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Forestry
Forest Health Protection
Intermountain Region
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State of Nevada

Nevada
Division of Forestry
Department of
Conservation and Natural
Resources

2015 Forest Pest Conditions In Nevada

Juniper Mistletoe Damage
Virginia City Highlands , Nevada
(Photo: Gene Phillips)

Forest Health Specialists

Forest Health Protection

USDA Forest Service
Ogden Field Office
Forest Health Protection
4746 S 1900 E
Ogden, UT 84403
Phone: 801-476-9720
FAX: 801-479-1477

Steve Munson, Group Leader
Email: smunson@fs.fed.us
Darren Blackford, Entomologist
Email: dblackford@fs.fed.us
Danielle Malesky, Entomologist
Email: dmalesky@fs.fed.us
Valerie DeBlander, Forestry Technician
Email: vdeblander@fs.fed.us
John Guyon II, Pathologist
Email: jguyon@fs.fed.us
Elizabeth Hebertson,
Entomologist/Pathologist
Email: lghebertson@fs.fed.us
Laura Dunning, Program Assistant
Email: ldunning@fs.fed.us

Nevada Division of Forestry

Department of Conservation
and Natural Resources
State Headquarters
2478 Fairview Dr.
Carson City, NV 89701
Gene Phillips, Forest Health Specialist
Email: gphillips@forestry.nv.gov
Phone: 775-849-2500 Ext..241

John Christopherson, Resource
Program Manager
Email: jchrist@forestry.nv.gov
Phone: 775-684-2507

Compiled by:
Gene Phillips, Forest Health Specialist, NDF DCNR
&
Danielle Reboletti, USFS, Entomologist

With Contributions from:
John Guyon II, USFS FHP Pathologist
Jeff Knight, Nevada State Entomologist

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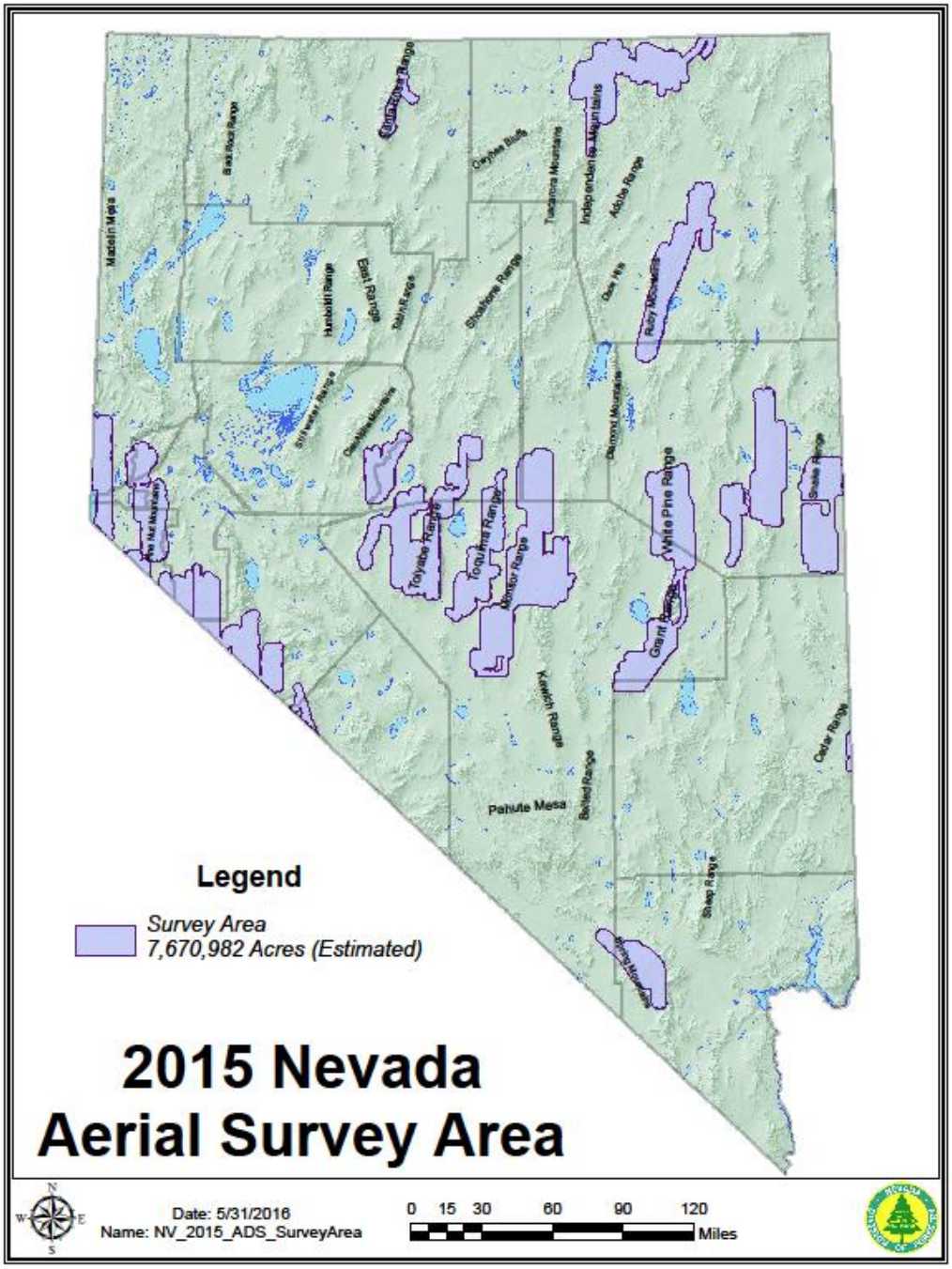

INTRODUCTION AND SUMMARY

In an effort to simplify discussions of forest health conditions in Nevada, this report focuses on only insects, diseases, and weather factors that impacted various tree species in the State. Data collected through aerial detection surveys (ADS) conducted by the USDA Forest Service and Nevada Division of Forestry are primarily used to determine mortality trends in the State from year to year. Mortality trends are described in terms of acres affected; however, not all trees on these acres are dead. Thus, an estimate of the number of trees killed is also provided. Not all forested lands are surveyed, and not all of the same acres are surveyed every year. Sometimes, tree mortality may be counted in the same area in consecutive years. This can lead to inflated estimates of actual tree mortality. Total acres tallied may also change between years due to increases or decreases in the total number of acres surveyed. Consequently, interpretation of ADS data should consider these sources of inconsistency Most of the area flown in 2014 was comprised of National Forest System (FS) and Bureau of Land Management (BLM) lands in eastern and central Nevada. The ADS data encompasses most of the Humboldt-Toiyabe National Forest including portions of the Bridgeport and Carson Ranger Districts located in California. A smaller percentage of acreage was surveyed to obtain data for Great Basin National Park, other federal lands, State lands, and private lands (Table 1).

TABLE1. TOTAL NUMBER OF ACRES SURVEYED IN EACH OF THE OWNERSHIP CATEGORIES FOR THE YEARS 2008 TO 2015

Table 1. Total number of acres surveyed in each of the ownership categories for the years 2008-2015.

Land Ownership/ Year	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
NF H-T (NV)	4,757,970	3,998,170	4,340,053	4,008,334	4,011,229	3,340,095	4,429,990	4,916,969
NF H-T (CA)	582,000	551,238	595,850	582,933	582,933	685,252	595,007	625,488
BLM	1,924,990	2,074,498	2,299,901	1,937,082	1,892,996	1,013,172	1,483,353	1,597,815
Private (NV)	440,637	540,760	360,865	519,280	306,606	148,504	391,378	397,047
Private (CA within NF)	31,800	28,071	32,335	41,528	29,846	60,155	70,501	32,977
Great Basin NP	75,995	77,005	76,890	75,604	75,604	76,959	77,021	77,078
Other Federal*	41,967	38,530	1,007	33,228	33,228	6,466	5,124	3,719
NV State Lands	17,073	22,113	20,579	20,105	17,163	148,504	21,848	19,889
TOTAL	7,872,432	7,330,385	7,727,480	7,218,094	6,949,605	5,479,107	7,074,222	7,670,982

*Includes United States Fish and Wildlife Service, Department of Defense, Bureau of Indian Affairs, and other tribal lands

Long term insect trend data summarizes activity detected on all surveyed ownerships in NV. However, the discussions of activity for individual insect and disease agents detected in 2015 are Nevada only and summarized on a county basis. The total number of acres in each county and the percentage of acres surveyed during 2015 are provided in Table 2.

TABLE 2 NUMBER AND PERCENTAGES OF ACRES SURVEYED IN NEVADA COUNTIES IN 2015

COUNTY	COUNTY ACRES	ACRES SURVEYED	PERCENT SURVEYED
Carson City	**103,569**	**47,008**	**45.4**
Churchill	3,215,911	115,053	3.6
Clark	5,176,177	231,167	4.5
Douglas	478,351	271,424	56.7
Elko	10,979,963	1,201,582	10.9
Esmeralda	2,294,165	32,577	1.4
Eureka	2,663,738	181,318	6.8
Humboldt	6,219,557	97,851	1.6
Lander	3,534,543	388,892	11
Lincoln	6,782,623	60,771	0.9
Lyon	1,310,315	330,290	25.2
Mineral	2,462,989	353,255	14.3
Nye	11,686,348	2,274,235	19.5
Storey	167,774	76,856	45.8
Washoe	4,234,009	196,860	4.6
White Pine	5,676,727	1,478,008	26
Total	66,986,759	7,337,148	11

In the winter of 2014-2015, moisture levels remained below average, and were at historic lows for the state of Nevada. The winter of 2015-2016, in Nevada showed much improvement with about normal winter precipitation throughout the state. Extreme drought conditions are still present, but exist mainly in west and northwest sections of the state. The rest of the state has improved from last year when almost the entire state was in exceptional drought. (Figure 1). The palmer Drought Stress Index still shows Nevada at being historic levels of drought, but conditions continue to improve as of the time of writing this reports and looks to improve through the spring of 2016 (Figure 2).

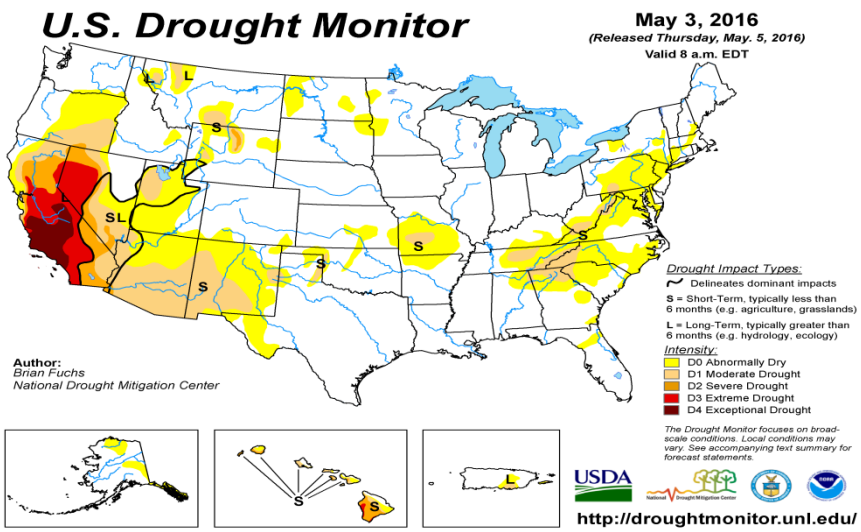

Figure 1 US Drought Monitor Map for May 3, 2016

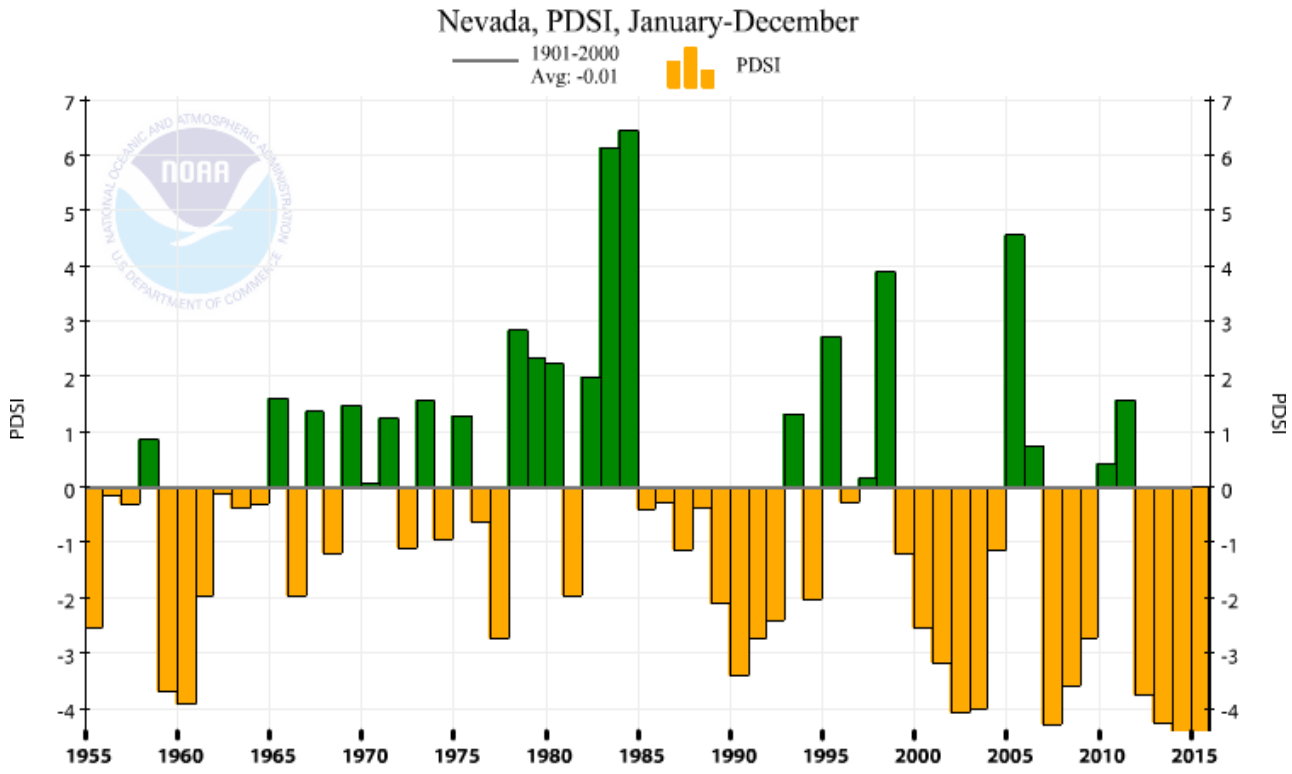

Figure 2 - National Oceanic and Atmospheric Administration (NOAA) Nevada Palmer Drought Severity Index – January - December Precipitation from 1955-2015 (National Climate Data Center).

