SUBSECTION-SECTION 4M.10

PUYALLUP TRIBE ALL HAZARD MITIGATION PLAN
WILDLAND/URBAN INTERFACE FIRE HAZARD

TABLE OF CONTENTS

Identification Description

Definition

A wildland/urban interface (WUI) area is that geographic area in which structures and other human development meets or intermingles with wildland or vegetative fuels. A WUI fire is a fire located in that geographic area. There are numerous locations within Pierce County where structural developments meet and intermingle with the wildland areas. This condition gives rise to the possibility of WUI fires, especially when weather conditions are dry and fuels are abundant.[1]

Types

WUI fires occur naturally (lightning strikes) or are started by people. Secondary events such as erosion, landslides, and flash floods often occur in areas which have been affected by wildland fires.[2] There are three types of WUI fires, delineated by cause. They are described below.

Naturally Occurring Fires

Naturally occurring interface fires, especially those caused by lightning, are rare in western Washington.[3] However, wildland fires started by lightning in Washington state burn more state-protected acreage than any other cause, an average of 10,866 acres annually.[4]

Manmade Fires

Manmade interface fires, stemming from people's carelessness and lack of fire knowledge, are common causes of interface fires. "West-side" people start 67% of the wildland fires that occur in Eastern Washington.[5] Major causes include arson, recreational fires that get out of control, smoker's carelessness, debris burning, and children playing with fire. From 1992 to 2001, on average, people caused more than 500 wildland fires each year on state-owned or protected lands; this compares to 135 fires caused by lightning strikes. Human caused fires in Washington burn an average of 4,404 state-protected acres each year.[6]

Controlled Burns

Controlled burns are fires conducted because the fire cycle is an important aspect of management for all ecosystems and controlled burns are not considered hazards unless they get out of control.[7]

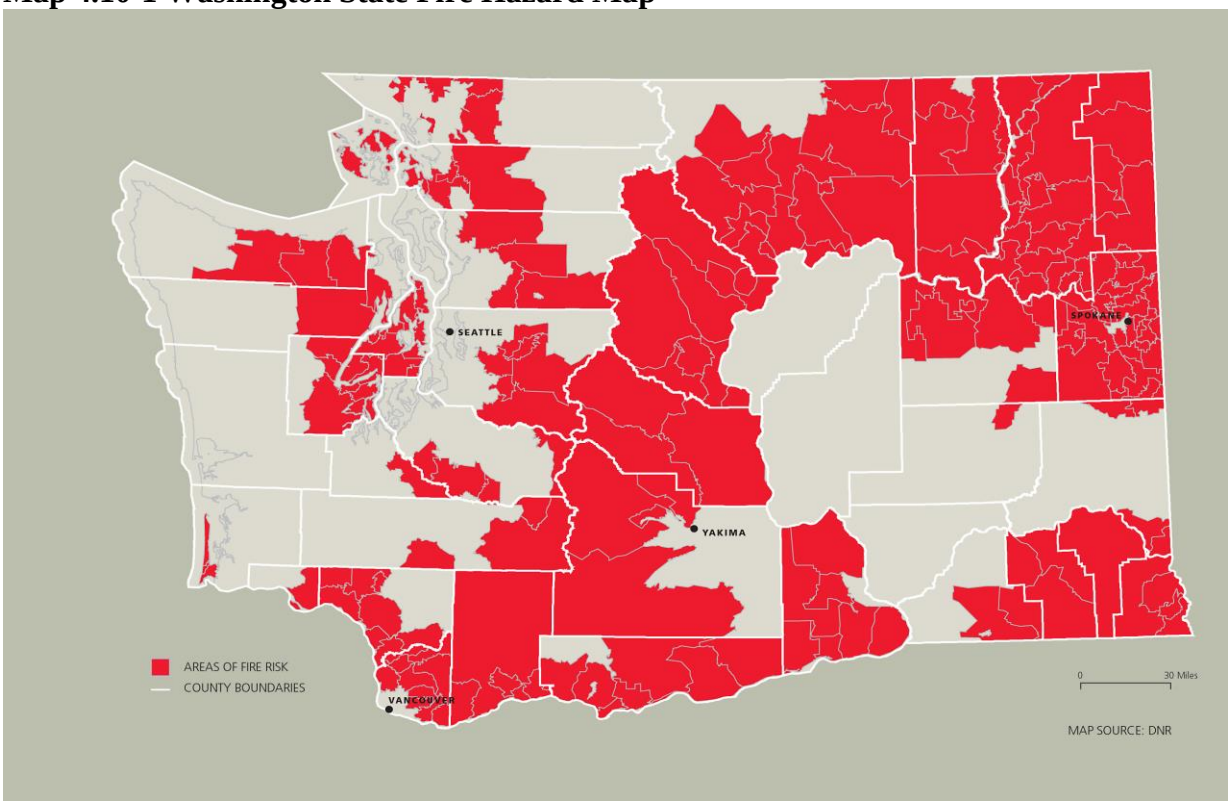
Profile

Location and Extent

Eastern Washington faces the greatest risk of fire, though Western Washington does have areas of risk as well. The Washington State Department of Natural Resources and its federal and local

partners determined the communities in the state that are at high risk after evaluating them for fire behavior potential, fire protection capability, and risk to social, cultural and community resources.[8] Map 4.10-1 illustrates the location and extent of these communities for the entire state. The following communities within Pierce County are identified as having a high risk to the WUI fire hazard: Ashford, Elbe, Eatonville, and Roy. Several other communities are identified in neighboring counties that are in close proximity to the Pierce County border.

