Hazard Profile – Wildland Fire

Summary

- The hazard – Wildland fire burns 17,000 acres of state-owned or protected land annually. The cost of wildland fire on these lands is more than $28 million annually in firefighting and damage to timber, habitat, and property.

- Previous occurrences – Washington has a long history of both small and very large fires. Some fires can reach 100,000 acres or more, which has occurred seven times since 1902. The state has experienced 19 fires of at least 2,500 acres on state-owned or protected land since 1992. The most recent large fire was the School Fire in 2005, which burned 52,000 acres, destroyed 215 homes and outbuildings, and damaged another 176 buildings.

- Probability of future events – About 900 wildland fires occur each year on state-owned or protected land; most are small and less than one acre in size. About 70 percent occur in Eastern Washington. Humans cause most wildland fires. The wildland fire season usually begins in early July and typically culminates in late September, but fires have occurred in every month of the year.

- Jurisdictions at greatest risk – The Washington Department of Natural Resources has identified 181 communities in 34 counties at greatest risk to wildland fire, based on criteria in the wildfire hazard severity analysis developed by the National Fire Protection Association.

Introduction [1, 2, 3, 4, 5, 6]

Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property.

The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event; however, wildland fires have occurred in every month of the year. Drought, snow pack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires. Lightning generally is the cause of most fires in the peak fire period of July, August and early September.

Short-term loss caused by a wildland fire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds; vulnerability to flooding increases due to the destruction of watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure.

The Washington Department of Natural Resources protects 2.5 million acres of state-owned land and 10 million acres of land in private ownership through legislative directive [RCW 76.04].

The department fights about 900 wildland fires per year across the state; about 70 percent are in Eastern Washington. Most are small, usually extinguished while they are less than one acre in size. People start most wildland fires on state lands; major causes include arson, recreational fires that get out of control, smokers' carelessness, debris burning, fireworks and children playing with fire. The major cause of fires on federally protected lands is lightning.

Wildland fires can spread to more than 100,000 acres, depending on a number of factors, and may require thousands of firefighters and several months to extinguish. Federal, state, county, city, and private agencies and private timber companies provide fire protection and firefighting services on forestlands in Washington.

Factors that influence wildland fire

A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.

- Fuel:
  - Lighter fuels such as grasses, leaves and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite.
  - Snags and hazard trees – those that are diseased, dying, or dead – are larger west of the Cascades, but more prolific east of the Cascades. In 2005, about 2.5 million acres of the state's 21 million acres of forestland contained trees killed or defoliated by forest insects and diseases.

- Weather:
  - West of the Cascades, strong, dry east winds in late summer and early fall produce extreme fire conditions. East wind events can persist up to 48 hours with wind speed reaching 60 miles per hour; these winds generally reach peak velocities during the night and early morning hours.
  - East of the Cascades, summer drying typically starts in mid June and runs through early September, with drought conditions extending this season. Passage of a dry, cold front through this region can result in sudden increase in wind speeds and a change in wind direction affecting fire spread.
  - Thunderstorm activity, which typically begins in June with wet storms, turns dry with little or no precipitation reaching the ground as the season progresses into July and August. Thunderstorms with dry lightning are more prevalent in Eastern Washington.

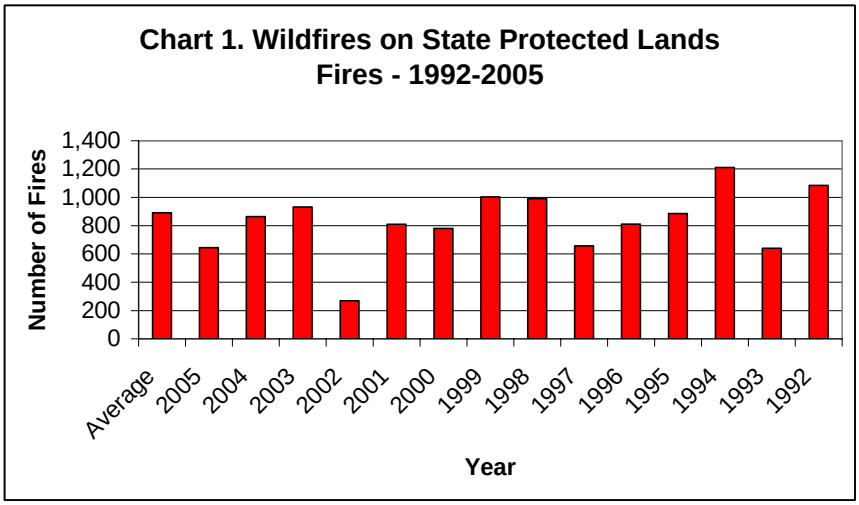
- Terrain:
  - Topography of a region or a local area influences the amount and moisture of fuel.
  - Barriers such as highways and lakes can affect spread of fire.