In 2015, the amount of insect and disease caused mortality decreased. This decrease in insect and disease related mortality may be attributed to several factors. Factors include, but are not limited to, the natural population trends of insects over the course of time given the increase in predatory and secondary insect post outbreaks. Additional factors likely exist that explain this trend.

Most of the tree mortality noted in 2015 is attributed to insect activity. Acres affected were largely dominated by pinyon scale & engraver, followed by mountain pine beetle and fir engraver beetle. Please note that some bark beetle-killed trees are not typically symptomatic (faded foliage) until one year following the year of attack. Therefore, the numbers of acres affected and trees killed by bark beetles, as recorded during ADS flights, are typically a reflection of the previous year's or earlier attacks. Levels of defoliation, however, may reflect either the activity of an insect or disease during the current year or activity since bud break. .

In 2015, Nevada mortality caused by most insects and diseases (number of trees killed) decreased from 2014 for the fifth year in a row. Mountain pine beetle in lodgepole, whitebark, white, and limber pine decreased to 1,269 acres. Fir engraver beetle mortality, decreased to only 690 acres down from 1,460 acres in 2014.

In 2015, acres affected by defoliators decreased. Pinyon needle scale decreased in 2015 with a total 2,827 acres damaged down from a total of 5,550 acres in 2014. ii) Pinyon sawfly, and Douglas-fir tussock moth were not detected in 2015 with no damaged acres recorded. Forest tent caterpillar was not detected in 2015. Whiate satin moth infestations were noted in the north and west portions of the state with no acres mapped, but is noted be present in Washoe, Humboldt, Elko and Lander counties.

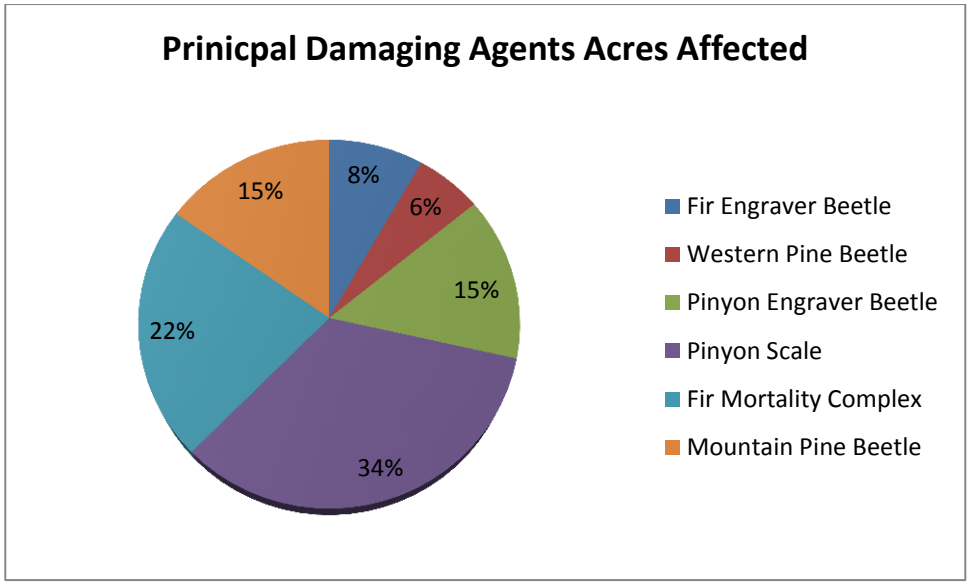

Figure 2 – Grahpic representation of the acres affected in Nevada by the main mortality and defoliation agents aerially mapped in 2015.

For additional information on forest insect and disease conditions and maps see:
http://foresthealth.fs.usda.gov/portal
and
http://forestry.nv.gov/forestry-resources/forest-health/

NOXIOUS WEEDS

Noxious weed species are widespread throughout Nevada. Nevada Department of Agriculture (NDOA) monitors and oversees Nevada's weed laws. Their main website for weed status, information, contacts, etc is:
http://agri.nv.gov/PLANT_NoxWeeds_index.htm

Below is NDOA's listing of Noxious Weeds in Nevada by Category A, B or C: Table 5

Common Name	Scientific Name
Category A Weeds:	
African Rue	Peganum harmala
Austrian fieldcress	Rorippa austriaca
Austrian peaweed	Sphaerophysa salsula / Swainsona salsula
Black henbane	Hyoscyamus niger
Camelthorn	Alhagi camelorum
Common crupina	Crupina vulgaris
Dalmation Toadflax	Linaria dalmatica
Dyer's woad	Isatis tinctoria
Eurasian water-milfoil	Myriophyllum spicatum
Giant Reed	Arundo donax
Giant Salvinia	Salvinia molesta
Goats rue	Galega officinalis
Green Fountain grass	Pennisetum setaceum
Houndstongue	Cynoglossum officinale
Hydrilla	Hydrilla verticillata
Iberian Starthistle	Centaurea iberica
Klamath weed	Hypericum perforatum
Malta Star thistle	Centaurea melitensis
Mayweed chamomile	Anthemis cotula
Mediterranean sage	Salvia aethiopis
Purple loosestrife	Lythrum salicaria, L.virgatum and their cultivars
Purple Star thistle	Centaurea calcitrapa
Rush skeletonweed	Chondrilla juncea
Sow Thistle	Sonchus arvensis
Spotted Knapweed	Centaurea masculosa
Squarrose knapweed	Centaurea virgata
Sulfur cinquefoil	Potentilla recta
Syrian Bean Caper	Zygophyllum fabago
Yellow Starthistle	Centaurea solstiltialis
Yellow Toadflax	Linaria vulgaris
Category B Weeds:	
Carolina Horse-nettle	Solanum carolinense

Diffuse Knapweed	Centaurea diffusa
Leafy spurge	Euphorbia esula
Medusahead	Taeniatherum caput-medusae
Musk Thistle	Carduus nutans
Russian Knapweed	Acroptilon repens
Sahara Mustard	Brassica tournefortii
Scotch Thistle	Onopordum acanthium
White Horse-nettle	Solanum elaeagnifolium
Category C Weeds:	
Canada Thistle	Cirsium arvense
Hoary cress	Cardaria draba
Johnson grass	Sorghum halepense
Perennial pepperweed	Lepidium latifolium
Poison Hemlock	Conium maculatum
Puncture vine	Tribulus terrestris
Salt cedar (tamarisk)	Tamarix spp
Water Hemlock	Cicuta maculata

Nevada Department of Agriculture (NDOA) began receiving USFS, State and Private Forestry grants in 2002. Working cooperatively with Cooperative Weed Management Areas (CWMA), they have been able to treat over 50,000 acres of noxious weeds statewide since 2002. Currently there are 37 Nevada CWMA's in the state. Each county in Nevada has at least one CWMA. In 2007, NDOA released bio-control agents for the following weeds and counties: spotted knapweed (Ely, White Pine County), Canada thistle (Gardnerville, Douglas County), and dalmatian toadflax (Pioche, Lincoln County). In 2011, Dalmatian toadflax and tamarisk leaf beetle collections and releases are being coordinated by Jeff Knight, State Entomologist. Tamarisk beetle (*Diorhabda elongate*) has now been observed south along Lake Mead and is found to be active in Big Bend State Park, in Laughlin, Nevada.

INSECTS: NATIVE

DEFOLIATORS

Douglas-fir Tussock Moth
Orgyia pseudotsugata

Hosts: All true firs and spruce

The Douglas-fir tussock moth (DFTM) is an important native insect capable of causing significant defoliation of subalpine fir in Nevada. Heavy

Figure 3 - Douglas-fir tussock moth larvae.

defoliation causes reduced growth, stress, and tree mortality. Heavy defoliation can cause top kill and mortality of advanced regeneration during a single season. Outbreaks are cyclic, usually appearing quickly followed by an abrupt decline within a one to four year period.

No DFTM defoliation of was detected during aerial surveys in 2015 and no moths were trapped in 2015.

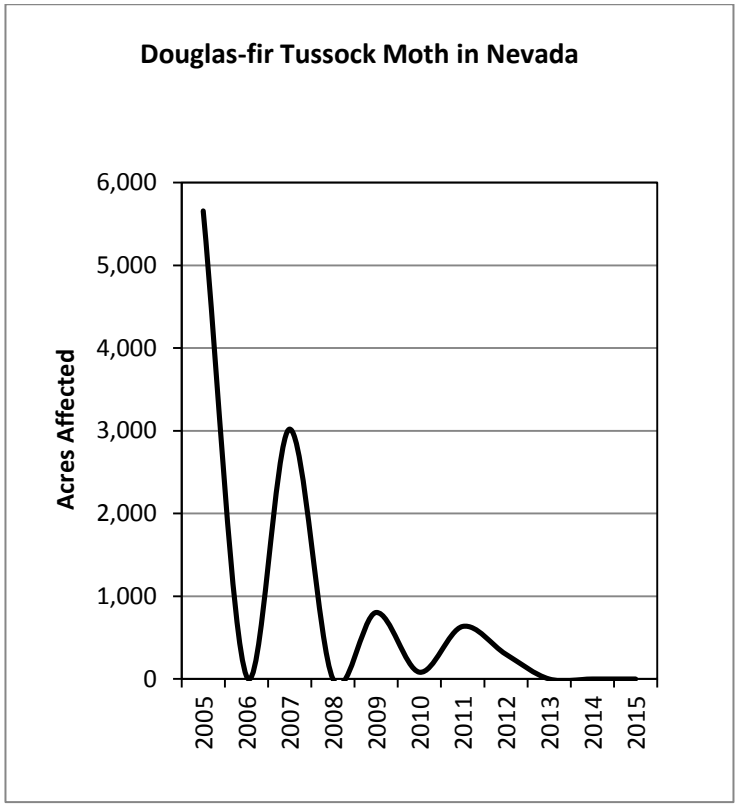

Figure 4 - Acres with Douglas-fir tussock moth defoliation in Nevada from 2005-2015.

Pinyon Sawfly
Neodiprion edulicolus

Host: pinyon pine

The pinyon sawfly is an important native insect capable of causing significant defoliation, but usually goes undetected because it occurs in small numbers and causes little damage. However, heavy defoliation causes reduced growth, stress, and tree mortality. Thin crowns add a ghostly, transparent appearance to the forest canopy. In some locations, sawfly outbreaks are occurring in conjunction with pinyon needle scale (*Matsucoccus acalyptus)* defoliation.

In 2015, outbreaks were very minimal and no sawfly damage was detected in the aerial detection survey. That does not mean that isolated outbreaks did not occur, they were just

not mapped during the annual survey. Defoliator activity is cyclical in nature and will likely pick back up in the future.

Pinyon Needle Scale

Matsucoccus acalyptus

Host: pinyon pine

The pinyon needle scale (PNS) is a sap-sucking insect that feeds on two year old needles. Foliage of infested trees turns yellow then brown. Heavy defoliation causes reduced growth, stress, and tree mortality. Past outbreaks have been recorded since 1959 throughout Nevada, causing localized defoliation and mortality of some trees. Historic outbreaks were noted in 1957-1963 in southeast Nevada and southwest Utah, affecting several hundred thousand acres. During 1969 and 1970, portions of the Humboldt-Toiyabe NF in California and Nevada were defoliated. A mild winter in 1969 was one of the many factors that triggered this severe outbreak. It was mostly the younger trees growing at lower elevations on alluvial fans that were affected. In 2007, a localized outbreak was found on Currant Summit on the border of Nye and White Pine Counties. In 2008, an area of 776 acres was found on the east side of the Schell Creek Mountains, in the low foothills north and south of Cleve Creek and north of Taft Creek in White Pine County. In 2008, more evidence of this infestation was found further south on the east side of Connors Pass on the Schell Creek Mountains.

Drought and scale defoliation likely exacerbated past pinyon mortality. The most severely affected areas were largely comprised of younger trees and occurred in the lowest areas of alluvial fans and hill slopes. In 2010, nearly 1,161,000 acres of the approximately 9,950,000 acres of pinyon in Nevada were mapped as scale-defoliated. At this point, PNS was affecting trees in the mid-elevation range. This represented 11.6% of Nevada's pinyon forest. In 2011, the PNS decreased to approximately half of the 2010 acreage, likely due to an above average precipitation year which caused a re-foliation event and an increase of predator/parasites, such as lady bugs and an unknown virus. The re-foliation significantly improved the condition of the trees in the higher elevation areas. Most of the 2011 damage was the lower elevation areas of 2010. In 2015, approximately 2,827 acres of pinyon scale infestation were mapped in NV. Much of the mapped area was also affected by a combination of insects such as twig beetles (*Pityophthorus spp., Pityogenes spp*.), and pinyon tip moth *(Dioryctria albovitella)* as well as *Matsucoccus monophyllae.* From the air, the damage caused by these other insects is similar in appearance to that of PNS infestation, and some areas will be dominated by one or a mixture of these insects. Consequently, differentiating damage attributed to these various causal agents can be extremely difficult, and therefore are all mapped as PNS.

A .