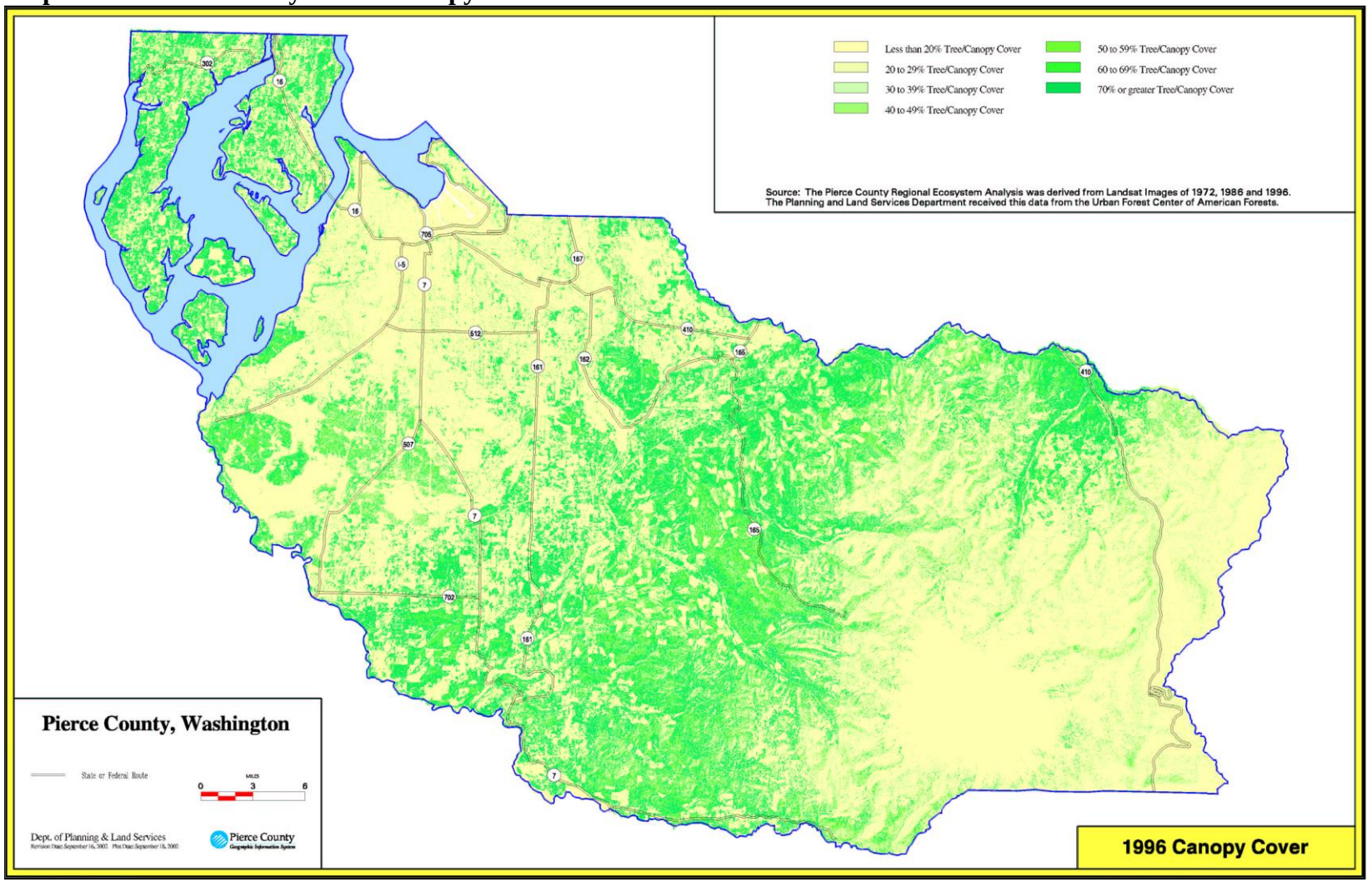
Map 4.10-1 Washington State Fire Hazard Map[9]



As the map illustrates the areas of greatest risk in unincorporated Pierce County include the Greenwater area northeast of Mt. Rainier—which includes the Crystal Mountain resort area—and the southern portion of the County extending from the Eatonville area to the Roy area. The Forest Canopy Map 4.10-2 provides further detail regarding the location and extent of fuel and areas of WUI. The map confirms that the areas of greatest risk due to WUI fires are those identified in Map 4.10-1 and illustrates that other areas of the Cascade foothills may also be at risk.

