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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

2014 Forest Pest Conditions In Nevada

White Pine Blister Rust in Sugar Pine Incline village, Nevada (Photo Jeff Haas) Lake Tahoe Basin

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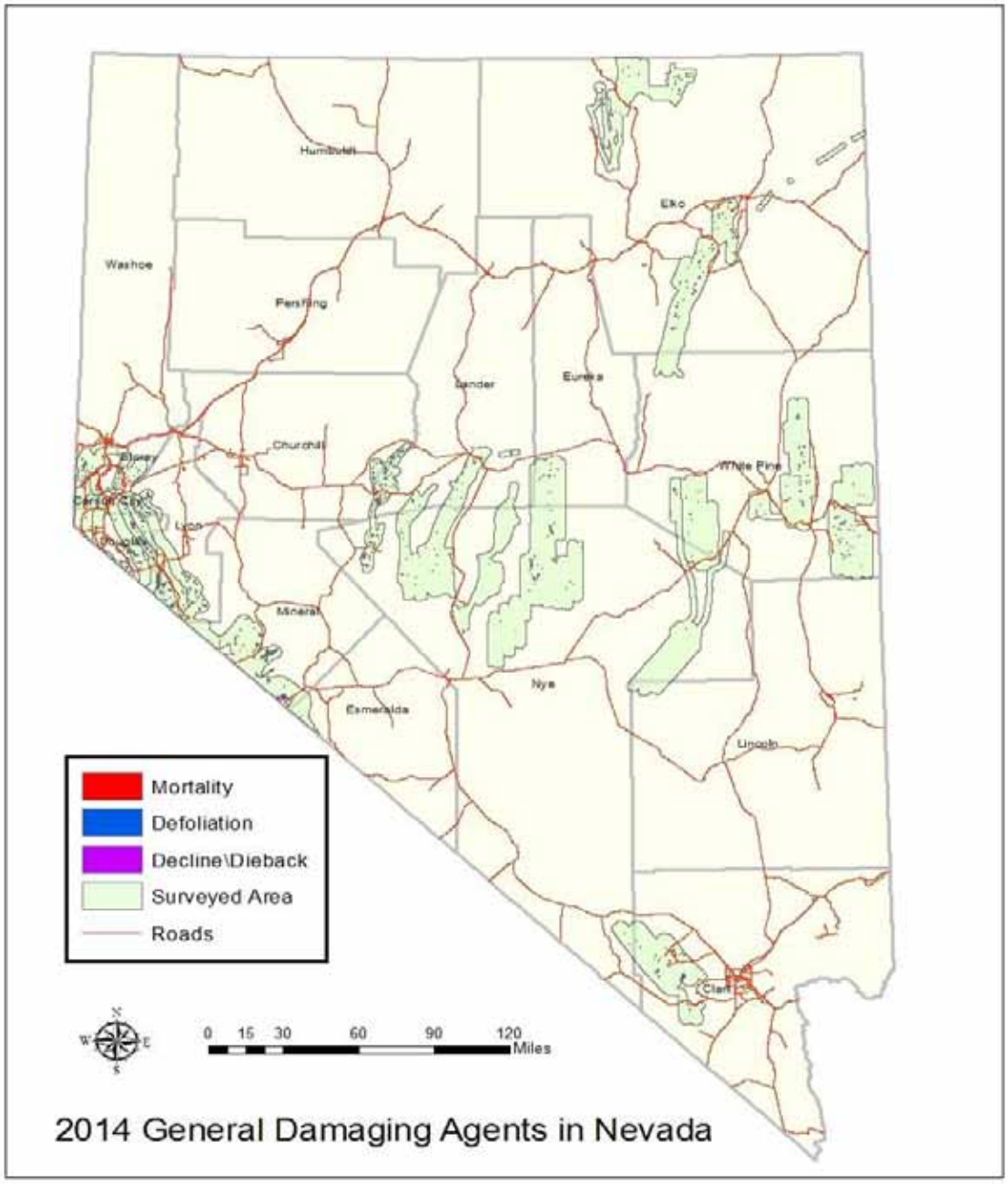

INTRODUCTION AND SUMMARY

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 2007 TO 2014

Land Ownership/Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
NF H-T (NV)	3,739,200	4,757,970	3,998,170	4,340,053	4,008,334	4,011,229	3,340,095	4,429,990
NF-HT (CA)	560,700	582,000	551,238	595,850	582,933	582,933	685,252	595,007
BLM	938,600	1,924,990	2,074,498	2,299,901	1,937,082	1,892,996	1,013,172	1,483,353
Private (NV)	381,900	440,637	540,760	360,865	519,280	306,606	148,504	391,378
Private (CA within NF)	36,200	31,800	28,071	32,335	41,528	29,846	60,155	70,501
Great Basin NP	76,900	75,995	77,005	76,890	75,604	75,604	76,959	77,021
Other Federal*	4,500	41,967	38,530	1,007	33,228	33,228	6,466	5,124
NV State Lands	20,100	17,073	22,113	20,579	20,105	17,163	148,504	21,848
TOTAL	5,758,100	7,872,432	7,330,385	7,727,480	7,218,094	6,949,605	5,479,107	7,074,222

*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 2014 are Nevada only and summarized on a county basis. The total number of acres in each county and the percentage of acres surveyed during 2014 are provided in Table 2.