B .

C .

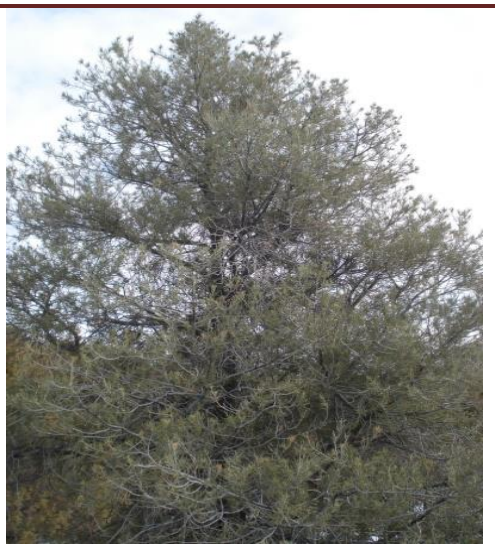

Figure 5 – (A) Top left photo of Berlin ichthyosaur State Park in 2007 before PNS infested the single leaf pinyon as shown on the top right photo of same general area in 2011 (note the see-through appearance of the foliage); (B) nearly epicormic re-growth exhibited on the defoliated pinyon in the spring 2011; (C) mature pinyon with heavy PNS infestation in 2012 in central NV.

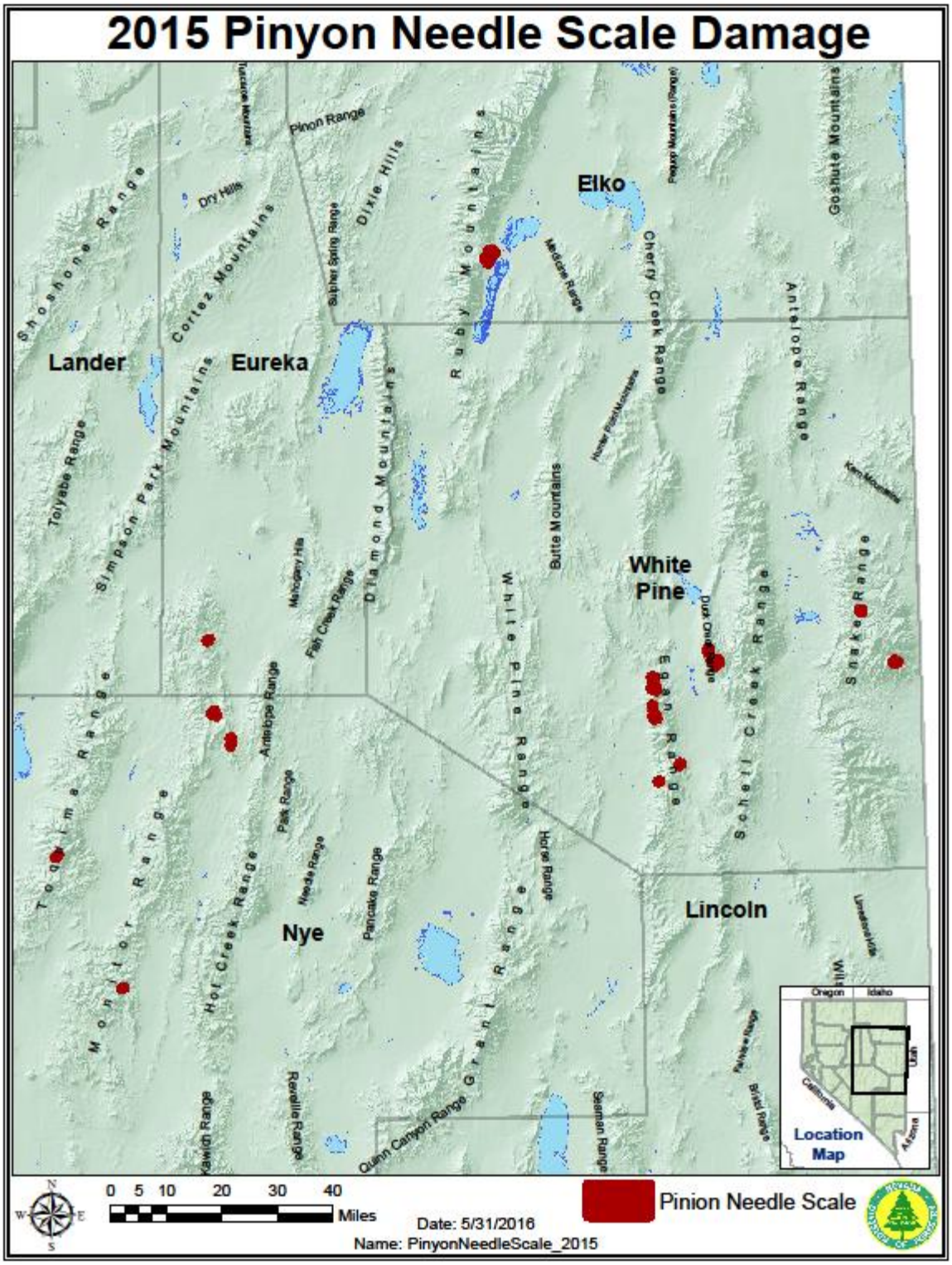

Figure 6- Pinyon needle scale damage in 2015.

Elko County – 1,286 acres were mapped in scattered patches in the Ruby Mountains.
Nye County – 260 acres of PNS defoliation were mapped. This was found mainly in the Monitor and Toquima Ranges.
White Pine County – 1,271 acres were detected throughout all elevations of the Egan, duck Creek and Snake Ranges.

Forest Tent Caterpillar

Malacosoma disstria

Hosts: aspen, birch, oak, some maples, and other deciduous species

The forest tent caterpillar (FTC) is a native defoliator of aspen. Overwintering takes place as a fully developed embryo inside the egg shell. When they hatch in the spring, the larvae tend to migrate high in the tree where they feed on expanding flower and leaf buds. After bud break, larvae feed on the foliage, being most gregarious in their early life stages. The adult is a tan moth about 4 cm long with two dark brown, oblique stripes on each forewing. The caterpillar (the most often seen life stage) is mostly dark blue with wavy reddish brown lines and distinct white, keyhole-shaped markings down the back. Larvae feed in groups without making any webbing. (Western Tent Caterpillar makes the large webs found on chokecherry and are reddish brown caterpillars). Flight and mating activities begin late afternoon through most of the night. There is one generation each year. Parasites tend to keep the outbreaks of this insect cyclic and in check over time.

In 2015, no FTC defoliation was observed during on the ground or aerial surveys.

Unknown and Frost Damage

Hosts: aspen, willows, cottonwoods, and other deciduous species

Approximately 288 acres of unknown or frost damaged aspen was aerially mapped throughout northern Nevada in 2015. Approximately 166 acres of the mapped area is in Elko County. These areas are very inaccessible so the cause of the defoliation was not verified in the field in 2015. Approximately 122 acres were mapped in Lyon and Nye County and was scattered in nature. The majority of the damage is attributed to frost damage.

INSECTS NATIVE

Bark Beetles

Fir Engraver Beetle

Scolytus ventralis

Hosts: true firs

Tree mortality due to fir-engraver beetle (FEB) has begun to increase due to the ongoing drought conditions. In 2015 approximately 1,369 trees were killed on 690 acres. This is a decrease of 53% in acres detected in 2014. However, many areas in the Lake Tahoe Basin are showing increased activity of FEB in stands heavily dominated by true firs. If the drought persists, epidemic levels of FEB will likely result here and throughout Nevada.

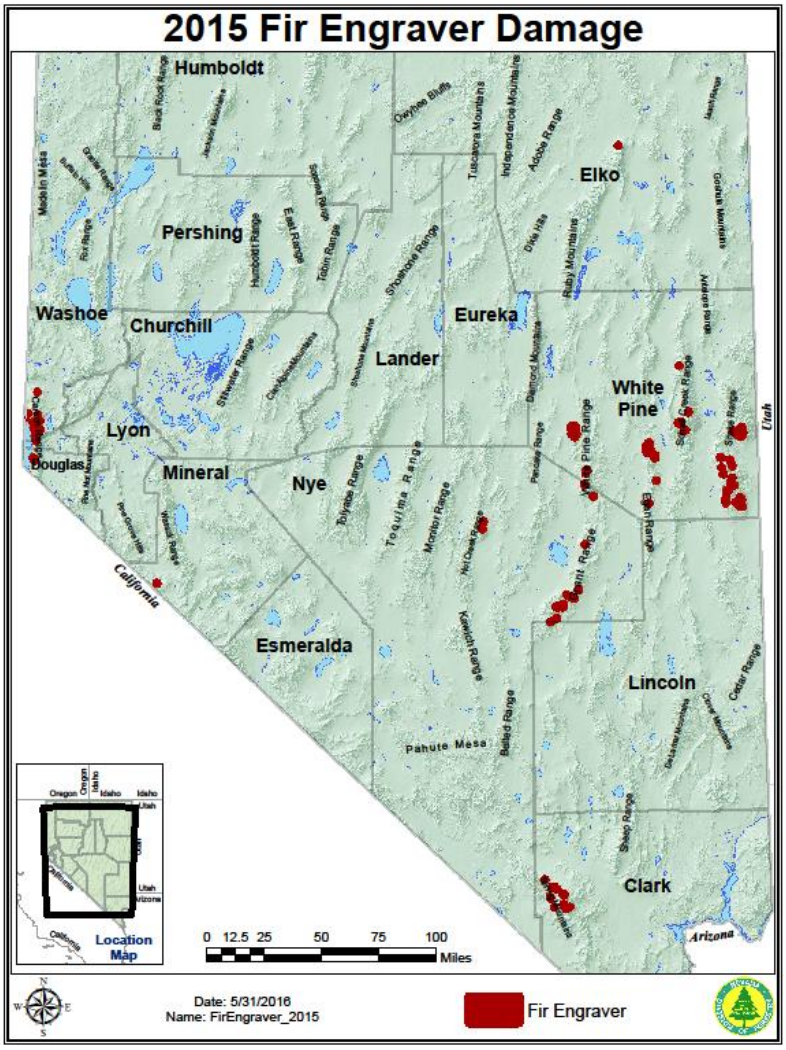

Figure 9 – Areas of mortality caused by the fir engraver beetle in Nevada in 2015.

Clark County- 2015 mortality; 246 killed trees on 102 acres. The area mapped was found in Lee and Kyle Canyon which is north and east of Mount Charleston.
Douglas County – Mortality in 2015; 6 killed trees on 3 acres located mainly in the Carson Range within the county.
Mineral County – Mortality; 5 killed trees on 2 acres located near the California border.
Nye County – Mortality occurred in 129 killed trees on 64 acres located mainly in the Hot Creek and Granite Ranges.
Washoe County – The largest amount of mortality in Nevada was found in Washoe County – 53 trees on 28 acres. This is a decrease from 2014. Damage is located all along the Sierra Front Range in white fir stands.
White Pine County – Mortality in White Pine County increased as well to 926 trees on 488 acres. Mapped activity is found in pockets in the White Pine, Schell Creek, Egan, and Snake Ranges.

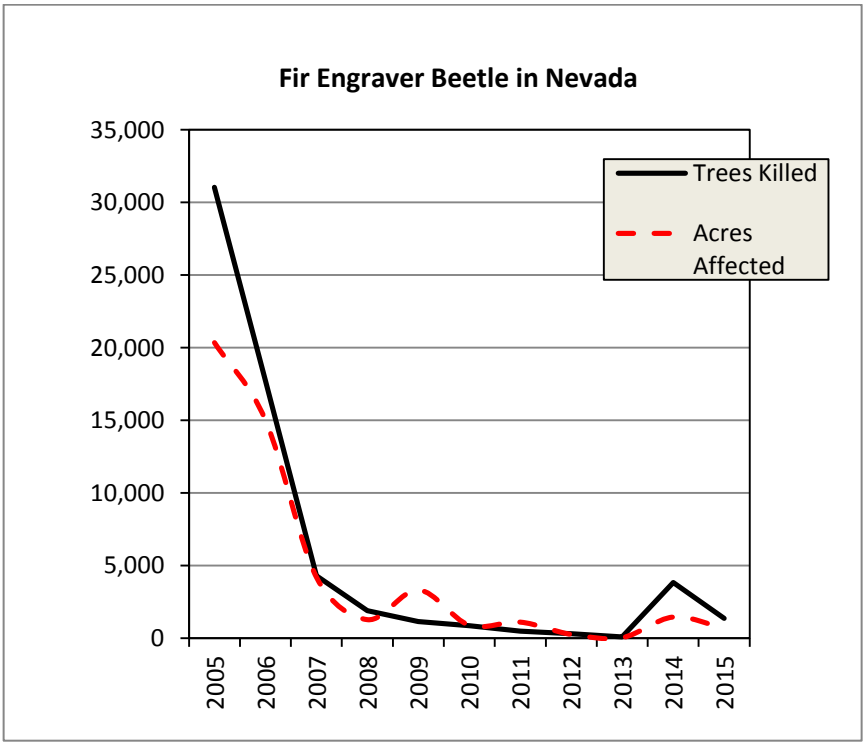

Figure 10 - Fir engraver mortality in Nevada 2005 - 2015

Jeffrey Pine Beetle
Dendroctonus jeffreyi

Host: Jeffrey pine

The Jeffrey pine beetle is the most destructive bark beetle of Jeffrey pine. Endemic populations usually attack scattered, slower growing, mature and over-mature trees and trees struck by lightning. In Nevada, Jeffrey pine is only found naturally along the Sierra Nevada Mountains. Field examinations of some of the mortality mapped in Alpine County, California revealed that some Jeffrey pine is also being killed by *Ips pini* in combination with roundhead and flathead woodborers. California flathead woodborer is also found as the main mortality agent on Jeffrey pine along the eastern front of the Carson Range in western Nevada.