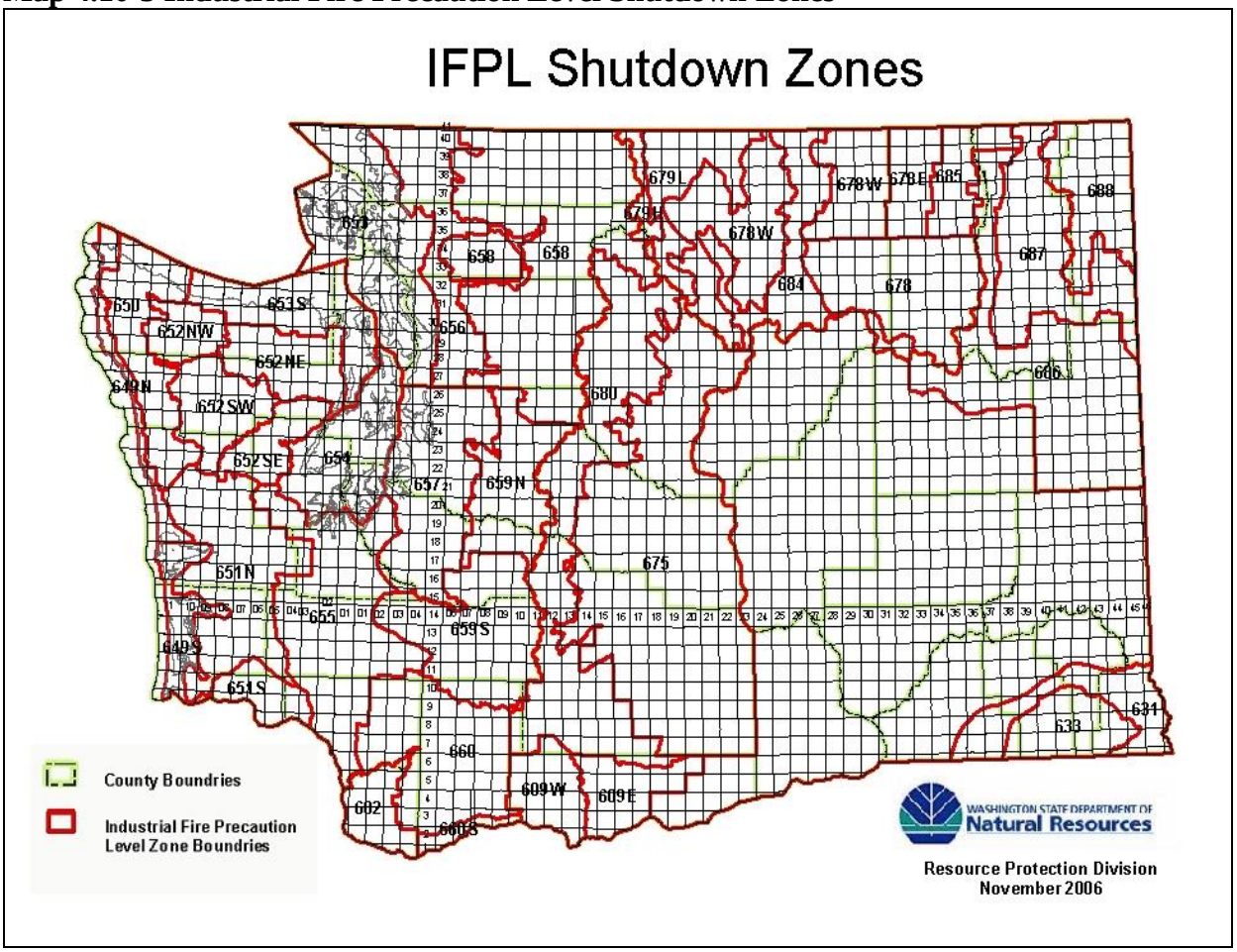
In order to prevent wildland fires from logging activities, the Washington State Department of Natural Resources (DNR), along with the US Forest Service (USFS), the Bureau of Land Management (BLM), and the Bureau of Indian Affairs (BIA) follow the Industrial Fire Precaution Levels (IFPL). This classification is based on the National Fire Danger Rating System (NFDRS) and covers the types of equipment that can be used and their hours of operation. It has a range from I, considered to have little danger, to IV which involves a general shutdown of the forest.[10]

Map 4.10-2 Pierce County Forest Canopy



Due to variables affecting the fire threat caused by topography, weather, and the amount of fuel the DNR has created 38 different fire danger rating areas, or zones, based on recommended actions by the NFDRS. Of these, there are 5 different fire danger rating areas that cover different portions of Pierce County. These include areas: 654, 655, 657, 659N and 659S and they can be seen on Map 4.10-3. The Planning Area lies within the 657 zone.

Map 4.10-3 Industrial Fire Precaution Level Shutdown Zones[11]



Each Shutdown Zone has unique characteristics, as mentioned above, of topography, weather and the quantity of available fuel, that usually create situations of similar fire danger throughout the zone; but that could be different for adjacent zones. These different characteristics can lead to the IFPL also being different for adjacent zones.

In addition to the industrial controls, the DNR administers the Public Use Restrictions, limiting the public's use and access to forested lands during periods of high fire danger.[12] Like the industrial limitations there are four levels of control that can be exercised. These are:

Summer Fire Rules – In affect from April 15 to October 15 or longer if warranted.

Burn Ban – When initiated by DNR prohibits all open fires on DNR lands. It may be done in coordination with federal and local agencies to cover land under their control.

Closed Entry Areas – Usually designated as "regions of extra fire danger" in the spring and closed to recreation throughout the summer.

Forestland Closure – In periods of extreme fire weather conditions, DNR may restrict all activities on some private and public lands, even to the point of not allowing home owners access to their homes.

Occurrences

Historically, wildland fires were not considered a hazard. Fire is a normal part of most forest and range ecosystems in temperate regions of the world. Fires traditionally burn on a fairly regular cycle, recycling carbon and nutrients stored in the ecosystem, and strongly affecting the species within the ecosystem.

While wildland fires are predominately recognized as an Eastern Washington phenomenon, they also happen on the west side of the Cascades. The burning cycle in western Washington is every 100 – 150 years.[13] This assumes a normal regrowth pattern after a forest has burned.