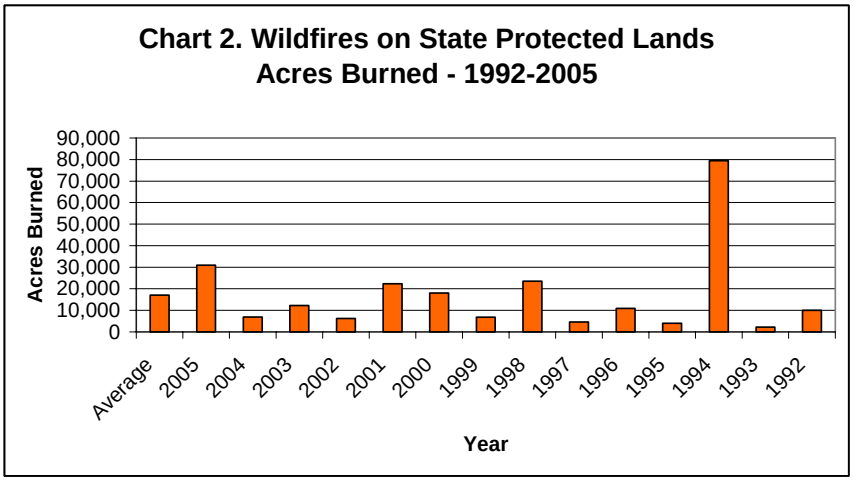
- Elevation and slope of landforms – fire spreads more easily as it moves uphill than downhill.

The peak burning period of a fire generally is between 1 p.m. and 6 p.m., with local factors (generally described above) greatly influencing this. Wildland fires can take on a life of their own when there is plenty of heat and fuel. They can create their own winds and weather, generating hurricane force winds of up to 120 miles per hour. Fires can heat fuels in their path, drying them out, and making them easier to ignite and burn.