TABLE 2 NUMBER AND PERCENTAGES OF ACRES SURVEYED IN NEVADA COUNTIES IN 2014

COUNTY	COUNTY ACRES	ACRES SURVEYED	PERCENT SURVEYED
Carson City	**103,569**	**96,338**	**93**
Churchill	3,215,911	70,184	2.2
Clark	5,176,177	391,095	7.6
Douglas	478,351	377,384	78.9
Elko	10,979,963	943,896	8.6
Esmeralda	2,294,165	45,863	2
Eureka	2,663,738	174,371	6.5
Humboldt	6,219,557	0	0
Lander	3,534,543	299,514	8.5
Lincoln	6,782,623	48,636	0.7
Lyon	1,310,315	344,865	26.3
Mineral	2,462,989	363,559	14.8
Nye	11,686,348	2,048,638	17.5
Storey	167,774	72,347	43.1
Washoe	4,234,009	159,625	3.8
White Pine	5,676,727	1,361,233	24
Total	66,986,759	6,797,547	10.1

In the winter of 2013-2014, moisture levels remained below average for the state of Nevada. This occurred again in the winter of 2014-2015, in Nevada and the majority of the state is experiencing extreme drought conditions (Figure 1).

In 2014, 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.

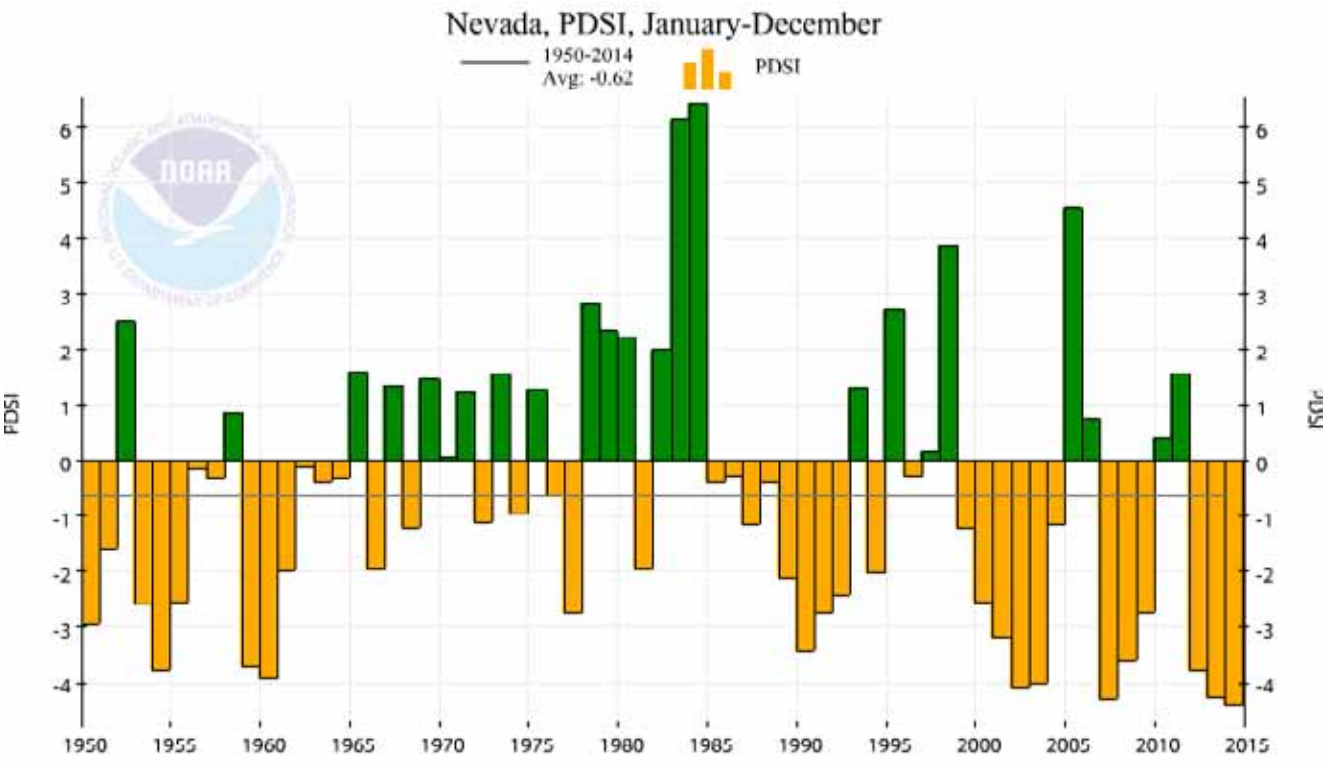

Figure 1 - National Oceanic and Atmospheric Administration (NOAA) Nevada Palmer Drought Severity Index – January - December Precipitation from 1950-2015 (National Climate Data Center).

Most of the tree mortality noted in 2014 is attributed to bark beetle activity. Acres affected were largely dominated by pinyon 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. Aspen and curlleaf mountain mahogany decline is largely attributed to successive years of drought, in conjunction with stress/damage induced by other biotic and abiotic factors such as a late spring/early summer frost.

In 2014, Nevada mortality caused by most insects and diseases (number of trees killed) decreased from 2013 for the fourth year in a row. Mountain pine beetle in lodgepole, whitebark, white, and limber pine decreased to 6,182 trees on 2,985 acres. Pinyon scale also decreased to only 5,440 acres being affected. The exception of mortality agents that increased was the fir engraver beetle, which increased as to 3,834 trees killed on 1,460 acres.

In 2014, acres affceted by defoliators decreased. Pinyon needle scale decreased nearly in 2014 with a total 5,440 acres damaged down from a total of 48,899 acres in 2013. ii) Pinyon sawfly, and Douglas-fir tussock moth were not detected in 2014 with no damaged acres recorded. Forest tent caterpillar was detected in 2014 , hower it was only recorded on 117 acres. Bark beetles increased the most throughout the state due to ongoing drought conditions. Mountain pine beetle, fir engraver beetle and pinyon engraver beetle saw the greatest increases in 2014 with a total of 28,452 acres recorded, as compared to 3,653 acres recorded in 2013. In additon, the 2012 outbreak of satin moth on aspen in locations throughout Nevada remained constant in 2014 on 34 acres located in different areas in western and central Nevada.