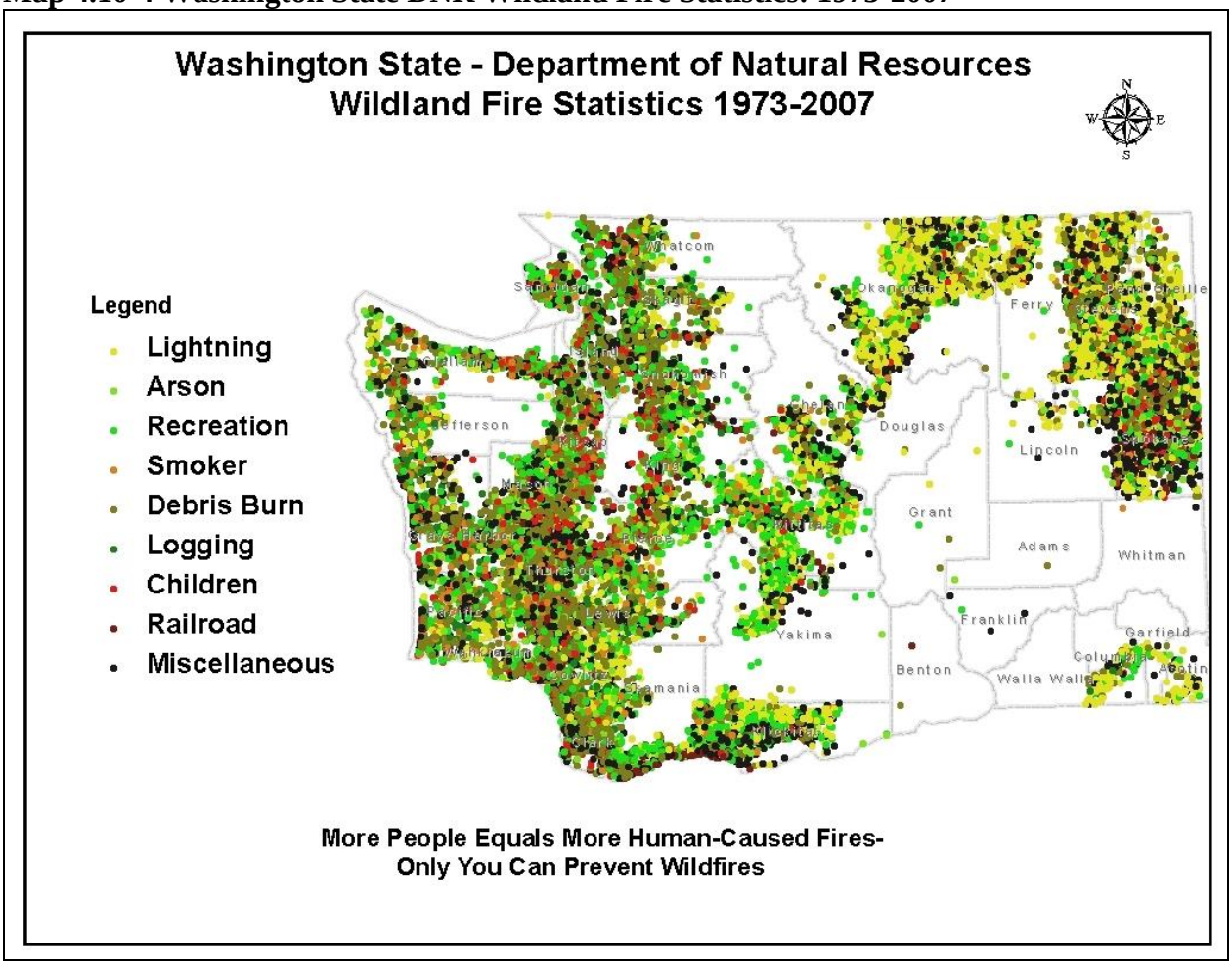
Figure 4.10-1 Carbon Copy Fire August 2006

The Carbon Copy fire in Pierce County and the Bear Gulch fire in Mason County during the summer of 2006 are two of the most recent large fires in Western Washington.

Wildland fires in Pierce County are largely confined to the drier periods of the year. In most years, this falls during the summer or the very earliest portion of fall. At that time, due to the lack of rain, the fuel moisture content[14] is usually at its lowest. Any time the weather turns dry and hot for a lengthy period of time in Pierce County, there is the possibility of a wildland fire. Due to the proximity of homes and businesses throughout Pierce County to areas with natural vegetation, given the right location and conditions, many fires could turn into a Wildland/Urban Interface Fire.

The best available information at this time indicates that fires have occurred in or near the locations identified above in the location and extent description. Map 4.10-4 illustrates fire occurrences in the records kept by DNR from 1973 through 2007.

Map 4.10-4 Washington State DNR Wildland Fire Statistics: 1973-2007



While not all of these are technically WUI fires, their relatively frequent occurrence indicates a risk to the WUI fire hazard near populated areas of Pierce County. Table 4.10-1 shows the number of classified fires[15] that DNR responded to from 2002 through 2007 in the South Puget Sound Region[16] and their cause.

Table 4.10-1 DNR Wildland Response South Puget Sound Region: 2002-2007[17]

Cause	2002	2003	2004	2005	2006	2007	Total	%
Arson	10	18	7	2	15	1	53	**12.4**
Children	11	8	4	4	10	3	40	**9.4**
Debris Burn	19	10	13	4	18	9	73	**17.1**
Lightening	1	4	5	1	0	0	11	**2.6**
Logging	2	1	2	1	1	0	7	**1.6**
Misc.	13	29	14	13	29	23	121	**28.3**
Rail Road	1	1	0	0	0	1	3	**.7**
Recreation	19	20	14	13	21	10	97	**22.7**
Smoker	10	8	0	2	2	0	22	**5.2**
Totals	**86**	**99**	**59**	**40**	**96**	**47**	**427**	**100**

While the vast majority of the fires listed in both Table 4.10-1 and Table 4.10-2 would not be defined as WUI fires, the Department of Natural Resources, South Puget Sound Region, is involved fighting a Wildland/Urban Interface fire as least every couple of years.[18] Very few structures have been lost in these fires due to the quick response and the high priority put on preventing the fires from involving the threatened structures. When this is combined with the WUI involvement of individual jurisdictions (cities, towns, and rural fire districts) in fighting wildland fires that threaten homes and other improved property in their individual districts or jurisdictions, the potential for a major fire is always there.