Frequency of Occurrence

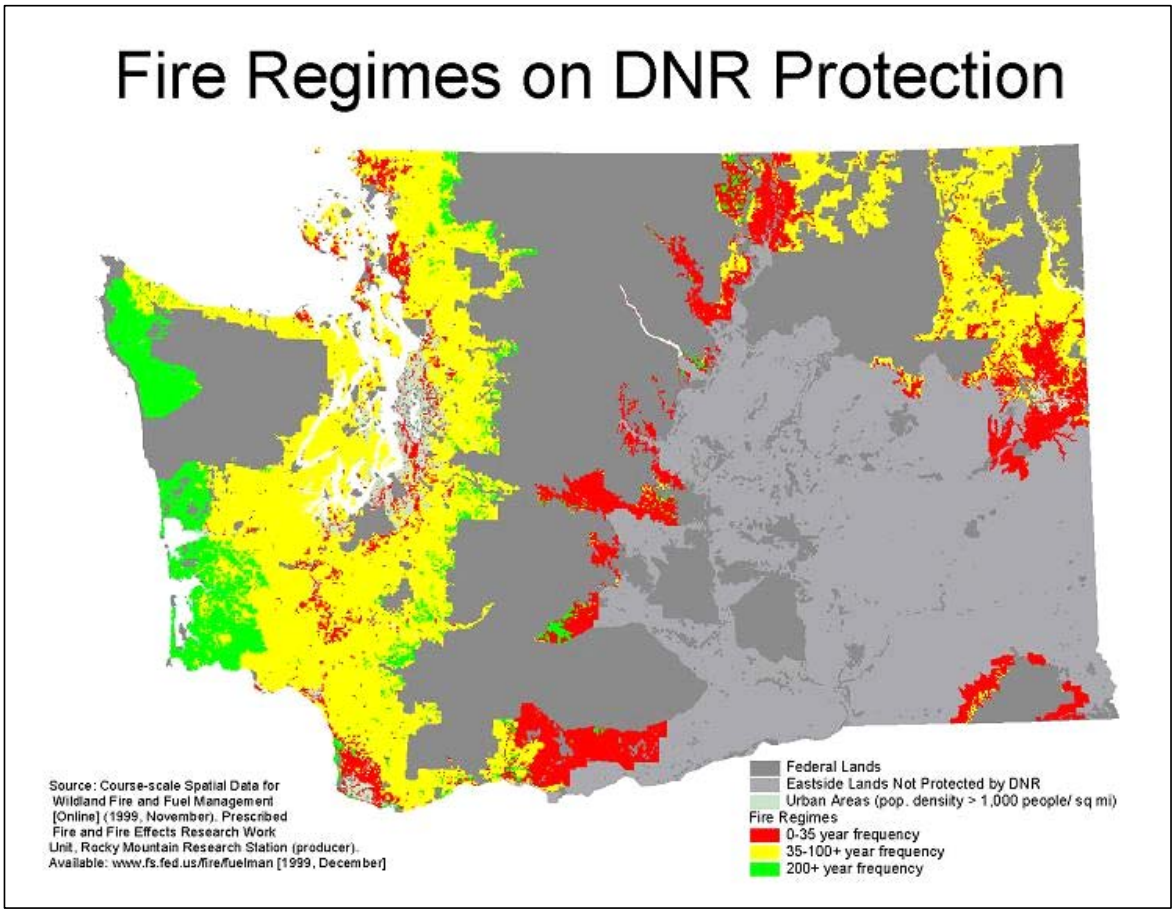
Based on figures from 1992 through 2005, about 900 fires have occurred annually on state protected lands (Chart 1), burning about 17,000 acres each year (Chart 2). Human causes account for more than half of the fires each year.





Source: Washington Department of Natural Resources

The fire regime map, below, shows fire frequency for state-protected lands in Washington; the map shows wildland fire occurs more frequently in the eastern part of the state.

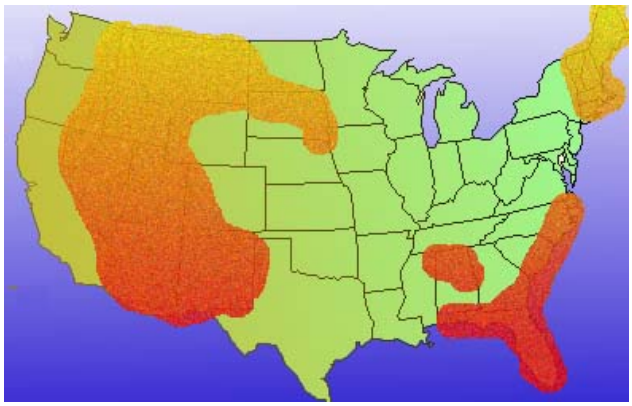


Fire Seasons

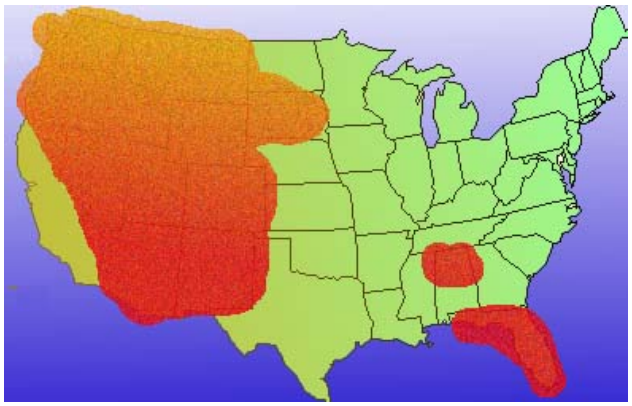
The wildland fire season in Washington usually begins in early July and typically culminates in late September. The fire season typically is longer in Eastern Washington than in Western Washington; fuel moisture and ignition sources play the most significant roles in the difference.