Figure 11 - Jeffrey pine beetle-caused tree mortality in Alpine county in California along Highway 88. (Photo: Sheri Smith)

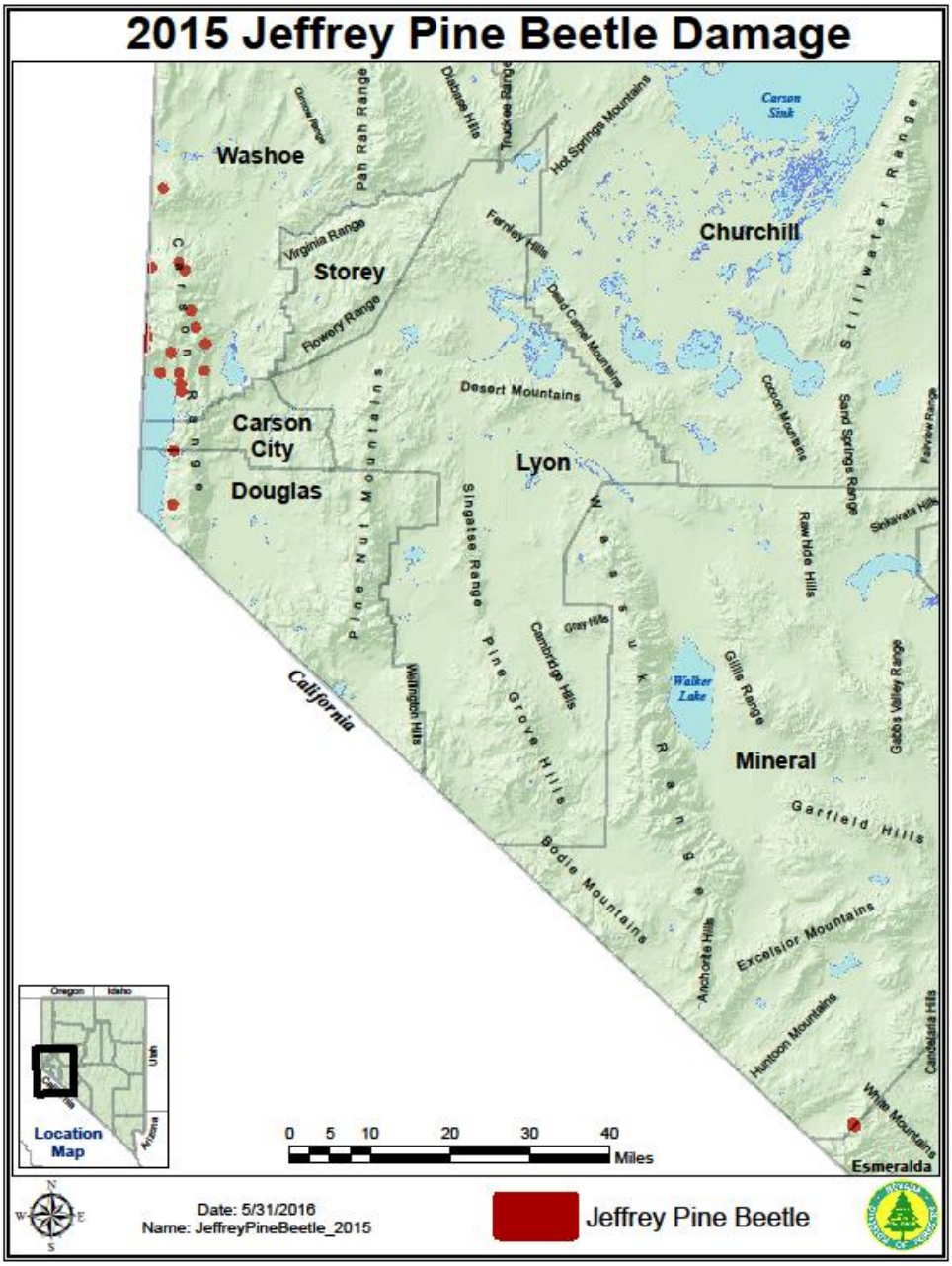

Figure 12 – Jeffrey Pine Beetle mortality in 2015 in western Nevada.

Douglas County – Mortality occurred in 4 trees on 2 acres mainly in the Carson Range within the county.
Mineral County – Mortality occurred in 369 trees on 37 acres near the Mineral and Esmeralda county line.
Washoe County – Mapped mortality, in 2015, decreased to 30 trees on 19 acres compared to 167 trees on 59 acres in 2014. Mapped activity is found in scattered pockets east of the Dog Valley area. Additional scattered pockets are located southwest of Reno, Nevada, in the headwaters of Gray Creek, northwest of Incline Village, and multiple pockets on the east shore of Lake Tahoe.

Mountain Pine Beetle
Dendroctonus ponderosae

Hosts: whitebark, limber, lodgepole, sugar, and ponderosa pine

Mountain pine beetle (MPB) can kill thousands of trees per year during outbreak conditions and millions of trees during extended epidemics in western forests. At endemic levels, MPB favors weakened, less vigorous trees with adequate phloem thickness to complete its life cycle. During epidemics, beetles may attack smaller diameter trees down to 4 inches diameter at breast height. Extensive mortality may alter large forest landscapes by converting pine forest ecosystems to grass and shrub landscapes for a period of 10-20 years. This conversion affects wildlife species, water yields and fuel loading.

In 2015, MPB-caused tree mortality in Nevada decreased in all species with the biggest decreases in whitebark and limber pine. Mortality decreased by nearly 135% with a total of 1,269 acres mapped. Most of the 2015 Nevada mortality occurred in Elko, Nye, Washoe, and White Pine counties.

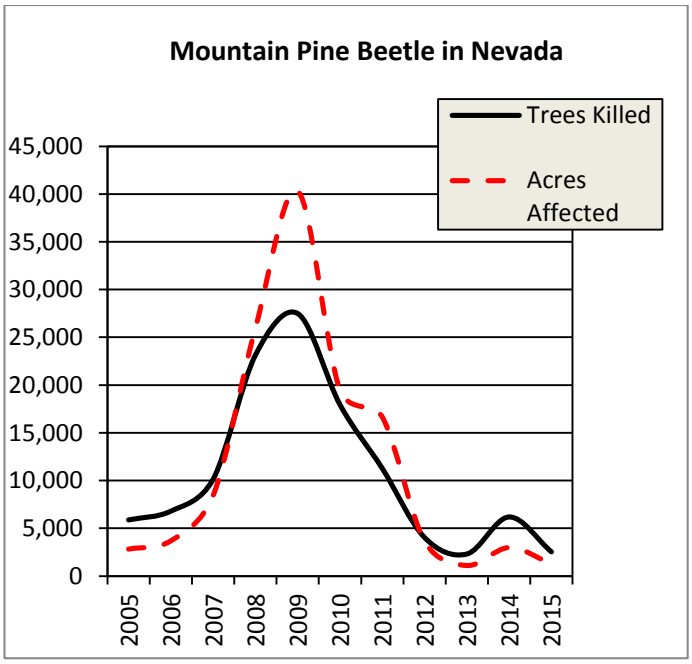

Figure 13 - Number of whitebark, limber, western white, and lodgepole pine trees killed and acres affected by mountain pine beetle in Nevada from 2005-2015.

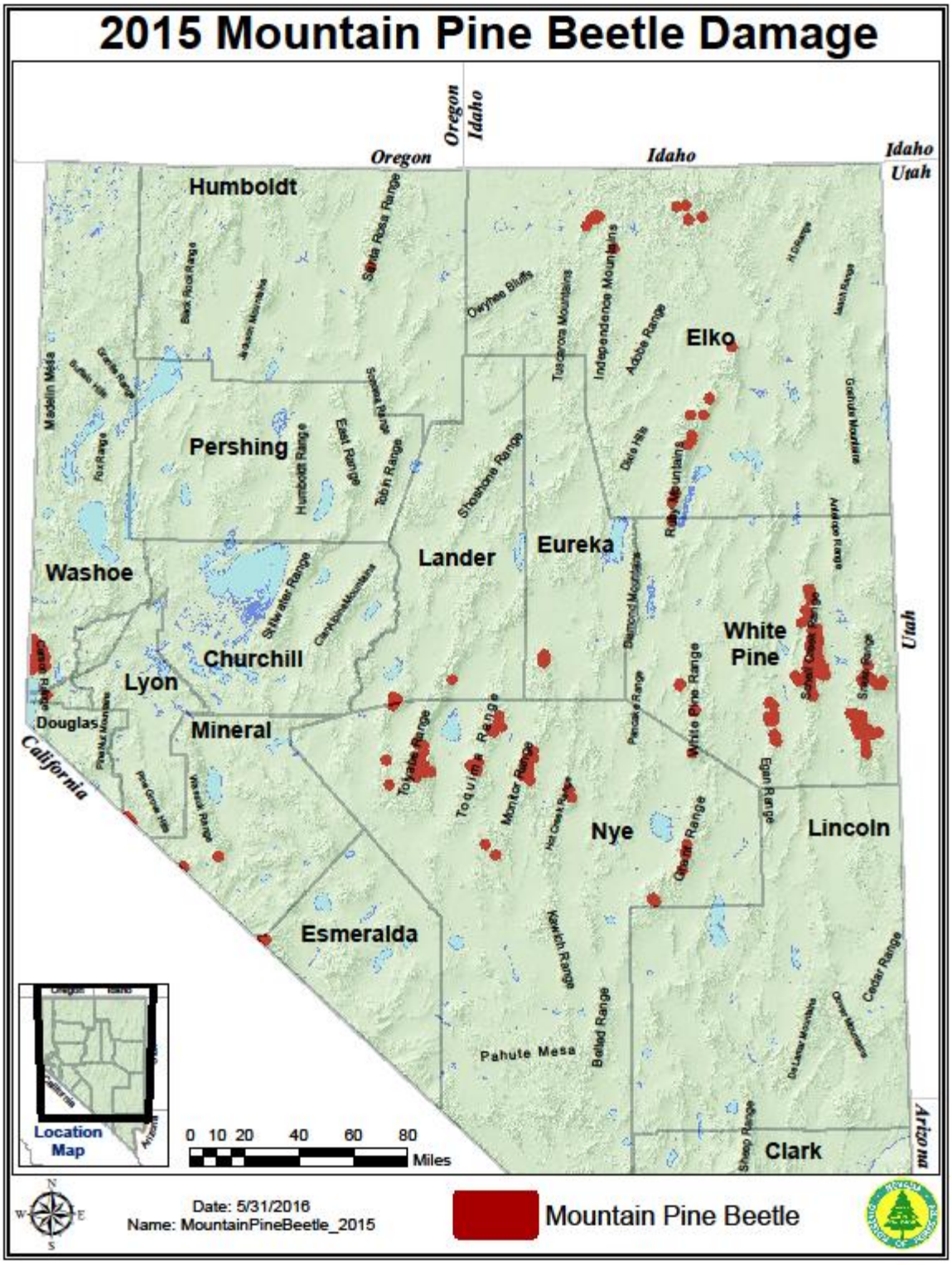

Figure 14 – Mountain pine beetle caused tree mortality in 2015.

Mountain Pine Beetle – Limber, Whitebark, and Western white pine

In 2015, mortality of limber, whitebark, and western white pines caused by MPB decreased to 442 trees on 230 acres. Mortality occurred in small groups of trees on high mountain ridges, but was more widespread at slightly lower elevations surveyed. This is good news to the sensitive and important nature of these species especially whitebark pine.

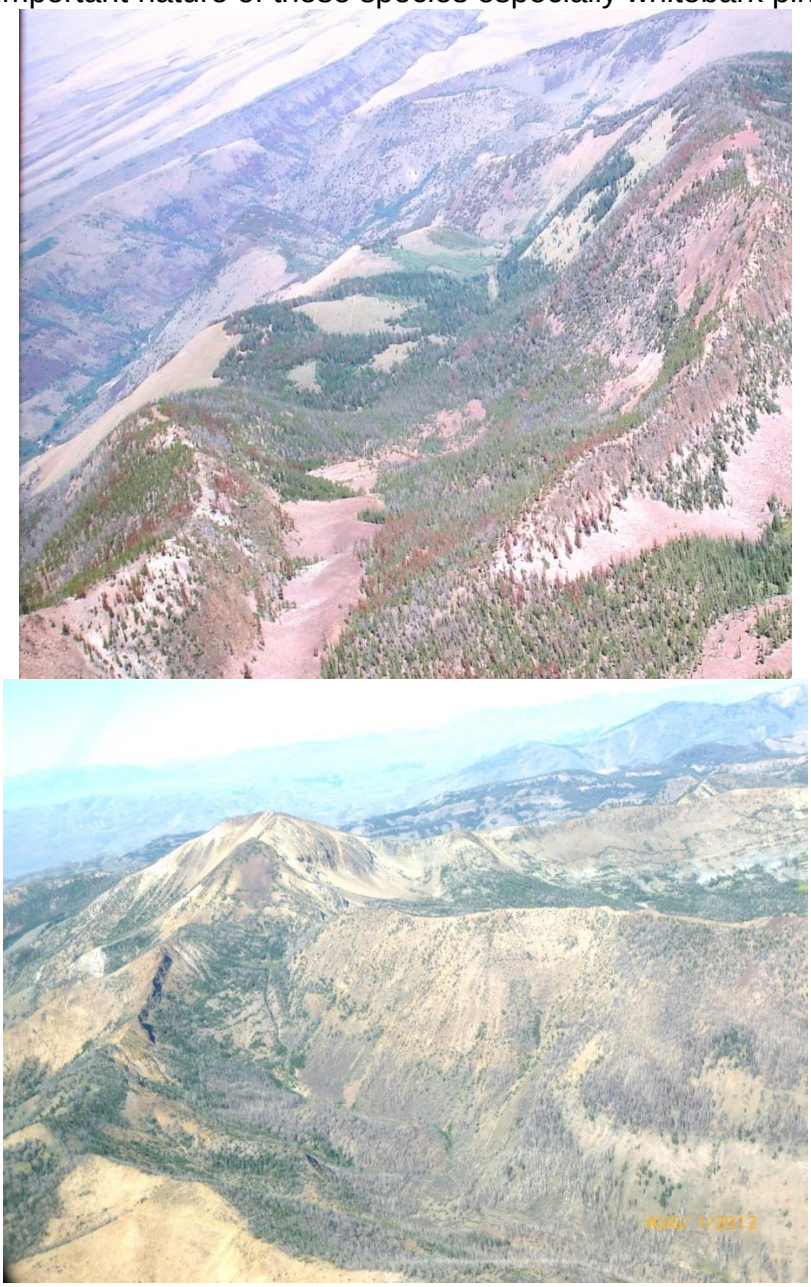

Figure 15. Mountain pine beetle-caused tree mortality, in the Jarbridge Mountains, captured moving down slope toward the town of Jarbridge, NV.(Photos-Gail Durham)

Elko County – Surveyors mapped 210 MPB killed whitebark and limber pine trees on 114 acres. The majority of this mortality occurred in the Ruby Mountains

Esmeralda County – Surveyors mapped 10 MPB-killed limber pine trees on 5 acres.
Lander County – Twenty five whitebark pine trees were mapped on 12 acres in scattered patches along the upper elevations of the Toiyabe Range.
Mineral County – Surveyors mapped 20 MPB killed limber pine trees on 10 acres.
Washoe County – There were 162 western white and whitebark pine trees on 81 acres mapped in 2015. This represents an almost a major decrease in acres from what was detected in 2014. The 2015 survey mapped MPB-killed trees in bristlecone pine in addition to western white and whitebark pine tree hosts. Scattered pockets were surveyed throughout the higher elevations of the Carson Range, mostly northwest of Mount Rose.