Table 4.10-2 shows the number of classified, unclassified and other agency response fires for the years 2002 through 2007 for Pierce County.

Table 4.10-2 Pierce County DNR Fires

Year	Classified	Other Agency Response	Unclassified	Total
2002	39	0	1	40
2003	21	0	0	21
2004	19	13	3	35
2005	9	7	0	16
2006	19	13	0	32
2007	8	9	1	18
Total	115	42	5	162

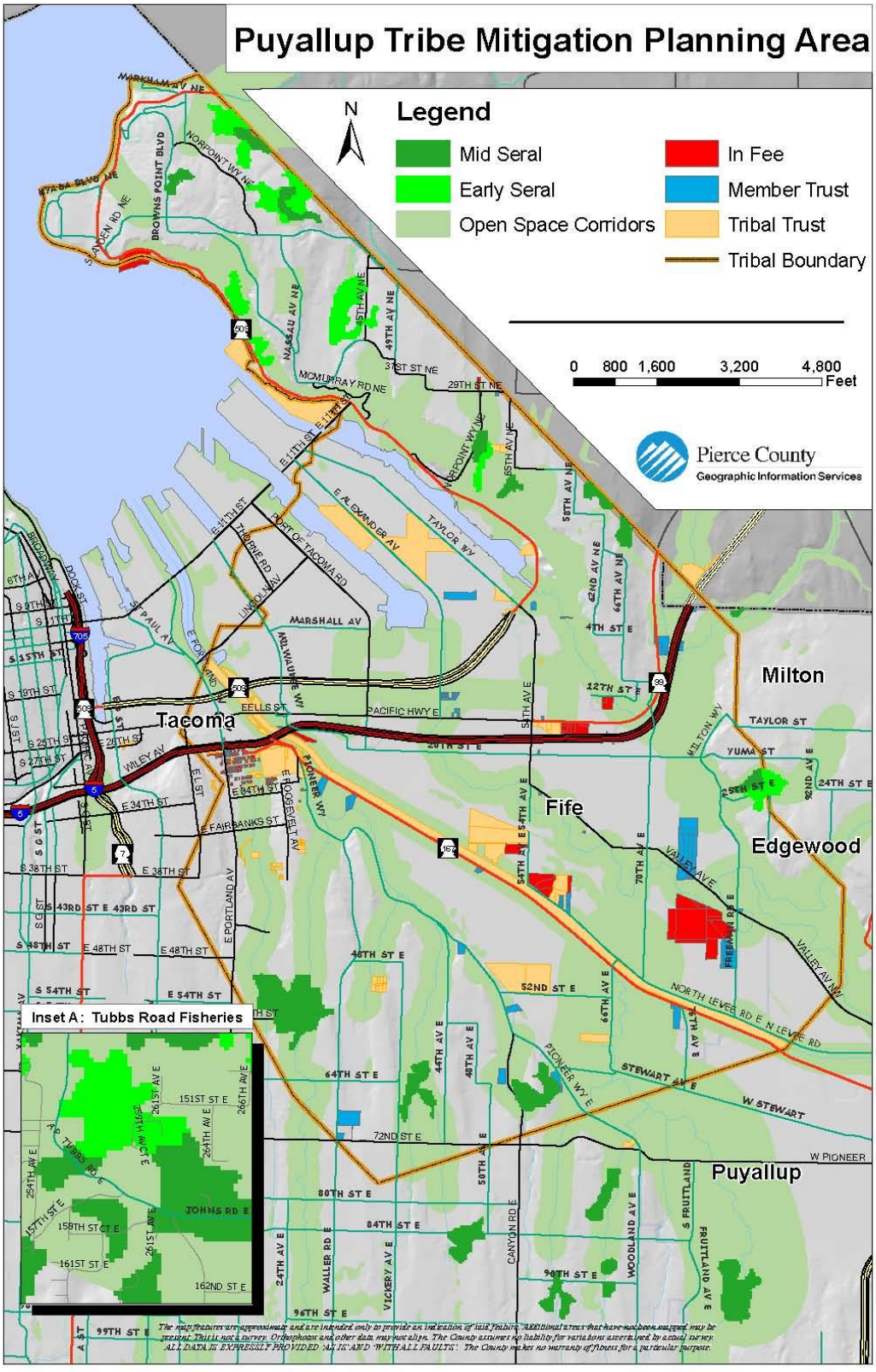
Wildfires will happen every year within the boundaries of Pierce County. Few will have the potential of developing into a WUI fire. The more rural communities have the highest potential for developing a large scale WUI fire. This includes, but is not limited to, the communities of Ashford, Elbe, Eatonville, Wilkeson, Carbonado, McKenna, and Roy.

Recurrence Rate

Today many factors affect the overall recurrence rate of fires. The main factor that was not part of the ecosystem in the past is the effect of the encroachment of humans into what has traditionally been forested area. Whether it is through logging, recreation, or the pressure of a growing population creating an expansion of homes and businesses into the traditionally rural areas of the County, the potential for fires to impact the human community has escalated over the past century and a half.

Based on information from past fire occurrences and information from the DNR, the probability of recurrence for the WUI fire hazard in Pierce County is a five year or less occurrence.

Map 4.10-5 Planning Area Wildland / Urban Interface Vulnerability



Vulnerability

Planning Area

The Planning Team determined that the Planning Area has a low vulnerability to the Wildland/ Urban Interface hazard because of the following factors: low probability of occurrence and the lack of a forest canopy community in the Planning Area. A detail map, Map 4.10-5 of the Planning Area shows there are many open corridors with the majority of foliage consisting of early seral. Early seral foliage coverage in the Planning Area is the result human population disturbances over the past 200 hundred years of vegetation removal and soil disturbance changes which have affected the plant composition and altered the conditions affecting seedling re-establishing. The Planning Area is an urban environment with shrubs, grass species and indigenous hardwood species such as Red Alder, Bitter Cherry, Big Leaf Maple, Pacific Madrone and Black Cottonwoods. This variety helps to maintain the ecosystem diversity.