- The eastern half is drier; the western half of the state receives more rainfall, and has spring seasons that are wetter and cooler than the east.

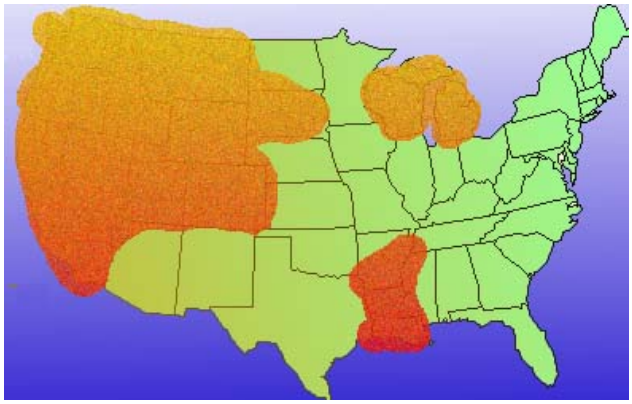
- Eastern Washington has a larger number of ignition sources, primarily the number of lightning strikes.



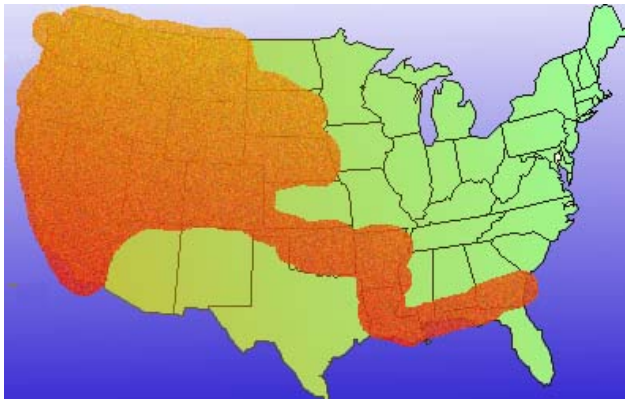
Fire Season – June



Fire Season – July



Fire Season – August



Fire Season – September

Source: Firewise Communities Program / USDA Forest Service[7]

Impact of Wildland Fire on State-Owned or Protected Land[8]

The cost of wildland fire on state-owned or protected lands is more than $28 million annually in firefighting and damages (based on figures available from the 1992 through 2003 fire seasons, the latest available).

Wildland fires cause about $9.6 million in damage annually. The bulk of the losses are harvestable timber and timber products valued at more than $6.8 million. Fire also destroys forage, wildlife, watersheds, recreation areas, and real and personal property valued at more than $2.8 million.

Data on indirect impacts of wildland fire, such as the economic loss caused by reduced revenue and tax receipts from reduced timber and crop sales or leasing of rangeland, is not available.

Significant Wildland Fires Since 1900 [9, 10, 11, 12, 13, 14]

Table 1, below provides information on some of the most significant wildland fires in Washington since 1900. This includes fires on lands of all ownership – federal, state, local, private, and Indian tribe.

Table 1. Significant Wildland Fires Since 1900

Year	Fire	Area	Acres Burned	Impacts
1902	Yacolt	Skamania, Clark Counties	238,900	38 deaths.
1910	Great Idaho Fire	Spokane and Pend Oreille Counties	150,000	3 million acres burned, mostly in Idaho and Montana; considered one of the nation's historically significant fires.
1929	Dole Valley	Skamania, Clark Counties	227,500	
	Toats Coulee	Okanogan County	80,000	
1951	Great Forks Fire	Clallam County	33,000	Fire threatened Forks leading to evacuation of the town. A sawmill, and a number of homes, cabins and barns destroyed.
1970	Lightning Bust	Chelan, Okanogan Counties	188,000	
1985	Barker Mountain	Okanogan County	60,000	
1987	Hangman Hills	Spokane	1,500	2 deaths; 24 homes destroyed.
1988	Dinkelman	Chelan County	50,000	1 death.
1991	Firestorm 1991	Ferry, Lincoln, Stevens, Pend Oreille, Spokane, and Whitman Counties	35,000	92 fires destroyed 114 homes and 40 buildings, another 250-300 buildings damaged, one death. Fires started by arcing electrical connections, spread over wide area by high winds. Federal Disaster #922. Stafford Act disaster assistance provided: $12.3 million.
1992	Skookum	Klickitat County	51,000	
1992	Castlerock Canyon	Wenatchee		24 homes destroyed.
1994	Tyee Creek, Hatchery Creek, Rat Creek, Round Mountain	Chelan County	180,000	2,700 homes threatened and evacuated, 37 homes destroyed.