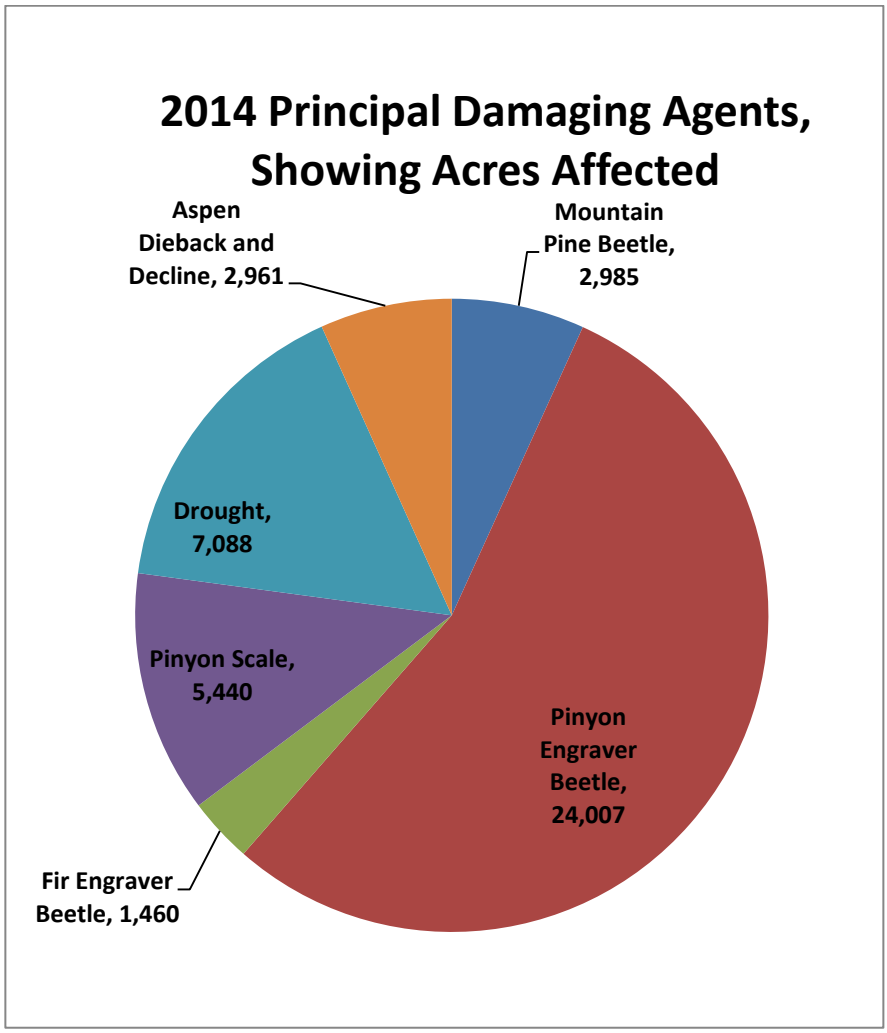

Figure 2 – Grahpic representation of the acres affected in Nevada by the main mortality and defoliation agents aerially mapped in 2014.

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 as far as Overton. All state (Nevada) and Federal releases of *Diorhabda* have been stopped due to a legal agreement with USDA and another party.

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 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.

Figure 3 - Douglas-fir tussock moth larvae.

(Photo from http://www.bugwood.org/)

No DFTM defoliation of was detected during aerial surveys in 2014 No moths were trapped in 2014.

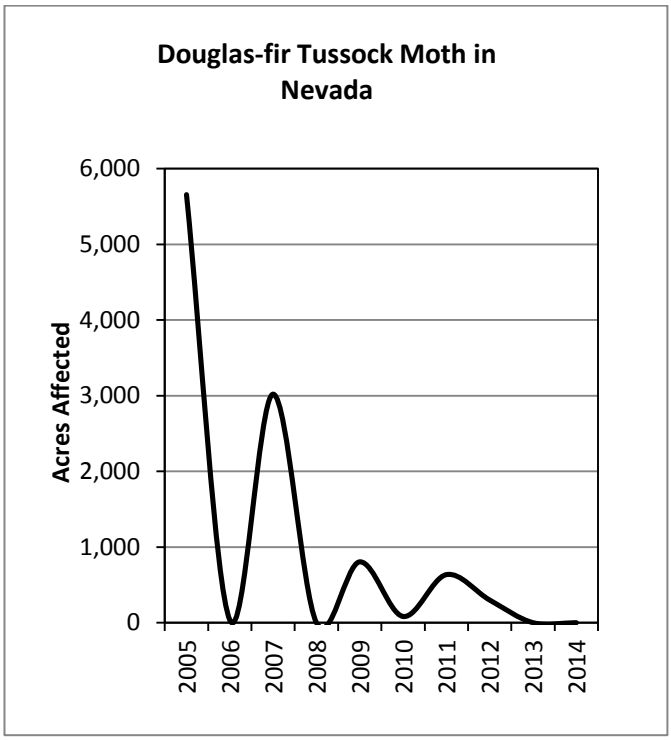

Figure 4 - Acres with Douglas-fir tussock moth defoliation in Nevada from 2005-2014.

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 2014, 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 2014, approximately 5,440 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.