Mountain Pine Beetle in Lodgepole Pine

Nye, Washoe, and White Pine Counties represented most of the mortality noted statewide. Six other counties had mortality noted in 2015. A total of 1,950 trees on 972 acres was observed and recorded. The damage was very scattered to isolated pockets of less than 5 acres statewide**.** Below is the trapping data from Mt. Rose for 2015.

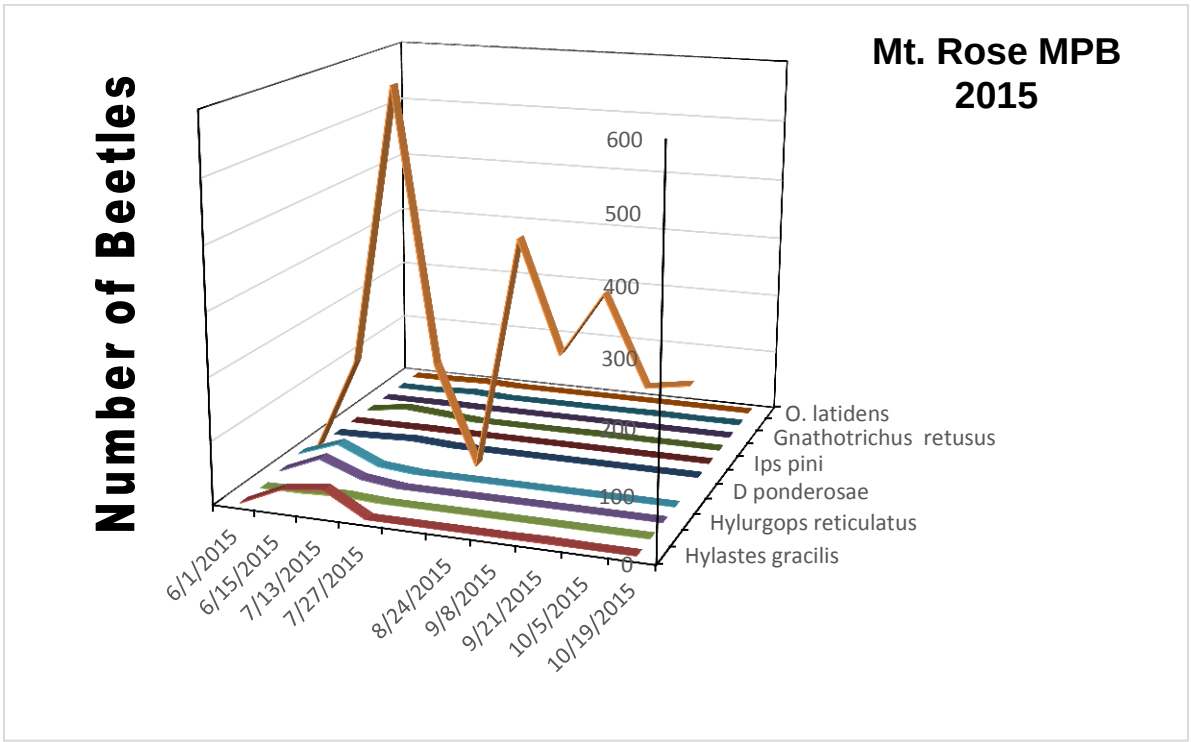

Figure 16 - Mt Rose Ski Area MPB trap catch data for summer 2015 with peak MPB catches from early-July and mid -October which covered 2 flights during the season. This data is mainly to track population trends of MPB and does not compare this activity to other beetles trapped. However, there are secondary beetle being trapped which can indicate increased bark beetle activity.

Western Pine Beetle (WPB) in Ponderosa Pine

In 2015, ponderosa pine mortality was attributed to western pine beetle in four counties within the state of Nevada. See figure 17 for trapping data.

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Clark County – In 2014, there were 561 WPB-killed ponderosa pine trees mapped on 487 acres in Clark County. This is a substantial increase in WPB damage and activity. The effects of long term drought and some damage from the Carpenter 1 wildfire in 2013 are the main stress agents in the Spring Mountains. Below is a graphs showing the results from trapping in Kyle Canyon for various bark beetles. Most of the catches were small twig beetles due to the installation of trap covers to prevent the trapping of rare butterflies: Monitoring traps are installed again for the 2015 field season to monitor any changes in beetle populations.

Nye County – Surveyors mapped 3 WPB killed ponderosa pine trees on 1 acre.

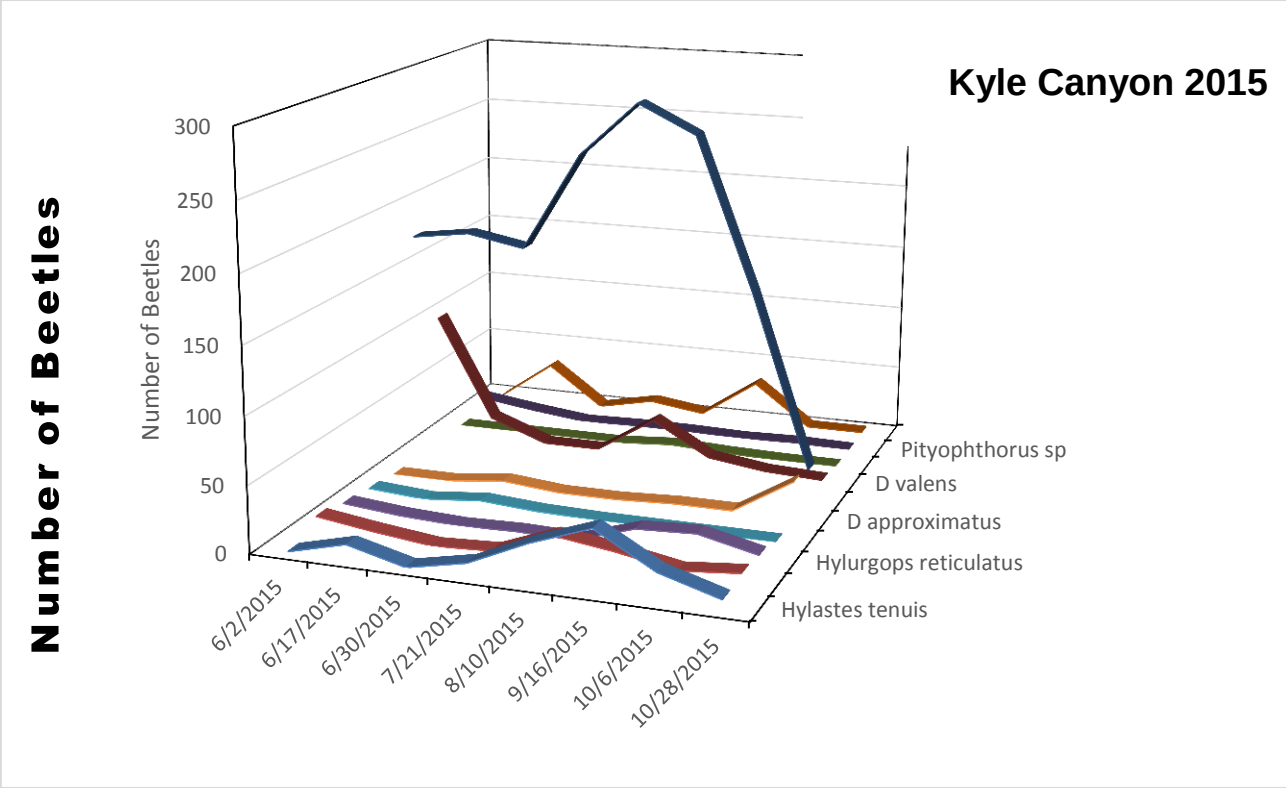

Figure 17 – Kyle Canyon trap catches summer of 2015 showing the dominance of D. brevicomis in early to mid-summer through mi-fall. This data is mainly to track secondary beetles which can indicate increased bark beetle activity.

Pinyon Engraver Beetle / Pinyon *Ips*

Ips confusus

Host: single leaf pinyon

The pinyon engraver beetle (PEB) is a pest in pinyon-juniper ecosystems often affecting valuable home landscape trees. The insect produces multiple generations each year and consequently populations can build and spread rapidly.

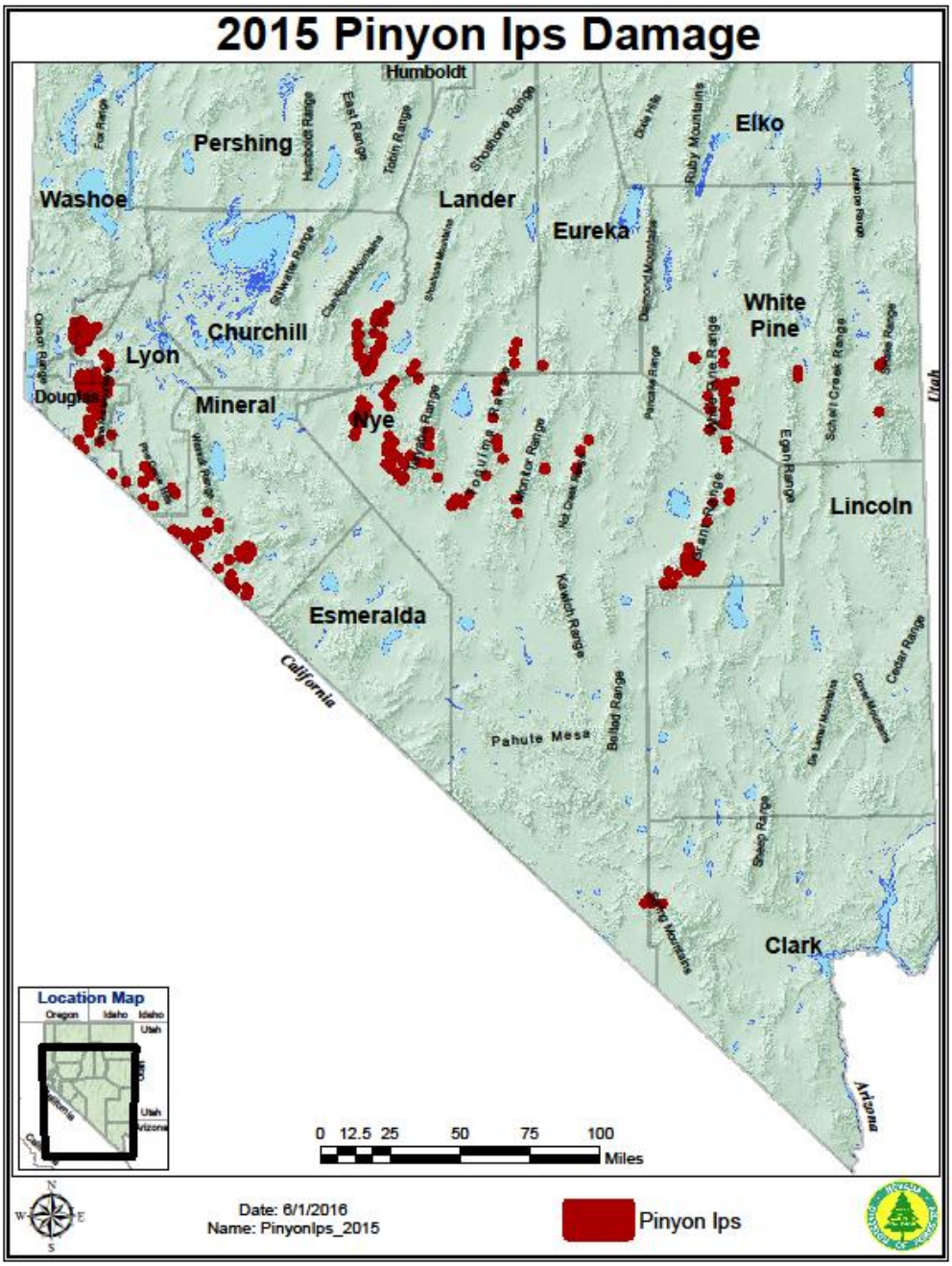

Figure 18 – Tree mortality caused by the pinyon engraver beetle in 2015 in Nevada.