Table 1. Significant Wildland Fires Since 1900

Year	Fire	Area	Acres Burned	Impacts
1996	Cold Creek	Benton, Yakima Counties	57,000	
2000	24 Command	Hanford Site, Benton County	192,000 (160,000 on Hanford Site)	Caused by vehicle accident, spread to Hanford Site; 36 structures lost. Burned across three radioactive waste disposal sites, no radioactive release detected. Fire came within two miles of 177 underground storage tanks filled with lethal radioactive waste.
2000	Mule Dry	Yakama Indian Reservation and Yakima, Klickitat, and Benton Counties	76,800	1 home destroyed.
2001	Rex Creek Complex / Virginia Lake Complex	Colville Indian Reservation and Chelan, Ferry, Okanogan Counties	130,000	Hundreds of homes threatened, 10 destroyed.
	Thirtymile	Okanogan	9,300	4 firefighters died.
2002	Deer Point	Chelan County	42,665	5 homes, 4 outbuildings destroyed.
2005	School	Columbia, Garfield counties	52,000	109 homes, 106 outbuildings destroyed; 120 homes, 56 outbuildings threatened. $15 million suppression costs.

Major Wildland Fires on State-Owned or Protected Lands, 1992-2005 [15, 16, 17]

Table 2, below, provides information on some of the most significant wildland fires on state-owned or protected lands during the latest 14-year period. (Note: List below generally does not include fires referenced above. Acreage burned figures are for state-owned or protected lands only; fires may have burned land under other ownership/protection.)

Table 2. Major Wildland Fires on State Protected Lands, 1992 – 2005

Year	Fire	County/Area	Acres	Impacts
1992	Skookum	Klickitat	2,600 (state protected lands only)	Fire threatened town of Goldendale.
1996	Bowie Road	Spokane	3,020	8 homes destroyed.
1997	Red Lake	Stevens	1,151	5 homes destroyed.
1998	Cleveland	Klickitat	18,500	11 homes destroyed, 143 cattle killed. Several cultural and historic sites and state natural area preserve damaged.
1999	Mallot	Okanogan	2,808	
2000	Alderdale	Klickitat	6,000	
	Rocky Hull	Okanogan	9,404	37 homes destroyed.
	Cayuse	Okanogan	5,460	
	Goodnoe	Klickitat	4,455	Destroyed pastureland, 1 barn.
	Buffalo Lake	Colville Indian Reservation	9,300	
	Wood Gulch	Klickitat	2,620	
2001	Libby	Okanogan	3,830	50 structures threatened, none lost.
	Spruce/Dome Complex	Yakima	2,442	
	Brewster Complex	Okanogan	6,154	
	Union Valley	Chelan	4,700	100 structures threatened, 3 destroyed.
	North Coppei	Columbia	4,810	
2002	Deer Mountain	Chelan	2,281	
2004	Mud Lake		4,000	
	Pot Peak-Sisi Ridge	Chelan	47,170	
2005	Dirty Face	Chelan	1,150	$6.7 million suppression costs.
	Second HUDS	Okanagon	4,274	$2 million suppression costs.
	West Omak Lake	Okanagon	11,325	$2 million suppression costs.
	Wood Gulch	Klickitat	5,400	$500,000 suppression costs.

Jurisdictions Most Vulnerable to Wildland Fire[18]

The State Forester designated 181 Wildfire-Urban Interface Communities as being at high risk to wildfire. A map (page 10) and list of designated communities (page 11) follow; the red shaded area of the map depicts at-risk areas by zip code.