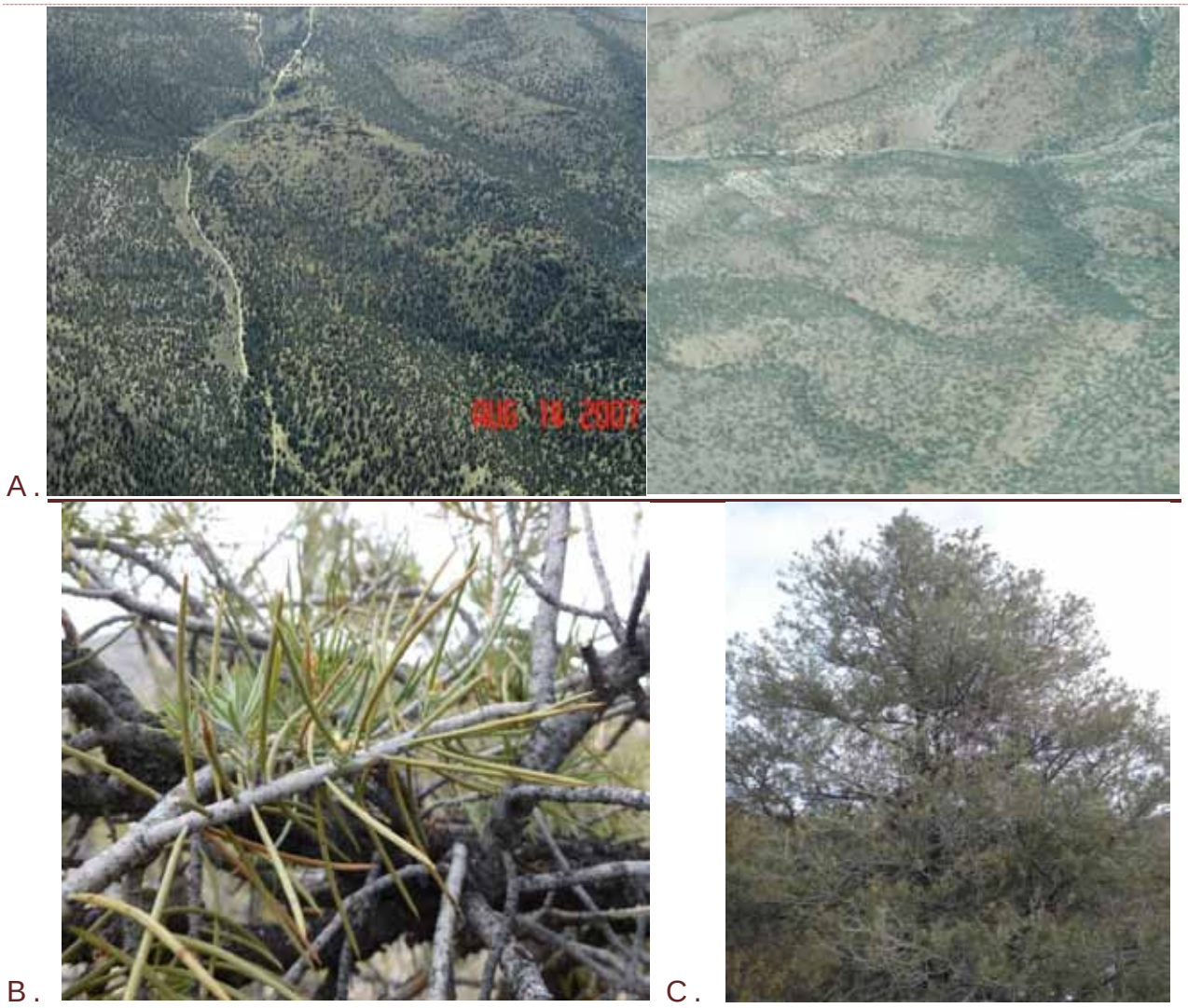

Figure 5 – (A) Top left photo of Berlin ichthyosaur State Park in 2007 before PNS infested the single leaf pinyon as shown on the top right photo of same general area in 2011 (note the see-through appearance of the foliage); (B) nearly epicormic re-growth exhibited on the defoliated pinyon in the spring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