Prior to 2003, pinyon pine was not frequently surveyed. In response to increasing concern of pinyon pine mortality in 2003, a multi-state effort was made to survey the extent of pinyon Ips-caused pinyon mortality. Approximately 3 million of the estimated 9.9 million acres of single-leaf pinyon that occur in Nevada were surveyed in 2003. In 2004, approximately 3.5 million acres of pinyon-juniper woodlands were flown and pinyon *Ips*-caused mortality of single leaf pinyon increased again. In 2005, 2006 and 2007, a dramatic decrease of pinyon mortality was seen within the surveyed area, in twelve counties. Although this mortality increased in 2009 up above 2006 levels, it did not represent a significant increase from 2010 to 2013. It decreased back down to near 2008 endemic levels (Figure 19).

In 2015, 3,118 trees were infested by pinyon *Ips*, affecting over 1,199 acres (Figure 19). This is a 95% decrease in tree mortality compared to 2014 (67,995 trees were infested by pinyon *Ips*, affecting over 24,007 acres). In 2015, eleven counties had recorded mortality from pinyon *Ips*. Mineral and Nye counties had the greatest number of trees killed which represents 75% of the state total.

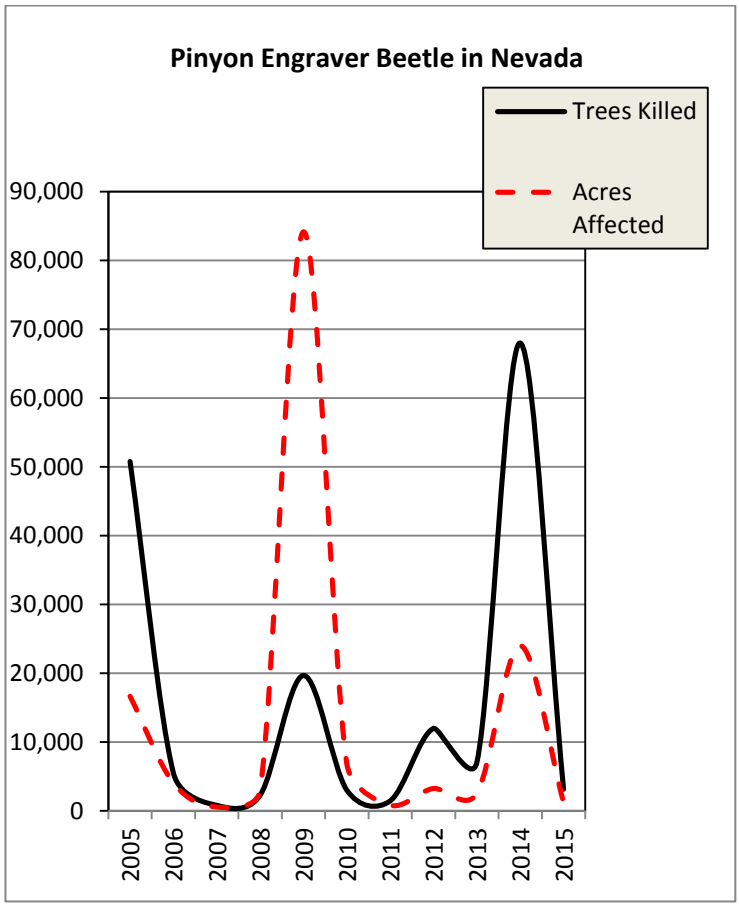

Figure 19 - Number of pinyon pine killed and acres affected by pinyon engraver beetle/pinyon *Ips* in Nevada and from 2005-2015.

Carson City County – In 2015, surveyor's mapped 18 pinyon *Ips*-killed pinyon pines on 12 acres.
Churchill County - In 2015, surveyor's mapped 70 pinyon *Ips*-killed pinyon pines on 41 acres.
Clark County – Surveyors detected 20 pinyon *Ips*-killed pinyon pine trees on 10 acres in 2015.
Douglas County – In 2014, surveyor's detected 201 pinyon *Ips*-killed pinyon pines on 113. This represents a major decrease in mapped tree mortality and acres affected. Damage is located in many scattered spots throughout the Pine Nut Mountain Range north of Holbrook Junction and into the eastern portion of Lyon County.
Lander County – In 2015 surveyors mapped 38 trees killed, on 25 acres. Damage is found in scattered pockets in the northwest Shoshones, and northern Toquima Ranges.
Lyon County –The number of detected pinyon *Ips*-killed pinyon pine was very minimal and little damage was detected. Surveyors mapped 68 trees killed on 39 acres. Mortality was identified in southern Pine Nut Mountains.
Mineral County – In 2015, surveyor's mapped 1,908 pinyon Ips-killed pinyon pine trees on 536 acres. Mortality is primarily located in the Excelsior Mountains
Nye County – Surveyors mapped 494 trees killed on 260 acres. Damage was identified in scattered pockets in the Grant, Hot Creek, Monitor, Toquima, southern Toiyabe Mountain Ranges.
Storey County – In 2015, surveyor's mapped 47 pinyon *Ips*-killed pinyon pines on 32 acres.
Washoe County – In 2015 damage was very light on only 7 pinyon *Ips*-killed pinyon pine trees on 6 acres were mapped. .
White Pine County – In 2015, ADS surveyors mapped 244 trees on 124 acres. Much of the mortality was associated with older pinyon needle scale in the eastern White Pine Range. Mortality was also observed in scattered pockets on the White Pine Range and in scattered pockets in the Egan, and Snake Mountain Ranges.

Pitch Mass Borer
Dioryctria spp.

Hosts: Singleleaf pinyon, ponderosa pine, Jeffrey pine

In the larval stage, *Dioryctria spp.* bore into the cambium of the trunk, branches, and shoots. This borer kills lateral branches and treetops of singleleaf pinyon and Jeffrey pine. With prolonged drought, this injury has weakened pinyon trees sufficiently to allow pinyon engraver beetle to successfully attack and kill pinyon pine trees. Pitch mass borer is found throughout the state of Nevada in most counties with singleleaf pinyon. The heaviest concentrations seem to occur in western Nevada where it also affects Jeffrey and ponderosa pine. Many young Jeffrey pines on the east slope of the Carson Range that came in after fires have been affected by this insect. In 2006 several entomologists, pathologists and foresters conducted a pinyon blister rust (*Cronartium occidentale)* search through the central portion of Nevada. They noted that pitch mass borer frequently uses rust cankers as an entry

point (Figure 20). The rust and borer are found extensively across the state but are not mapped by ADS.

Figure 20 - Pitch mass borer infesting pinyon pine infected with pinyon blister rust.

INSECTS: NON-NATIVE

White Satin Moth

Leucoma salicis (L.)

Hosts: aspen, willows, cottonwoods, and other deciduous species

The white satin moth (WSM) is a non- native defoliator of aspen in the family of tussock moths (*Lymantriidae*). WSM is native to Europe and Asia. This is the same family gypsy moth and Douglas fir tussock moth are found in. It was introduced into North America in British Columbia in 1920. It is currently distributed from Newfoundland through eastern Canada, northeastern US and from BC to northern California and in 2004 found in southwest Wyoming. It is now been found in spots throughout Northern Nevada. Overwintering takes place as a second-instar larvae which seek out hibernation sites on the trunk or branches of

a host tree and molt after spinning silken coverings (hibernacula) which are hard to see because they are covered with bark, mosses and other detritus. When they emerge in May they feed on the young new leaves. This feeding continues until late June to early July and the larvae go through five to 6 more instars until they are approximately 3.5 – 4.5 cm long.. The caterpillar (the most often seen life stage) is mostly grayish brown with a dark head and back, but what stands out is the one row of large oblong white to pale-yellow patches down the middle of the back and two yellow lines sub-dorsally. The two lateral and sub-dorsal rows of orange tubercles have tufts of long brown hairs attached. These larvae spin cocoons in the leaves to pupate into shiny black, 1.5 to 2.2 cm long pupae with tufts of yellow hair. In July and August the adult moths emerge. The white adult moth about 2 - 4 cm long have no markings on the wings; the bodies are black and covered with white silky hairs that only allow glimpses of black beneath. See Figure 21 photos below:

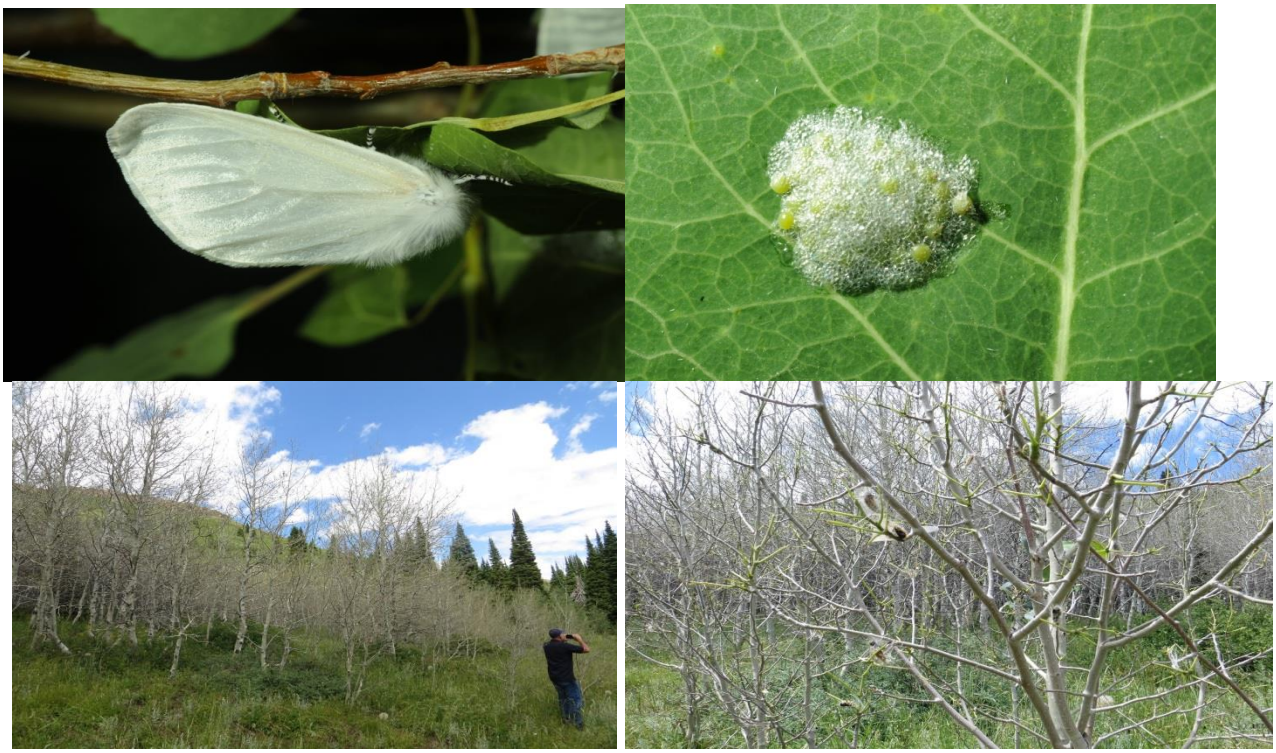

Figure 21 – Female White satin moth (top left); egg mass (top right);
complete defoliation (bottom left); cocoons(bottom right). Lime Creek defoliation, Jarbridge Ranger District on the Humboldt Toiyabe Nationla Forest(July, 2015)

In 2015, little defoliation was observed. The NDF Forest Health specialist did receive numerous verified reports of WSM activity and damage. Approximately 2-5 acres of damage was noted in the Lime Creek drainage on the Jarbridge Ranger District of the HTF. Reports of activity were verified in the Orovada area, as well as Winnemucca, Nevada. There is on ongoing 15 acre infestation in the Mill Creek drainage south of Battle Mountain on private land. The previous infestation and damage in North Canyon, north of Spooner summit has been very sporadic. This infestation west of Carson City should some early increased

activity but dissipated as the summer season ended. It is estimated statewide 30-50 acres are seeing some level of activity and damage. The NDF Forest Health Specialist is monitoring reports, and activity and is verifying them on the ground to obtain better damage estimates statewide.

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous species

In 2015, gypsy moth was surveyed by Nevada Department of Agriculture (NDOA). Trapping was conducted from May to September. In all 178 traps were placed in 14 counties; all traps were negative. The last identified adult male was discovered in an RV park in Winnemucca in 1999. No moths were trapped in 2015.

Figure 22 - Adult gypsy moths; female above; male below, Photo: USDA APHIS PPQ archive, www.bugwood.org.

Red palm weevil
Rhynchophorus ferrugineus

Hosts: various palm tree species

Red palm weevil (*Rhynchophorus ferrugineus*), South American weevil (*Rhynchophorus palmarum*), and Silky cane weevil (*Metamasius hemopterus*) were surveyed for using a modified bucket trap baited with pheromone and fermenting fruit. In all, 36 traps were placed in Clark County and southern Nye County. All traps were negative.

Exotic Wood Borers including: Scolytinae/Sirex Wood Wasp (Sirex noctillo), Asian Longhorn Beetle (Anoplophora glabripennis), and Emerald Ash Borer Beetle (Agrilus planipennis)

Hosts: various species

In 2014, the Nevada Department of Agriculture NDOA conducted funnel trapping for exotic wood borers using EDRR style trapping methods and sites (36 traps total) surveyed in 6

counties. All traps were negative. Emerald Ash Borer (*Agrilus planipennis*) trapping and data collection was performed in the Las Vegas and Reno areas. Trapping was conducted with 24 traps located in 4 counties and all traps were negative.

Stem and Branch Diseases

Dwarf Mistletoes

Arceuthobium spp.