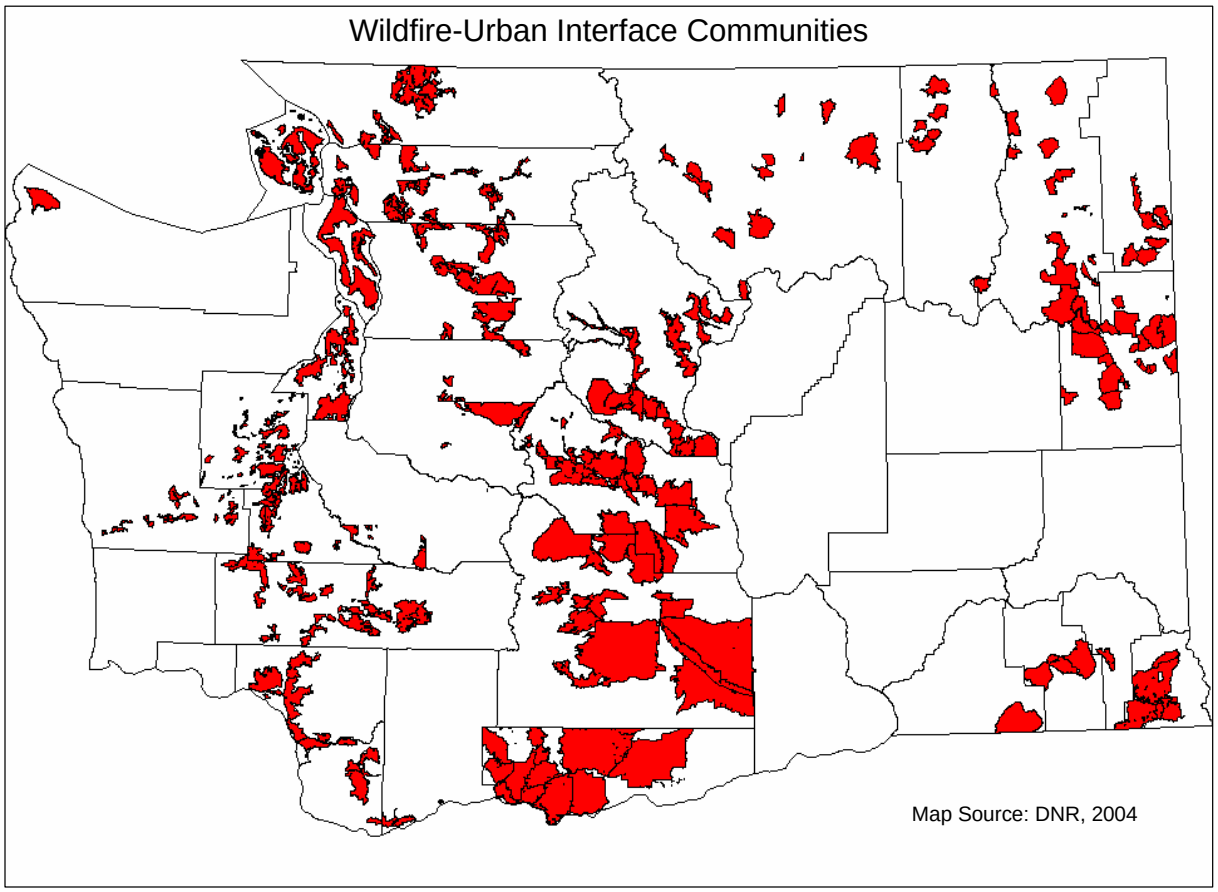
The Washington Department of Natural Resources and its federal and local partners determined the listed 181 communities are at high risk after evaluating them for fire behavior potential, fire protection capability, and risk to social, cultural and community resources. Risk factors included area fire 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.