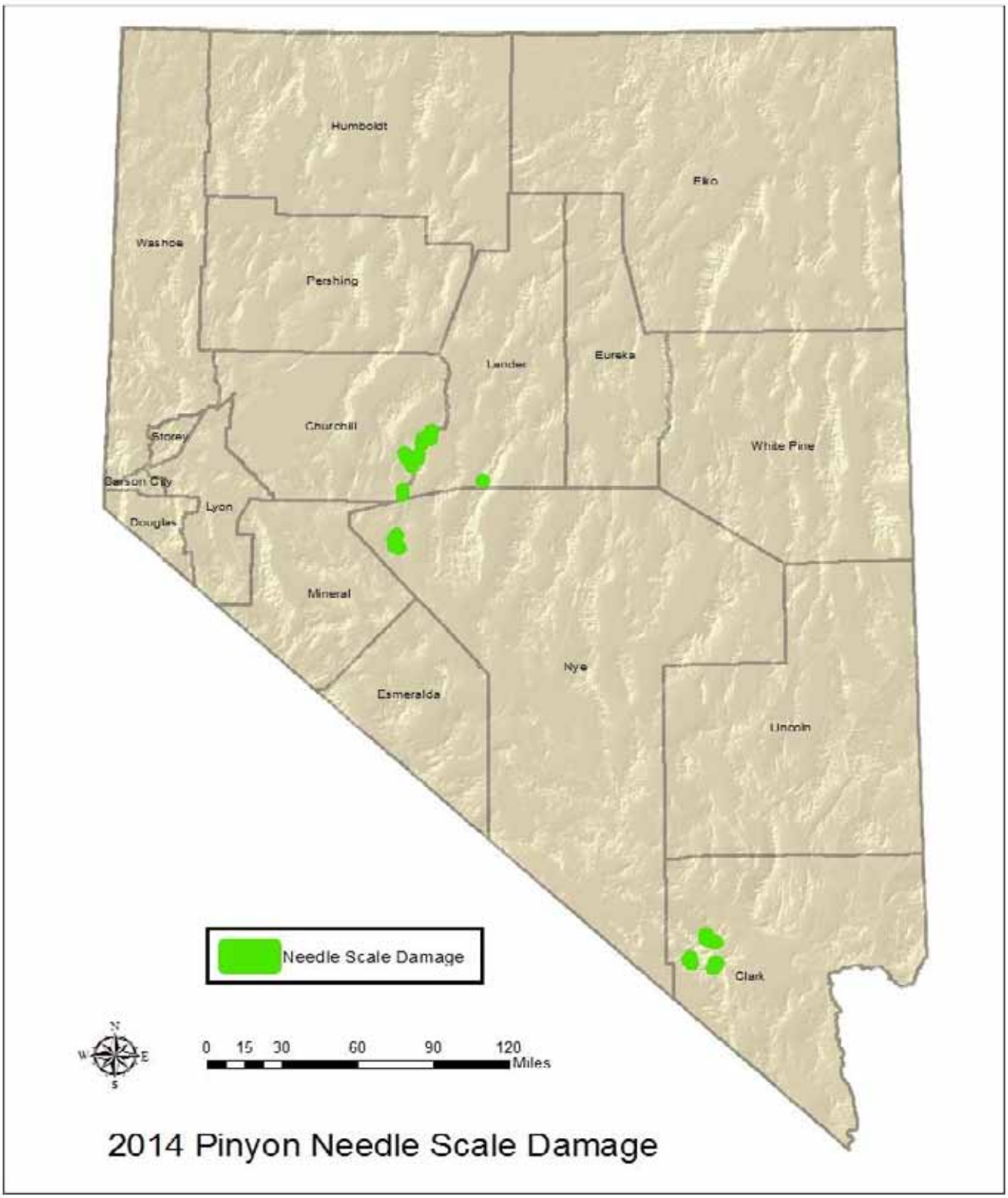

Figure 6- Pinyon needle scale (and other defoliator insect) damage in 2014.

Churchill County – 898 acres were mapped in scattered patches in the Stillwater and Tobin Ranges.
Clark County – 2,545 acres of PNS defoliation were mapped; this includes the central Spring Mountain Range, south of Wallace Canyon.
Lander County – 460 acres were mapped in large patches at lowest elevations of the Toiyabe Range. This is a continued reduction from last year.
Nye County – 1,565 acres were detected throughout the lower elevations of the Park, Hot Creek, Monitor, Toquima, Shoshone, Toiyabe, Grant, Paradise, Horse and White Pine Ranges in large elevational band swaths.

Pinyon Axil Scale
Matsucoccus monophyllae

Host: pinyon pine

In the spring of 2011, *M. monophyllae* was found on many of the singleleaf pinyon trees infested with pinyon needle scale in Western Nevada. Although it is impossible to differentiate from pinyon needle scale from the air, it is probably more widespread than just Western Nevada. Species taxonomically identified by Jeff Knight, Nevada State Entomologist in Spring 2011 from collections by Gail Durham from the western Pinenut Mountains in Douglas County, NV. This insect was noted throughout Nevada in needle scale infested areas.

Figure- 7 - *Matsucoccus monophyllae* in twig axil on *M. acalyptus* infested twig, May 2011.

Figure 8 – *M. monophyllae* at the base of the needles on twig on *M. acalyptus* infested twig.

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 2014, the area of FTC defoliation increased slightly from 2013. Approximately 117 acres were mapped in Elko County.

Unknown and Frost Damage

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

Approximately 96 acres of unknown or frost damaged aspen was aerially mapped throughout northern Nevada in 2014. Approximately 10 acres of the mapped area is in wilderness areas located in Mineral County. These areas are very inaccessible so the cause of the defoliation was not verified in the field in 2014. Approximately 86 acres were mapped in Douglas 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 2014 approximately 3,834 trees were killed on 1,460 acres. This is large increase from the 44 acres detected in 2013. 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.

In all counties detected, increases in both trees killed and acres affected were mapped.

