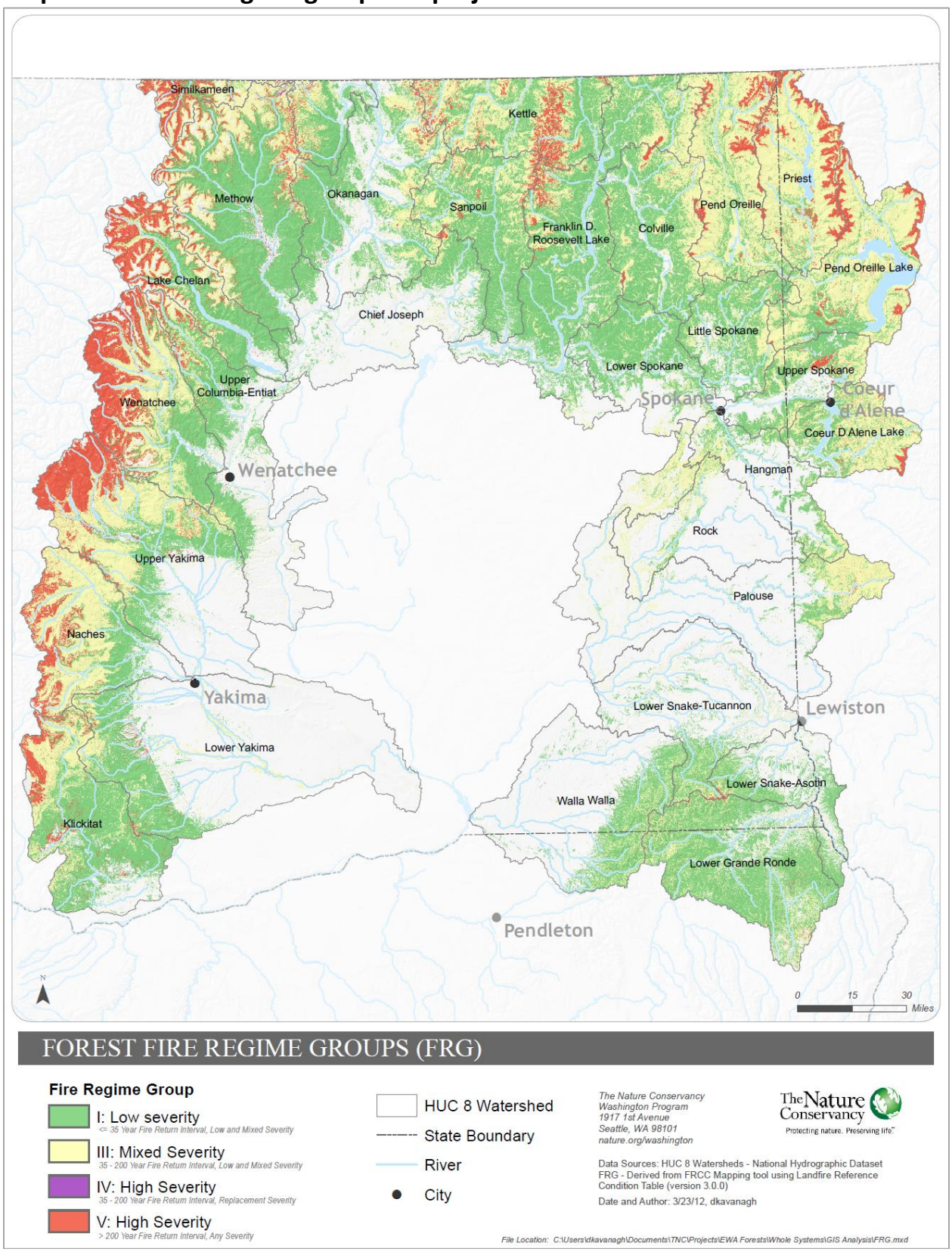


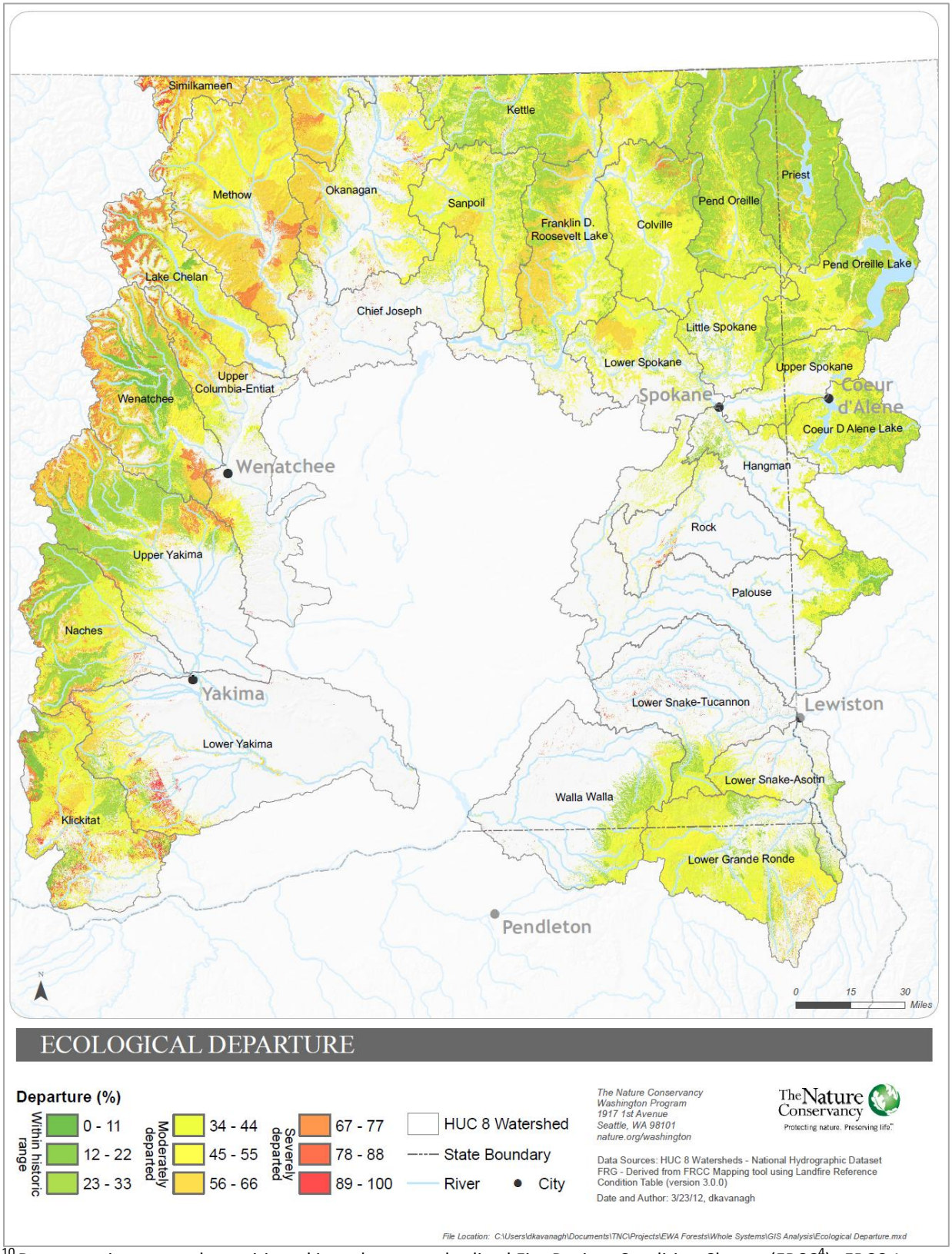
Figure 4. Management designations for project area



Map 1: Forest fire regime groups for project area



Map 2: Ecological departure for project area[10]



[10] Departure is commonly partitioned into three standardized Fire Regime Condition Classes (FRCC[4]): FRCC 1 < 33%; FRCC 2 = 33% - 66%; FRCC 3 > 66%