Hosts: Douglas-fir, pines, true firs, and single-leaf pinyon

Dwarf mistletoes (DMT) are the single-most damaging agents of coniferous trees. These parasitic plants remain the most widespread and frequently observed disease within the state. Profusely branched, dense masses of host branches called “witches brooms” are often observed. Dwarf mistletoe infests trees of all ages, and infection may exist in secondary growth and regeneration, as well as mature and over mature tree stands. Dwarf mistletoes spread fastest and are most problematic when an infected overstory exists over new regeneration. Severe dwarf mistletoe infestation can:

- Predispose trees to attack by insects and other diseases,
- Reduce incremental growth,
- Affect the forest canopy structure,
- Lower resistance to drought,
- Affect production of seed,

Conversely, dwarf mistletoes may be beneficial to wildlife habitat in some cases, depending on the type of wildlife habitat desired.

Pinyon engraver beetle-caused mortality was observed in some of the heavy dwarf mistletoe infected pinyon pine stands around the state of Nevada. Continued drought through the fall of 2015, continues to cause dwarf mistletoe-weakened trees to succumb to bark beetle attacks.

Currently, fuel reduction activities are being undertaken in heavily DMT infested stands of pinyon pine in western Nevada. The treatments are intended to create a buffer between non-infected stands and infected stands to prevent the spread of this disease. This type of treatment can be effective, due to the primarily short range spread mechanism of dwarf mistletoes.

Ponderosa and Jeffrey pines are often found heavily infected with western dwarf mistletoe (*A. campylopodum*) and then are attacked by *Ips*, flathead borers, Jeffrey pine beetle, and western pine beetle as well as other agents, especially during prolonged drought periods. Additionally, true fir trees infected with dwarf mistletoe are commonly attacked by fir engraver beetle, or experience branch dieback due to *Cytospora* canker. In 2011, limber pine dwarf mistletoe (*A. cyanocarpum*) was found infecting whitebark and limber pines on the East

Humboldt and Ruby Mountains predisposing them to attack by mountain pine beetle in those areas.

Figure 23 – A. cyanocarpum infecting whitebark pine in Lamoille Canyon in the Ruby Mountains and on limber pine at Angel Lake in the East Humboldts. These trees were subsequently killed by mountain pine beetle.

Pinyon Blister Rust

Cronartium occidentale

Host: singleleaf pinyon pine

An informal survey of central Nevada by various FS pathologists and entomologists as well as BLM and Nevada State Foresters revealed that the disease is common throughout the state. It attacks and kills small trees (Figure 32) and causes branch flagging on larger more trees. Many of the rust infections were attacked by pitch mass borer. This disease is mainly found in a band between 6000 and 7000 feet of elevation near drainages that are suitable for the alternate host (*Ribes* spp.).

Figure 24- Single leaf pinyon pine infected with pinyon blister rust near its base.

White Pine Blister Rust

Cronartium ribicola

Hosts: limber, bristlecone, whitebark, sugar, and western white pine

White pine blister rust (WPBR) has been observed in western Nevada on the east side of the Sierra Nevada Mountains in sugar, whitebark and western white pines. The rust has expanded its range in Nevada in recent years, with populations of rust now confirmed in the Jarbidge Mountains. Continued WPBR infections have been identified in the Lake Tahoe Basin and most recently near Incline Village, Nevada near Crystal Bay. The NDF has purchased blister rust resistant seed from the Sugar Pine Foundation in order to grow blister rust resistant sugar pine. These seedlings can be used in reforestation efforts where natural regeneration is not occurring. This seedling growing effort has just begun so no results available at this time.

At this point in time the only confirmed population of white pine blister rust in eastern Nevada is in the Jarbidge Mountains. There is concern that WPBR could become established in sensitive populations of Great Basin bristlecone pine. In 2010, researchers initiated an effort to collect seed from Great Basin bristlecone to include this species into breeding efforts aimed at detecting resistance to WPBR in 5 needle pines. Additionally, seed from bristlecone in Great Basin National Park was collected in 2011. No new information on these seed collection efforts has been received. In 2013, there was an erroneous report of a single white pine blister rust infested limber pine tree at Great Basin National Park.

Figure 25 – White Pine Blister Rust in sugar Pine
Photo – Jeff Haas

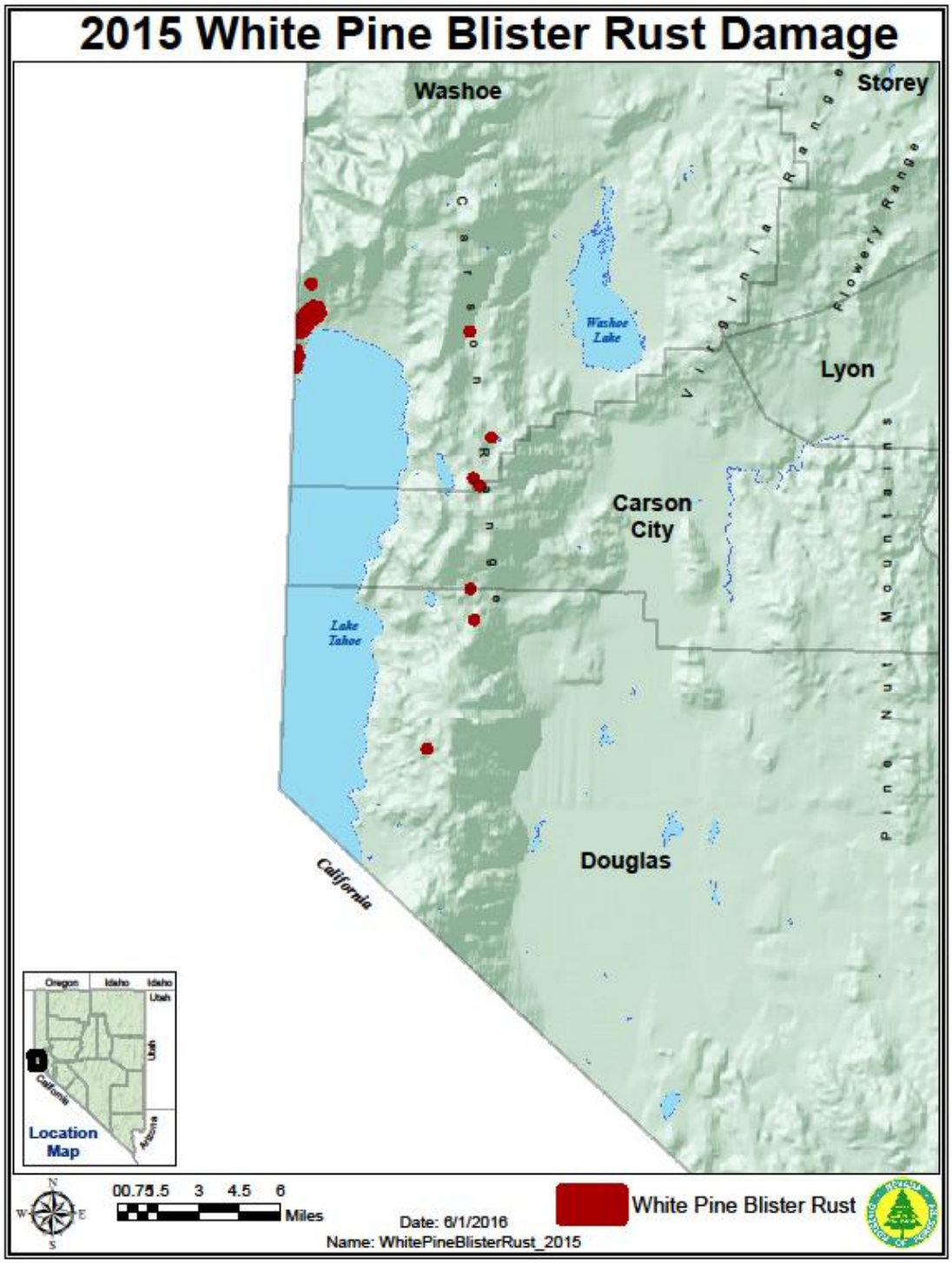

Figure 26- White Pine Blister Rust Damage in sugar Pine 2015

Aerial surveys in 2015 indicated scattered mortality throughout the Lake Tahoe Basin. Approximately 36 trees on 309 acres were observed showing decline or mortality, with the majority being observed in Washoe, Carson, and Douglas Counties.

Sudden Oak Death

Phytophthora ramorum

Sudden Oak Death (SOD), an exotic forest disease caused by the pathogen *Phytophthora ramorum*, has been killing thousands of tanoak and oaks in the coastal areas of California, but has not been observed in Nevada. However, potentially infected nursery stock was released into all 50 states from a single California nursery, prompting NDOA officials to contract with the USFS to conduct surveys. Both forest areas and areas near nurseries were surveyed, but showed no SOD. SOD has been detected for all regions surveyed to date.

ROOT DISEASES

Annosum Root Disease

Heterobasidion irregulare
Heterobasidion occidentale

Hosts: Lodgepole pine, Jeffrey pine, ponderosa pine (*H. irregulare*), spruce, true firs, and incense cedar (*H. occidentale*)

H. occidentale can be found throughout the state on true firs, but it frequently acts as butt decay or as a saprophyte on dead trees, stumps, roots, and cull logs or fallen stems. *H. irregulare* can be found in mature pine trees on the east side of the Sierras and the fungus can kill young ponderosa pine, especially in plantations on droughty soils. Symptomatic small trees can frequently be found around infected stumps with butt decay. The symptoms on larger trees include a thinning crown, decay in the root system and fruiting bodies that develop at the base of the tree or inside stumps.

Figure 27 – Conk at base of tree

Armillaria Root Disease
Armillaria spp.

Hosts: All trees

Evidence of Armillaria root disease can be found throughout the state causing mortality in all species of trees. This disease also frequently functions as a weak pathogen or saprophyte. Fruiting bodies grow in clusters from the roots or at the base of the tree during moist conditions. There is a close association between root disease pockets and endemic level bark beetle populations. Armillaria was observed on pinyon pine roots in the Virginia Highlands of Storey County and on white fir in the Success Summit area of the Schell Creeks of White Pine County in 2006. It has also been found on Jeffrey pine roots in Carson City County in the Clear Creek area.

Figure 28 - Armillaria mushrooms, photo: Gail Durham

Black Stain Root Disease

Ophiostoma wageneri

Hosts: pinyon pine, ponderosa pine, Jeffrey pine and Douglas-fir

Figure 29 - Black stain root disease. Photo-Donald Owen

Black stain root disease is an important disease of several hosts. It is found mainly in pinyon pine, but it can infest both Jeffery and ponderosa pine which has been found in small areas of the eastern Carson Range. It usually kills affected trees within a few years, and it can produce groups of mortality that are several acres in size. Pockets of infected trees are preferred host for low-level populations of pinyon engraver beetles. No new pockets of black stain root disease were observed by aerial survey in 2015.

Cytospora Canker
Cytospora spp.

Host: aspen

Cytospora canker is one of the most common diseases affecting aspen in ornamental situations and often attacks stressed trees through wounds. This fungus girdles branches by killing the cambium. Large, vigorous trees can withstand the disease and are rarely killed. Activity from this pathogen is most likely a symptom of several years of water stress or defoliation from other insects or diseases. From the air, decline due to Cytospora canker can look similar to decline by forest tent caterpillar defoliation.

LEAF AND NEEDLE DISEASES

Aspen Leaf Spot
Marssonina populi

Host: Aspen

Blight and leaf spot caused by this disease have been seen in the past throughout the host type. In late June through early July, Nevada received heavy amounts of precipitation which caused a significant amount of blight and leaf spot by late summer.

Figure 30 - Symptoms of aspen leaf spot disease.

Approximately 11,074 acres were surveyed as unknown Aspen defoliation. Elko County had 7,278 acres surveyed. Nye, Humboldt, and Lander County had 1,317 acres, 8787 acres and 577 acres surveyed respectively. The majority of the damage included heavy blight and leaf spot causing noticeable leaf discoloration and dieback. Fall color was impacted with trees losing their leaves early or not showing much fall color at all. Since these leaf diseases are cyclical and weather dependent it is not anticipated to be a long term problem. Aspen stands affected in 2015 should leaf out much difficulty in 2016.

DECLINES / COMPLEXES

Subalpine Fir Mortality Complex

Host: Subalpine fir

The western balsam bark beetle (WBBB) is the most significant mortality agent in a complex of forest insects and disease causing subalpine fir mortality. Endemic populations will occur in storm-damaged trees, slash, or trees of poor vigor. WBBB infestations may build to epidemic levels, where mortality can occur in groups of 100 to 10,000 trees. Annosum root disease, woodborers and several species of smaller bark beetles are also involved in this complex. Environmental stress due to drought or overcrowding may also have a role in the death of trees in this category.

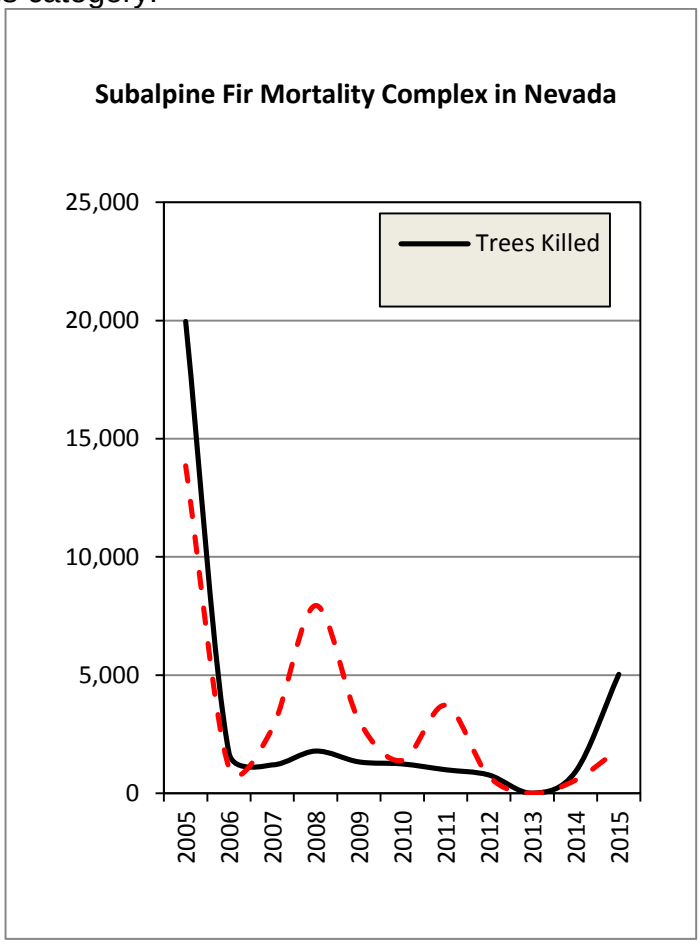

Figure 31 - Subalpine fir mortality complex 2005 - 2015

In 2015, mortality attributed to subalpine fir mortality complex increased from 911 acres in 2014 to 1,864 acres in 2015. The majority of the mapped 2015 ADS activity is located in Elko County.