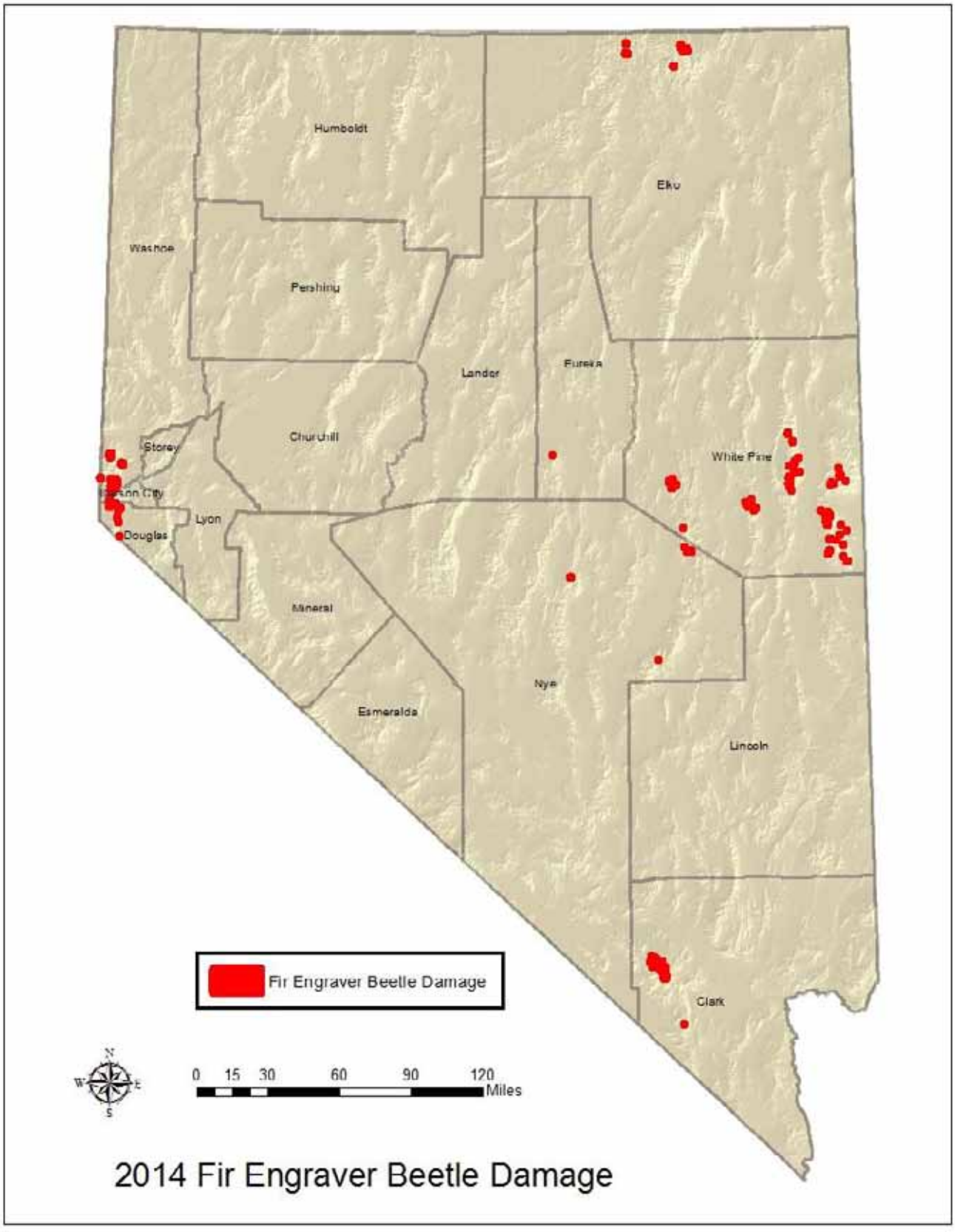

Figure 9 – Areas of mortality caused by the fir engraver beetle in Nevada in 2014.

Carson County – Mortality occurred in 25 killed trees on 8 acres located in the Carson Range within the county.
Clark County- 2014 mortality increased - 172 killed trees on 87 acres. The area mapped was found in Lee and Kyle Canyon which is north and east of Mount Charleston.
Douglas County – Mortality increased in 2014 to 110 killed trees on 28 acres located mainly in the Carson Range within the county.
Elko County - Mortality occurred in 43 killed trees on 23 acres located mainly in the northern Ruby Mountains.
Eureka County – Mortality was very low with only 2 killed trees on 1 acre.
Nye County – Mortality occurred in 51 killed trees on 26 acres located mainly in the southern Monitor Range.
Washoe County – The largest amount of mortality in Nevada was found in Washoe County – 2,140 trees on 769 acres. This is a dramatic increase since no was recorded in 2013. All along the Sierra Front Range in white fir stands.
White Pine County – Mortality in White Pine County increased as well to 1,291 trees on 519 acres as compared to - 75 trees on 37 acres in 2013. Mapped activity is found in scattered pockets in the White Pine, Schell Creek and Snake Ranges.

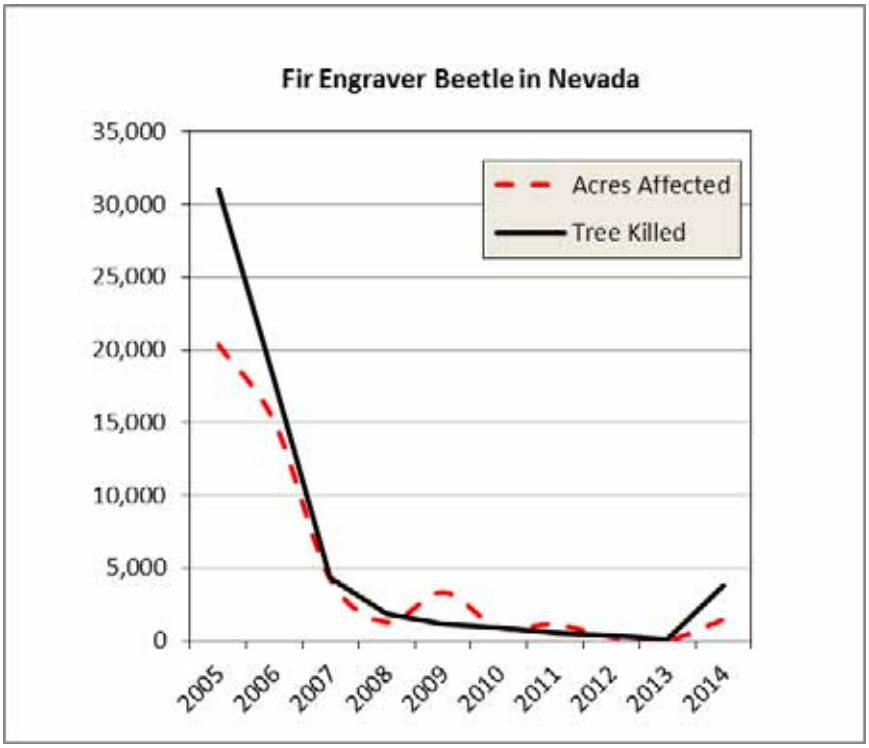

Figure 10 - Fir engraver mortality in Nevada 2005 - 2014

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)