In the entire Planning Area, AROUND 16,000 acres are vulnerable to wildland/urban interface fire hazards identified by the Planning Team. The total damage to the Planning Area could equal approximately $8 billion (the assessed value of all parcels in the Planning Area, October, 2016).

Impacts

Health and Safety of Persons in the Affected Area at the Time of the Incident

The health and safety of persons in the affected area at the time of the fire could be deeply compromised. Burns, smoke inhalation, psychological trauma and death are among the impacts on the population living, working, recreating, or visiting within the impacted area. The Southern California wildfires of 2003 and 2007 and the Oakland Hills fire of 1991 are perfect examples of major WUI fires that can not only cause damage, but death as well. The Oakland Hills fire killed 25 people, the 2003 Southern California fire 22, and the 2007 fires a dozen. This does not count the dozens who were injured in each of these fires.

In some ways, the psychological damage can be as traumatic as some of the physical injury. Both adults and children can present long-term psychological changes due to the incident.

Children may manifest these through regression or other actions including:

- Fear of injury or death;
- Fear of separation;
- Inability to sleep;
- Afraid of the dark;
- Afraid of closed spaces;
- Afraid of outdoors;
- Regression of toilet training/bed wetting or other outgrown childish behavior;
- Withdrawal from normal activities;
- Fear of sudden noises;
- Refusing to eat, nightmares, hyperactivity and irritability; and

- Aggressive episodes with other children. [19]

"Adult stress symptoms include: anxiety, depression, insomnia, irritability, impairment in concentration, loss of productivity, feelings of sadness and gloom, and the tendency to link the fire to other traumatic events in their life."[20]

Health and Safety of Personnel Responding to the Incident

The impacts to personnel responding to a Wildland/Urban Interface Fire include burns, trauma, smoke inhalation, psychological trauma and death. Injury and death can occur from equipment failure or not wearing the proper equipment. (The last reported major injury to a wildland firefighter in 2005 was from the responder not wearing the proper PPE.[21]) They can occur from falling snags, burnover, or even a bulldozer rolling over on steep terrain.

Approximately 20 wildland firefighters killed annually. During the 29 year period, from 1990 to 2009, 359 people nationwide were killed during wildland fire operations. This number includes contractors working the fire. Of those 359 firefighters killed, four major causes were responsible for 275 or 89% of those deaths. They are:

- Aircraft accidents, 93 people, 26% of total
- Vehicle accidents, 79 people, 22% of total
- Heart attacks, 78 people, 22% of total
- Burnovers, 65 people, 18% of total[22,23]

For example in 2005, of the 12 wildland fire deaths in the United States, three were from an airplane crash and three from auto accidents. Three were from heart attacks and the final three were one each from burns/smoke inhalation, snag and electrocution. Fifty percent of those killed were from volunteer fire departments.[24] Pierce County lost Fire Chief Dan Packer in a blaze in Yreka California on July 26, 2008 when he was doing reconnaissance and was overrun by the fire front.[25,26]

Long term effects can include heart disease, emphysema and other environmental caused disease.

Continuity of Operations and Delivery of Services

Depending on the area impacted by a Wildland/Urban Interface Fire, the continuity of operations for multiple jurisdictions or agencies might all be affected at the same time. Many of the smaller jurisdictions or agencies, especially those located in the more rural areas of the County, with a limited staff and facilities, could have their entire infrastructure destroyed, their community gone and staff may have evacuated because of the danger posed by a large WUI Fire.

Another problem is the isolation of certain areas. Many areas exist with their only access being the narrow two-lane roads that connect them to the more populated portions of the County. Pierce County also contains seven inhabited islands and one near island[27]. Four of these have their only access by ferry and three by a two lane road and bridge.

In contrast, larger entities with their infrastructure, equipment, and staff spread over a broad geographical area, will be less likely to experience the inability to continue operations. Long-term operational recovery may not be feasible for some of the smaller jurisdictions if the WUI Fire was large enough to totally, or near totally, cover their jurisdiction. Losing both the resident population due to the fire and the resulting tax base, in addition to loss of their infrastructure could make operational recovery prohibitive.

In the case of a WUI fire, the delivery of services can be broken down into two parts. First there is the delivery of services during the fire itself. With many of the smaller jurisdictions being somewhat isolated, the ability of a response to a fire could be delayed. And as staff and residents flee the area, delivery of other services will decrease and for some, become non-existent. This is exacerbated in some areas, like Ketron Island, which has no fire response at all located on the island, and is only accessible by ferry.

Second, delivery of regular, day-to-day services to the impacted area could be compromised for many months, if not years. In some cases, it is possible that the effects on service delivery will be not just to the area with direct fire damage, but also to areas around the periphery of the fire. Fire damage will include not just the building stock, but also much of the other infrastructure. Power poles and lines will be down, blacktop roads will have melted and in some cases, burned. The damage within the burned area could be so severe that few services will actually be required within it. Rather, it could be difficult providing services across the burned area to homes and businesses outside the actual area of damage. With power lines down, well houses burned, roads damaged, etc. not all services will be immediately available to neighboring communities outside the burned area. Within the burned area, infrastructure will need to be repaired prior to rebuilding being accomplished.

Property, Facilities, and Infrastructure

Within the geographic area covered by a WUI Fire there will be considerable damage to the facilities and infrastructure. The fires that burn throughout the western states present year-to-year images of the destruction possible. Pierce County, like any of these other communities, can expect private property, public facilities, equipment and infrastructure in some communities to have major damage or in some cases total loss.