The counties in which these jurisdictions lie are:

Asotin	Chelan	Clallam	Clark	Columbia	Cowlitz	Ferry
Garfield	Island	King	Kitsap	Kittitas	Klickitat	Lewis
Mason	Okanogan	Pend Oreille	Pierce	San Juan	Skagit	Skamania
Snohomish	Spokane	Stevens	Thurston	Walla Walla	Whatcom	Yakima

Urban Interface Communities at High Risk to Wildfire

12 Mile
7 Mile
Aeneas Valley
Ahtanum
Alta Lake
Amboy
Asotin Creek
Aspen Meadows
Bakers Pond
Beacon Hill
Bead Lake
Belle Vista
Ben Howard
Big Lake
Blewett
Brender Canyon
Burnt Valley
BZCorners
Cabin Creek
Camano
Capitol Forest
Carlton
Carnation
Castle Rock
Centralia Alpha
Chewelah Golf Co
Chiliwist
Chuckanut Mtn.
Chumstick
Cinebar
Clayton
Cle Elem
Cloverland
Colockum
Conconully
Concrete
Cooper Point
Cowiche
Coyote Trail
Crumbacher
Curlew
Darrington/Sauk
Deer Lake
Dennison Chattar
Devil Mtn.
Diamond Lake
East Ellensburg
Elk Heights
Ellensburg Pass
Enterprise
Entiat
Enumclaw
Fertile Valley
Fidalgo
Field Spring
Finley-Dry Gulch
Flowery Trail
Foothills
Ford
Four Mounds
Furport
Geiger
Glacier
Glenoma
Glenwood
Grande Ronde
Green Canyon
Greenwater
Grouse Flats
Guemis
Haward
Herron Creek
High Prairie
Highway 410
Hockinson
Icicle Creek
Index
Jim Creek
Johnson Point
Jump Off
Kalama
Kalispell Reserv
Kelly Hill
Kelso
Kendall
Kettle Falls
Kitsap
Klickitat East
Klickitat Heights
Klickitat Valley
Lake Chelan
Lake Kachness
Lake Lawrence
Lake Wenatchee
Liberty
Liberty Lake
Longview
Lookout Mtn
Loomis
Loon Lake
Lopez
Lower Lake Cle E
Lower Lake Keech
Lower Valley Nor
Lower Valley Riv
Lower Valley Sou
Lower Wenas
Lummi
Makah
Malloy Praire
Malo East
Maloney Mountain
Manastash
Marblemount
Marshall
Martin/Mossy
Mason
Mazama
Mccoy Flats
Midway
Mill Creek
Mission Creek
Montesano
Mount Hull
Moxee
Mt. Loop
Mtn Home Rd
Mullen Hill
National
Navarre Coulee
Newman Lake
Nooksack
North Bend
NW Goldendale
Onion Creek
Orcas
Orient
Oso/Cavanaugh
Outer Islands
Painted Hills
Park Road
Peoh Point
Peshastin Creek
Plain
Pleasant Prairie
Ponderosa
Porter
Reecer
Rendevous
Republic
Ridge at Hangman
Rimrock
Robinette
Rochester
Rockport
Roy-McKenna
Salmon LaSac
Samish
San Juan
Shaw
Skamania
Skykomish
Snoqualmie
Snowblaze
Snowden
South Skagit
Springdale
Squilchuck
Steamboat Island
Stemilt
Stevenson
Suncrest
Teanaway
Teanaway2
Tenino
Terrace Heights
Trout Creek
Trout Lake
Tum Tum
Union Valley
Upper Nason Crk.
Upper Wenas
Waitsburg
Waitts Lake
Washougal
Washougal River
West Grays
West Lewis
West Wenatchee
Whatcom
Whidbey
White River
White Salmon
White Swan
Winlock
Winthrop
Woodland
Yacolt
Yakima Canyon



Source: Department of Natural Resources, 2004.

At-Risk State Agency Facilities

State Agency facilities identified as being at-risk to wildland fire (see table, page12) were determined using geo-spacial software to match their location to the wildland fire-urban interface hazard zone, represented on the above map.