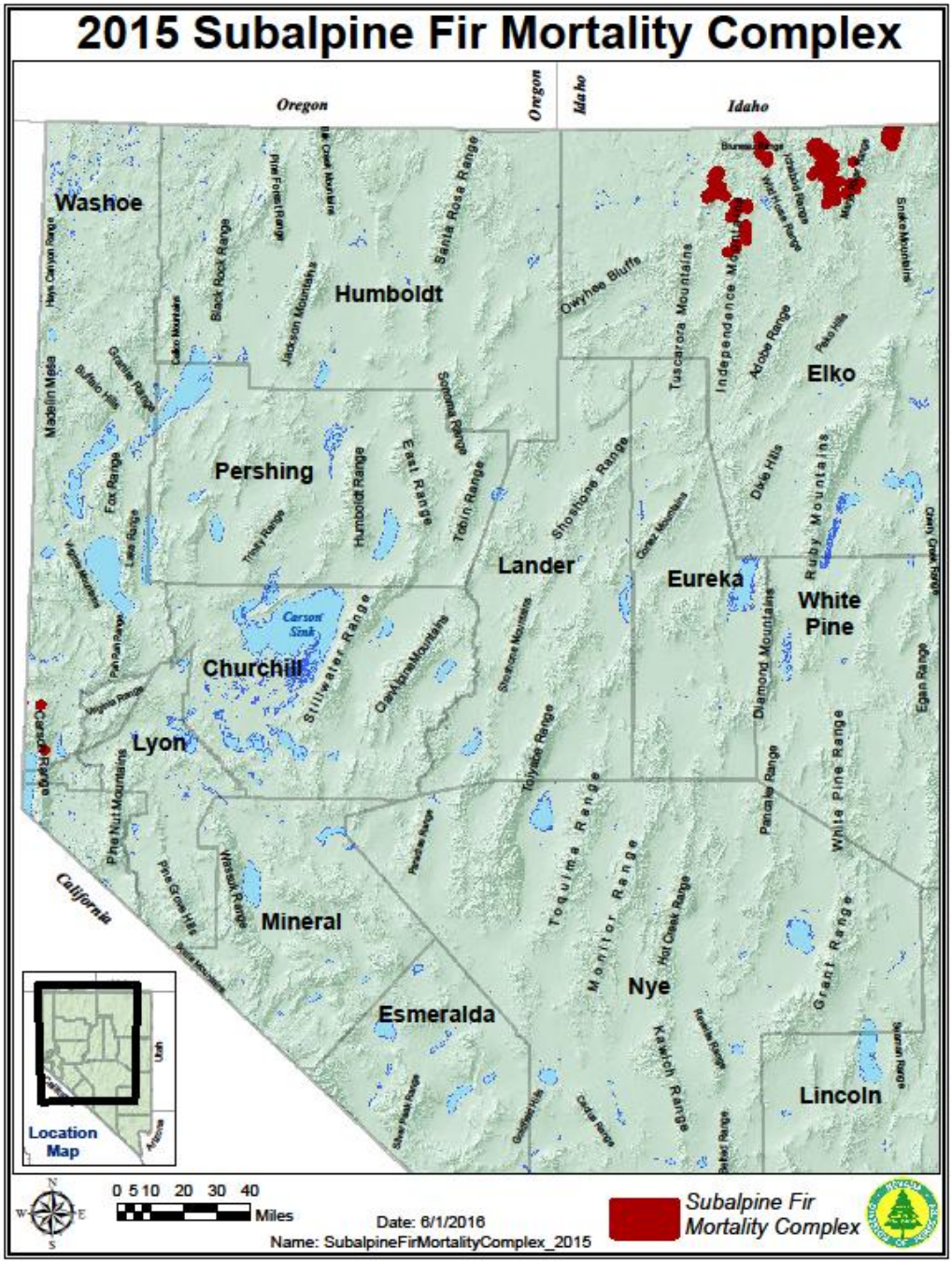

Figure 32 - Subalpine fir mortality in 2015.

Elko County – Approximately, 5,021 trees on 1,859 acres were detected in 2015. This is located Jarbridge Mountains.
Washoe County – Approximately 10 trees on 5 acres were detected in 2015 in the Carson Range..

Aspen Decline/Dieback

Host: Aspen

A decrease in the amount of aspen forest acreage has been reported throughout the western U.S. for many years. The primary factors involved are succession of aspen forest to other vegetation types due to fire exclusion, and damage to young aspen sprouts by grazing animals. This phenomenon has been labeled “aspen decline” by some authors. This type of “decline” should be distinguished from the aspen dieback that has been detected in aerial survey that is caused by several agents including drought stress, insects, diseases and other stresses. This dieback can impact aspen clones that have been impacted by fire exclusion and grazing pressure causing them to decline and die.

Aspen dieback has been noted anecdotally for many years in the Intermountain Region, and dieback has been recorded by aerial survey since 2003. In 2004, Intermountain Region FHP examined what had been mapped as insect defoliator damage or Cytospora canker in several areas in north-central Nevada and discovered that a number of insect and disease agents were involved. Research across North America has revealed mostly canker diseases and insect borers are causing the decline in which drought stress is the largest contributing factor to decline and dieback.

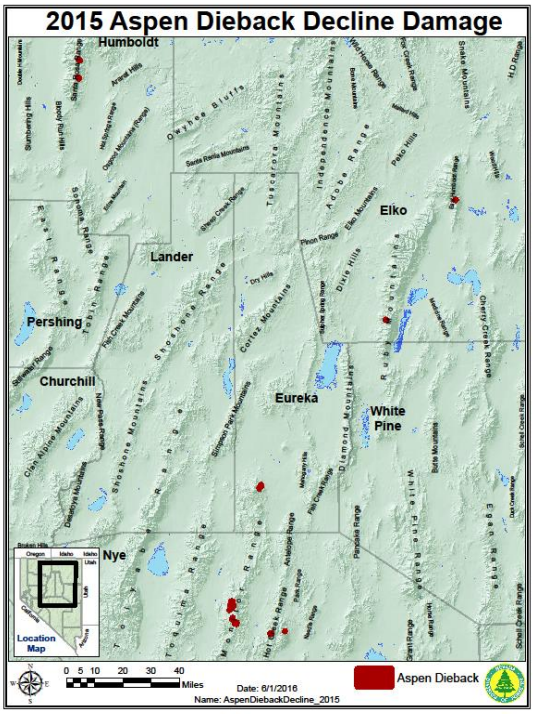

Figure 33 – Dieback & Decline of Aspen in Nevada 2014

Elko County – In 2015 there was 166 acres of detectable aspen decline/dieback.
Lyon County – Scattered pockets were found at the mid-to-high elevation ranges in the northern Monitor Range and a total of 33acres were mapped.
Nye Counties – In 2015, surveyors detected 89acres of aspen decline/dieback in Nye County. Dieback is found in pockets in the southern Monitor and Hot Creek Ranges.

ABIOTIC DAMAGE

Wind damage / Blowdown

Areas of concentrated, high velocity winds can cause trees to blow over. Blowdown occurs in groups or as scattered trees within the landscape. Depending on the tree species, patches of blowdown in coniferous forests can provide a food source for various bark beetles, enabling populations to build to epidemic levels. These epidemic populations may then attack and kill standing, live trees adjacent to the blowdown. No blowdown was mapped in Nevada in 2015.

Wildfire Damage

In 2015, wildfire damage was minimal. Although it was a hot dry summer fewer lightning starts or human caused fires occurred. Lightning storms were attributed with moisture last season with fewer than normal starts. Only 42,479 acres burned statewide across all ownerships with very little damage to the forest resources of the state.

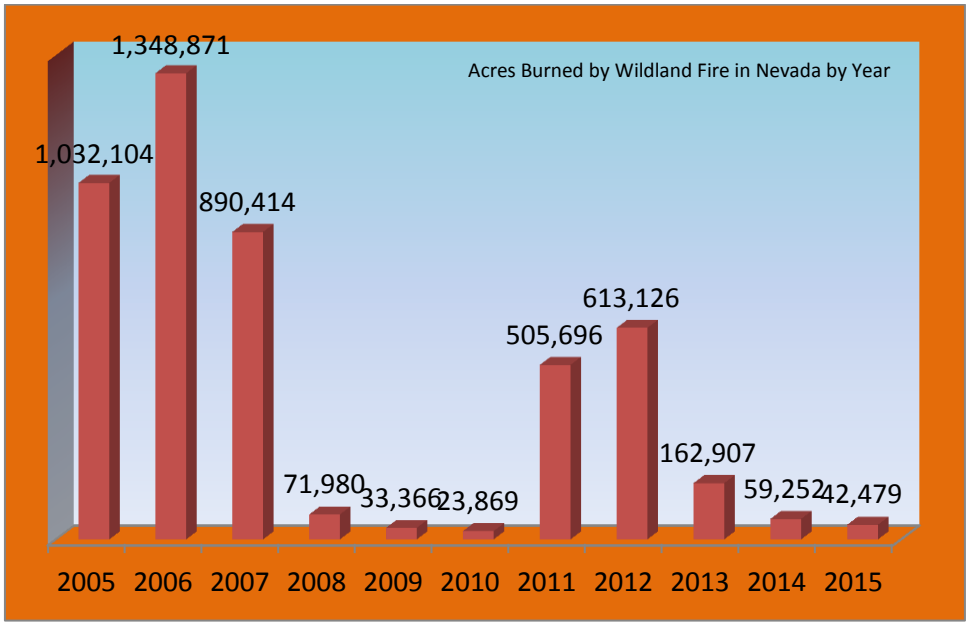

Figure 36 - Acres burned in Nevada 2005 - 2015

Frost Damage

There was no frost damage detected in 2015 in Nevada. Previous (2012 ADS data) aspen damage due to frost was mapped extensively throughout the mountain ranges of Nevada including the Snake, Schell Creek, Egan, Quinn Canyon, White Pine, Toiyabe, Shoshone, Santa Rosa, Pinenut, Sweetwater and Carson Ranges. Most of this re-foliated after the early summer damage, but it was not a full re-foliation and the stands appeared partially defoliated from the air.

Noxious weeds

Noxious weeds are a continuing problem for all Western states. They have the ability to colonize disturbed habitats, aggressively displacing native plant species and altering ecosystems. Several state and federal agencies have the responsibility for monitoring and controlling noxious weeds. Our intention by including this information is to increase awareness of these potential problems. Table 5 at the beginning of this document is the list of plants declared noxious weeds by the State of Nevada for specific counties. The NDOA in coordination with the Nevada Department of Conservation and Natural Resources' Natural Heritage Database tracks weed populations throughout the state. For up-to-date information on Nevada Noxious Weeds and the three-tier State List go to:

http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm

http://www.invasivespecies.gov
This website is the gateway to federal and state efforts concerning invasive species. There are links to numerous invasive species databases. This website should be one of your first stops.

http://www.agri.nv.gov/PLANT_NoxWeeds_index.htm
This website contains any information you need about noxious weed prevention, control and management for all land managers in the state of Nevada.

http://www.cdfa.ca.gov/phpps/ipc/encyclowedia/encyclowedia_hp.htm
California Department of Food and Agriculture has a very comprehensive website. Information includes: identification, biology, and management. Pictures of the plants in various stages are just a click away.

http://www.nwcb.wa.gov/index.htm
State of Washington's noxious weed control board website has information on black henbane, buffalo bur, camel thorn, Canada thistle, Dalmatian toadflax, dyer's woad, goatsrue, houndstongue, johnsongrass, jointed goatgrass, diffuse, Russian and spotted knapweed, leafy spurge, Mediterranean sage, musk thistle, perennial pepperweed, purple loosestrife, puncturevine, rush skeletonweed, silverleaf nightshade, scotch thistle, St. Johnswort, yellow nutsedge, purple and yellow starthistle, and velvetleaf. Topics include description, economic importance, geographic distribution, habitat, history, growth and development, reproduction, response to herbicides, response to cultural controls, and biocontrol potentials.

http://www.ipm.ucdavis.edu/PMG/selectnewpest.landscape.html#WEED

University of California pest management website has information on Bermuda grass, field bindweed, Russian thistle, yellow starthistle, and others. Topics include identification, biology, and management through cultural and chemical control options.

http://www.ext.colostate.edu/pubs/natres/pubnatr.html
Colorado State University Cooperative Extension website in the Range section has fact sheets on musk thistle, leafy spurge, Canada thistle, diffuse, Russian, and spotted knapweeds. Information includes description, phenology, and management options such as cultural, chemical, mechanical, and biological.

http://www.weedcenter.org
An interagency website housed at the Montana State University. The Center for Invasive Plant Management (CIPM) promotes the ecological management of invasive plants in the West through education, by facilitating collaboration among researchers, educators, and land managers, and by funding research projects and weed management areas. The center serves as an information clearinghouse, providing examples of ecological management, and delivering implementation tools and products to land managers. The center operates in partnership with federal, state, counties, private industry, universities, foundations, and landowners.

http://invader.dbs.umt.edu
The University of Montana's Invaders Database has a search engine that links the user to informational websites on most of the invasive weeds. You can search the database for the list of Noxious Weeds by state and most identified plants have additional information and links to more information.