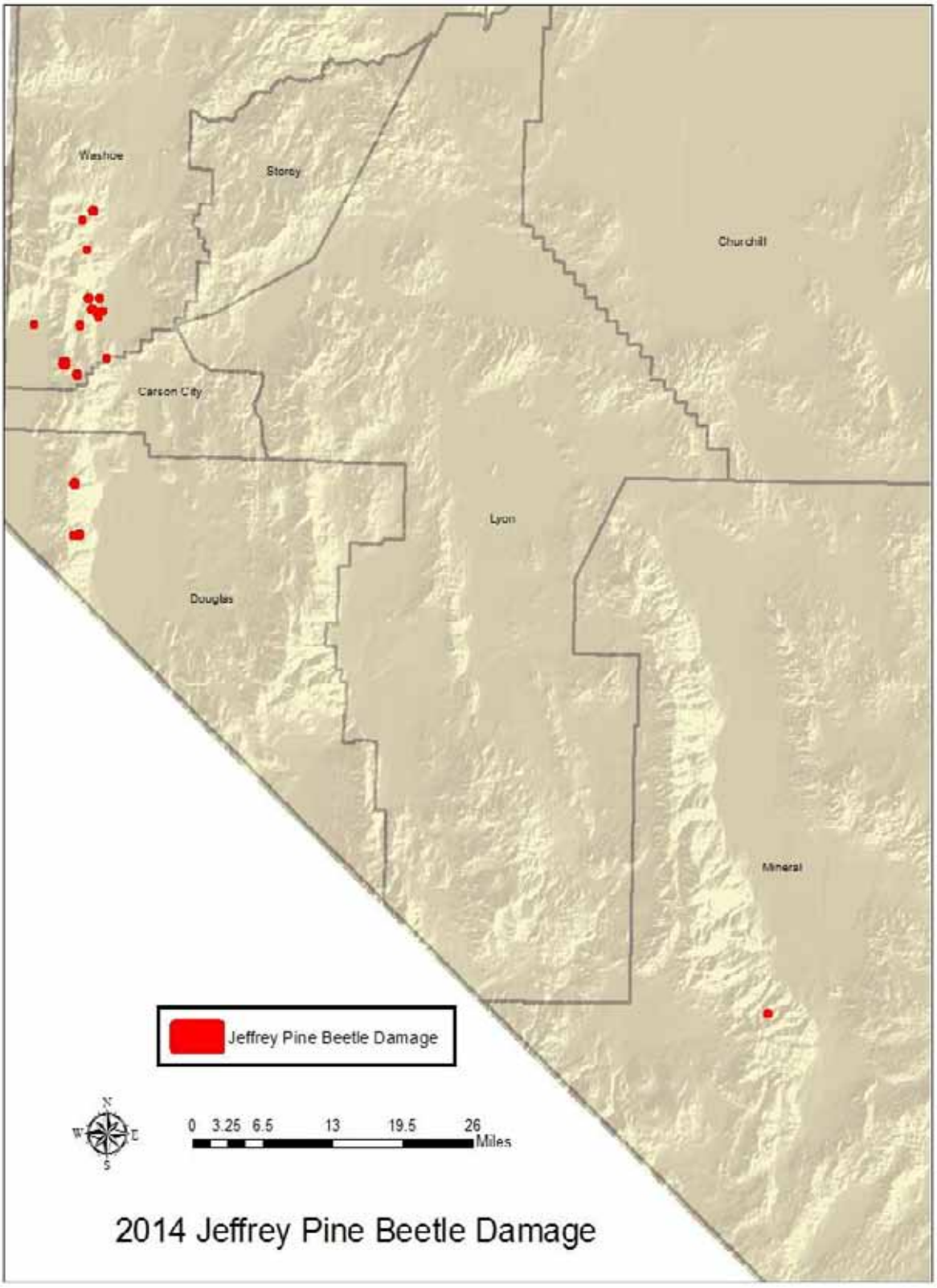

Figure 12 – Jeffrey Pine Beetle mortality in 2014 in western Nevada.

Douglas County – Mortality occurred in 13 trees on 16 acres mainly in the Carson Range within the county.
Mineral County – Mortality occurred on one acre on the HTF south of Walker Lake.
Washoe County – Mapped mortality, in 2014, increased to 167 trees on 59 acres compared to 3 trees on 1 acre in 2013. 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 2014, MPB-caused tree mortality in Nevada increased in all species with the biggest increase in whitebark and limber pine. Mortality increased by nearly 170% with a total of 2,985 acres mapped. Most of the 2014 Nevada mortality occurred in Douglas, Elko, Nye, Washoe, and White Pine counties.