These fires can become hot enough to burn asphalt, which can render the roads impassable for more than just a few days. Utility poles and wires will be totally gone. Many buildings of individual jurisdictions can be destroyed just as individuals' homes can be burned. Cars, trucks, busses and equipment caught in the path of a fire can be a total loss.

The Environment

Environmental impacts from a major wilderness fire can be extreme, and may be exacerbated even further if the fire becomes a wilderness/urban interface fire.

Normal environmental damage includes deforestation, death of animals, pollution of streams and rivers with burnt material, increased erosion and later landslides. This damage may take decades

to reverse. If the fire happens in an area of old-growth forest, which may have been in existence for hundreds of years, it could take centuries for the environment to regain its original form and biodiversity. However, even with the damage done, not everything about the damage is detrimental. The damage done to the environment and the destruction of the forest opens up areas for colonization by new plants and animals. These burned areas allow sunlight to reach the ground. In doing so, plants that have not been able to survive in the heavily shaded understory, that normally exist in old growth forests, will thrive. As they do so, they will attract animals that thrive on them. Over time, the remnants of the original forest will encroach on the open area and it will once again return to forest.

With a fire that affects the interface between the forest and the developed areas of the County, there is the problem of further pollution. The burning of materials used in construction, the rupturing of oil, gas or other hazardous materials tanks, the melting and burning of tires, and the distribution of fire fighting chemicals across the landscape.

Over the past few years, an increase in the knowledge of the effects from fire-fighting chemicals has shown that there can be long-term detrimental impacts on the environment, especially on water features and areas where the groundwater may become contaminated.[28;29] This is particularly relevant when there are repeat uses of the chemicals to control fires.

Economic and Financial Condition

The economic and financial condition of any individual jurisdiction will depend on the size of the Wildland/Urban Interface Fire and which parts of the community are directly affected. A fire that burns a couple of thousand acres of previously logged but not re-grown terrain and destroys a dozen homes will have a relatively benign long-term economic impact for the larger community. In comparison, one that destroys an area the same size, but burns an entire small community, will have long-term lasting effects, if the community is able to rebuild at all. The Southern California wildfires of 2003 and 2007 and the Oakland Hills fire of 1991 are perfect examples of major WUI fires that were able to destroy a large quantity of very expensive real estate. The long-term effects include: a loss of economic vitality because of the destroyed businesses and wilderness jobs associated with recreation and logging; a loss of tax revenue; and, possibly the permanent loss to the community of the people that lived in the homes either due to death from the fire or moving away in the aftermath of the disaster.

Public Confidence in the Jurisdiction's Governance

The reputation of the entity will be directly related to the perception of competence in handling the fire threat and how well it was handled. The more damage caused by the fire that is shown to have been preventable by some action of the agency or jurisdiction, the lower the resulting reputation will be and the greater the decrease in confidence in the entity's ability to handle future situations.

A rapidly handled fire with little damage to homes or businesses will enhance the jurisdiction's reputation while a fire that burns many homes or businesses, even if it was well–handled, may allow a lack of confidence to develop. Visuals of teams working to protect the homes and property of individuals will help to shore up this image.

Resource Directory

Regional

- **Pierce County Department of Emergency Management**
  http://www.co.pierce.wa.us/PC/Abtus/ourorg/dem/abtusdem.htm

- **State of Washington Department of Natural Resources**
  http://www.dnr.wa.gov/htdocs/adm/comm/fireinfo.html
  http://www.dnr.wa.gov/htdocs/rp/prevent.htm

- **The Washington State Industrial Fire Precaution Level System**
  http://www.dnr.wa.gov/htdocs/rp/ifpl.htm

National

- **Firewise Communities**
  http://www.firewise.org

- **Forest Service, United States Department of Agriculture**
  http://www.fs.fed.us

- **Bureau of Land Management, United States Department of the Interior**
  http://www.blm.gov/nifc/st/en/prog/fire.1.html

- **National Park Service, U.S. Department of the Interior**
  http://data2.itc.nps.gov/fire/index.cfm

- **Fish and Wildlife Service, U. S. Department of the Interior**
  http://www.fws.gov/fire/

- **Bureau of Indian Affairs, U.S. Department of the Interior**
  http://www.doi.gov/bureau-indian-affairs.html