State Agency Structures At Risk	VULNERABILITY ASSESSMENT	
Number and Function of Buildings	**Approx. Square Footage of Facilities**	**Approx. Value of Owned and Leased Structures and Building Contents**
Total at-risk buildings: 1,731 state facilities were identified as being in the wildland fire-urban interface hazard zone potentially at-risk to direct damage or to the indirect impacts of wildland fire (utility services reductions, transportation restrictions, etc.).	6,519,583	$1,303,916,600

Function of at-risk buildings: Included in the state facilities potentially at-risk to wildland fires in the urban interface are the following:

- University of Washington's Big Beef Creek Laboratory and Friday Harbor Marine Laboratory.
- Communication towers and facilities of the Washington Departments of Natural Resources, Transportation, and State Patrol.
- Ferry terminals at Southworth, Bremerton, Clinton, Keystone, Lopez Island, and Friday Harbor, and a variety of vehicle maintenance, storage and other facilities of the Department of Transportation.
- Lewis River, Tucannon, Mossyrock, Methow, Marblemount, and Arlington fish hatcheries, and facilities at a variety of wildlife and fishing access areas belonging to the Department of Fish and Wildlife.
- Campus of Echo Glen Children's Center for juvenile offenders.
- Grandview and Toppenish armories of the State Military Department
- The Washington Veteran's Home in Retsil.
- Picnic, comfort, shelter and other facilities at more than 30 parks operated by the State Parks and Recreation Commission.

Total at-risk critical facilities: 217 state critical facilities were identified as being in the wildland fire-urban interface hazard zone potentially at-risk to direct damage or to the indirect impacts of wildland fire (utility services reductions, transportation restrictions, etc.).	745,729	$150,945,800

Function of at-risk critical facilities: Included in the state facilities potentially at-risk to wildland fires in the urban interface are the following:

- Lighhouses at Fort Casey and Limekiln State Parks.
- Pump houses, chemical storage, emergency generators and other facilities at state parks, state fish hatcheries, and transportation department installations statewide.
- Communication towers and facilities of the Washington Departments of Natural Resources, Transportation, and State Patrol.
- Campus of Echo Glen Children's Center for juvenile offenders.

[1] *Washington State 2001 Hazard Identification and Vulnerability Assessment*, Washington State Military Department, Emergency Management Division, April 2001.

[2] Untitled document in *The Winning Series* describing the fuels, strategy, tactics, special safety and logistical concerns in the Pacific Northwest, Wildfire Lessons Learned Center, National Wildfire Coordinating Group, <http://www.wildfirelessons.net/Winning_Series.htm>, (August 5, 2003).

[3] Washington Department of Natural Resources, annual fire statistics, 1992 – 2005.

[4] *Washington Forest Health Issues in 2005,* Washington Department of Natural Resources, <http://www.dnr.wa.gov/htdocs/rp/forhealth/2005highlights/fhresultsinter.html>, (July 14, 2006).

[5] Oral communication from Bob Bannon, Natural Resource Program Section Administrator, Resource Protection Division, Washington Department of Natural Resources, August 1, 2003.

[6] Written communication from Jennifer Bammert, Resource Protection Division, Washington Department of Natural Resources, November 14, 2003.

[7] Firewise Communities, <http://www.firewise.org/resources/peak_fire_seasona_index.html>, (July 12, 2006).

[8] Washington Department of Natural Resources, annual fire statistics, 1992 – 2005

[9] Ibid.

[10] *Washington Wildfire Mitigation Plan*, Washington Department of Community Development and Washington Department of Natural Resources, May 1994.

[11] *Firestorm '91 And Wind Mitigation Survey Report, FEMA-922-DR-WA*, Washington Department of Community Development and Washington Department of Natural Resources, November 1992.

[12] Washington State Emergency Operation Center incident records, Washington Emergency Management Division, 1994 – 2001.

[13] Written communication from Paul Hampton, Resource Protection Division, Washington Department of Natural Resources, November 17, 2003.

[14] *DNR Resource Protection Program 2005 Summary*, Washington Department of Natural Resources, March 2, 2006.

[15] Washington State Emergency Operation Center incident records, Washington Emergency Management Division, 1994 – 2001.

[16] Washington Department of Natural Resources, annual fire statistics, 1992 – 2005

[17] *DNR Resource Protection Program 2005 Summary*, Washington Department of Natural Resources, March 2, 2006.

[18] Originally published in *Federal Register*, Volume 66, Number 100, pages 43432-43433, August 17, 2001, and updated by the Washington Department of Natural Resources in *A Progress Report on The National Fire Plan in Washington,* 2002. List Revised, 2004.