- **National Fire Plan**
  http://www.fireplan.gov

Endnotes

[1] Modified from PC HIVA, WUI Fire Section, September 5, 2002, p.33. http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/HIVAWEB.pdf
[2] "Is Montana at Risk? Identified Hazards for The State of Montana." Montana Disaster and Emergency Services. http://dma.mt.gov/des/risks.asp [Internet Accessed February, 2007].
[3] Modified from PC HIVA, WUI Fire Section, September 5, 2002, p.33. http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/HIVAWEB.pdf
[4] Modified from Washington State Natural Hazard Mitigation Plan (DRAFT), WUI Fire Section. Washington State Emergency Management Division. September 5, 2002.
[5] Modified from PC HIVA, WUI Fire Section, September 5, 2002 p.33. http://www.co.pierce.wa.us/xml/abtus/ourorg/dem/HIVAWEB.pdf
[6] Modified from Washington State Natural Hazard Mitigation Plan (DRAFT), WUI Fire Section. Washington State Emergency Management Division. September 5, 2002.
[7] *Ibid.*
[8] Risk factors included area fire history, type and density of vegetative fuels, extreme weather conditions, topography, number and density of structures and their distance from fuels, location of municipal watershed, and likely loss of housing or business. The evaluation used the criteria in the wildfire hazard severity analysis of the National Fire Protection Association's NFPA 299 Standard for Protection of Life and Property from Wildfire, 1997 Edition.
Modified from Washington State Natural Hazard Mitigation Plan (DRAFT), WUI Fire Section. Washington State Emergency Management Division. September 5, 2002.
[9] Graphic from A Progress Report on the National Fire Plan in Washington State, Department of Natural Resources, September 2002.
[10] The Washington State Industrial Fire Precaution Level System, Washington State Department of Natural Resources, www.dnr.wa.gov/htdocs/rp/ifpl.htm#4
[11] Map from Department of Natural Resources, www.dnr.wa.gov/htdocs/rp/sdown.gif
[12] The Washington State Industrial Fire Precaution Level System, Public Use Restrictions, Washington State Department of Natural Resources, www.dnr.wa.gov/htdocs/rp/ifpl.htm#4
[13] In Western Washington the 100 to 150 year burning cycle is based on a normal forest regrowth after a major fire that burns a large section of a forest. These fires are called "Stand Replacement Fires." Once a stand replacement fire has happened it takes that long to develop enough vegetative material to support a repeat of the previous fire. Information from personal conversation with Chuck Frame, Fire Operations Manager, DNR South Puget Sound Region, 02/01/2008.
[14] Fuel Moisture Content is the quantity of moisture in the fuel expressed as a percent of the oven-dried weight. http://www.pfmt.org/fire/glossary.htm
[15] The Department of Natural Resources classifies the fires that they respond to as a Statistical or Classified Fire, an Unclassified Fire, a False Alarm, or Other Agency Response. Statistical Fire (Classified Fire): an uncontrolled fire requiring suppression action by DNR or it's cooperators to prevent the fire from spreading to or burning on any lands for which the Department of Natural Resources (DNR) has the protection responsibility.
Unclassified Fire: fires that have gone out naturally without burning onto forest lands, or that result from legitimate prescribed burning or debris burning that are extinguished by the causative agency without extra cost to DNR. It includes abandoned campfires which cannot spread or are confined to fireplaces or stoves and burning buildings, automotive equipment, haystacks, etc., which under prevailing conditions do not threaten DNR protected lands. An Other Agency Fire is one that another agency responded to within the framework of DNR land to initiate a quicker response than DNR would have been able to do. From Department of Natural Resources Fire Classification sent via correspondence from Chuck Frame at Washington DNR.
[16] The DNR South Puget Sound Region consists of King, Pierce, Kitsap, and Mason Counties as well as small portions of Lewis and Snohomish Counties.
[17] Data from statistics compiled by the Department of Natural Resources and received in a meeting with Chuck Frame, Fire Operations Manager, DNR South Puget Sound Region, 02/28/08.
[18] Personal phone conversation with Chuck Frame, Fire Operations Manager, DNR South Puget Sound Region, March 3, 2008.

[19] California Wildfires — Psychological Effects; Psychologist is Available to Discuss Trauma, From the Business Wire Oct. 26, 2003, from http://findarticles.com/p/articles/mi_m0EIN/is_2003_Oct_26/ai_109257122
[20] Ibid.
[21] Madden, Gene, Safety Zone: Too Many Lost, Reflecting on 2005 wildland fatalities, Wildland Firefighter Magazine, May 2006, Vol. 24, Issue 5 as reprinted at http://www.firerescue1.com/wildland-firefighter/24-5/104009/
[22] Wildland Fire Operations Risk Management Information Paper, Emphasis on risk management in wildland fire operations for 2007, FEMA, U.S. Fire Administration, U.S. Fire Administration, 16825 S. Seton Ave., Emmitsburg, MD 21727, available at www.usfa.dhs.gov/fireservice/subjects/wildfire/risk_management.shtm
(301) 447-1000 Fax: (301) 447-1346 Admissions Fax: (301) 447-1441
[23] Various issues of Safety Gram including, http://www.nifc.gov/wfstar/safety_gram07.pdf http://www.wildlandfire.com/docs/2009/safe/08FinalSafetyGram123108.pdf , http://www.nwcg.gov/teams/shwt/safety-grams/sg_2009-d.pdf
[24] Madden, Gene, Safety Zone: Too Many Lost, Reflecting on 2005 wildland fatalities, Wildland Firefighter Magazine, May 2006, Vol 24, Issue 5 as reprinted at http://www.firerescue1.com/wildland-firefighter/24-5/104009/
[25]Safety Gram: Fatalities, Entrapments and Serious Accident Summary for 2008 http://safenet.nifc.gov/notice.nsf/0c09f454f5ecec4c87256a17005edd36/39b02626dc0932f38725755200771ee0/$FILE/2008%20Final%20Safety%20Gram_12-31-08.pdf
[26] Fire Engineering, Fire Chief Dan Packer Dies in California Wildfire, http://community.fireengineering.com/forum/topic/show?id=1219672%3ATopic%3A69181
[27] Ketron, Anderson, McNeil and Herron Islands are accessible only by ferry and Raft and Fox Islands are accessible by two lane road and a bridge, as is Day Island which is not a true island being barely connected to the mainland at its south end The final one, Tanglewood Island has only 4 homes and is reachable only by boat.
[28] Ecological Effects of Fire Fighting Foams and Retardants, Robyn Adams and Dianne Simmons, Conference Proceedings, Australian Bushfire Conference, Albury, July 1999. from web http://www.csu.edu.au/special/bushfire99/papers/adams/
[29] Perfluorinated Surfactants and the Environmental Implication of Their Use in Fire-Fighting Foams, Cheryl A. Moody and Jennifer A Field, Environmental Science & Technology, Vol. 34, NO. 18, 2000, pps.3864 – 3870. as referenced at http://www.csu.edu.au/special/bushfire99/papers/adams/