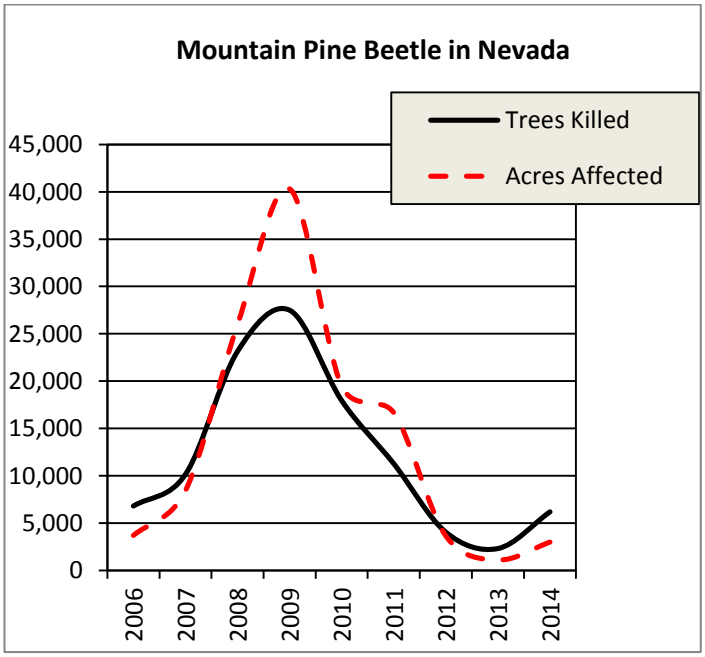

Figure 13 - Number of whitebark, limber, western white, and lodgepole pine trees killed and acres affected by mountain pine beetle in Nevada from 2006-2014.

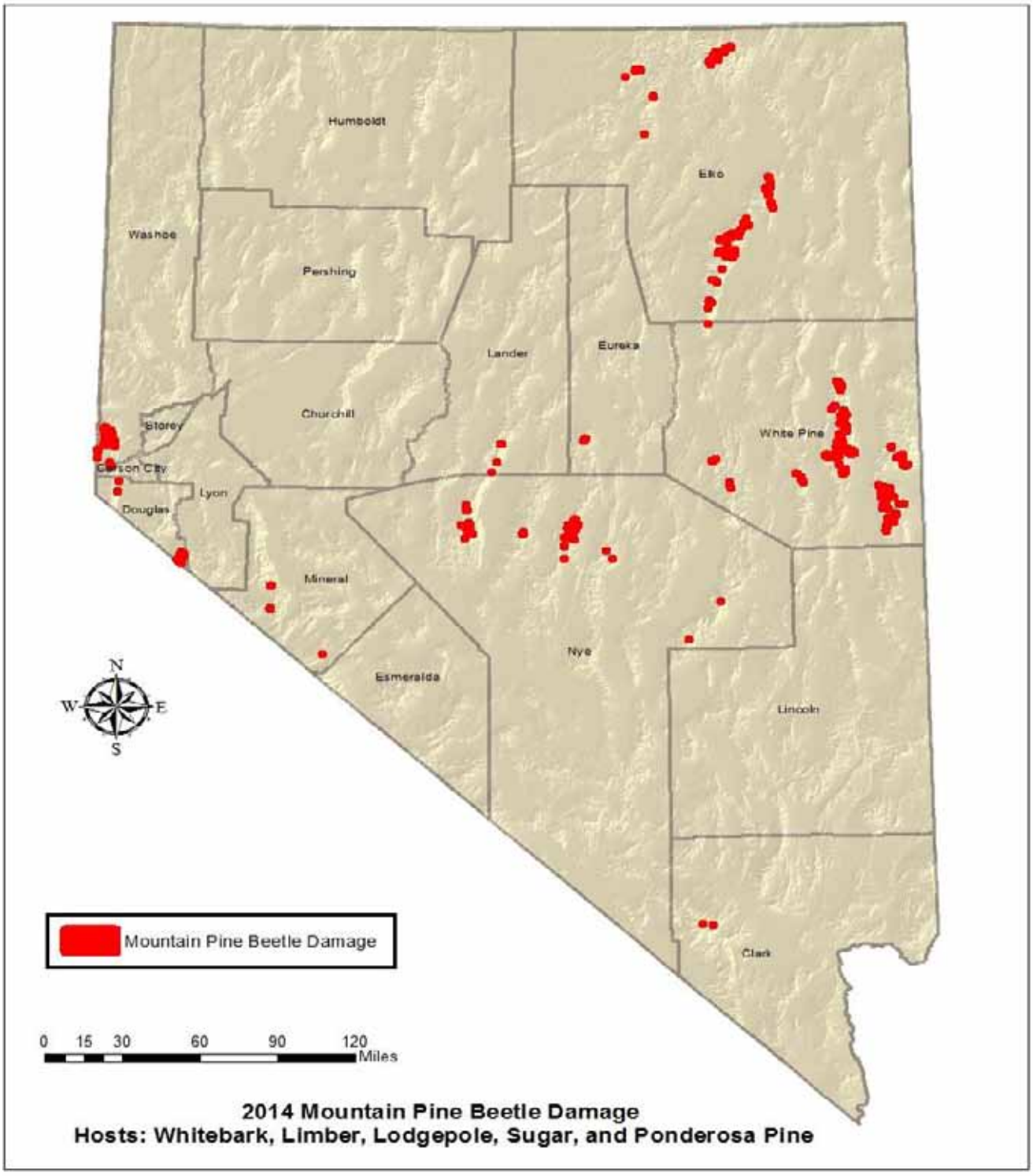

Figure 14 – Aerial Detection Surveys of Nevada and eastern California mountain pine beetle-caused tree mortality in 2014.

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

In 2014, mortality of limber, whitebark, and western white pines caused by MPB increased by 202% to 1,968 trees on 2,959 acres. Mortality occurred in small groups of trees on high mountain ridges, but was more widespread at slightly lower elevations surveyed.

Figure 15. Mountain pine beetle-caused tree mortality, in the Jarbridge Mountains, captured moving down slope toward the town of Jarbridge, NV. Photo taken in August 2010 (top) and August 2012 (bottom) illustrating the expanses of dead pine hosts in 2012. (Photos: Gail Durham)

Clark County – Surveyors mapped 4 MPB killed limber pine trees on 3 acres.
Douglas County – Surveyors mapped 996 MPB killed whitebark pine trees on 805 acres in the Carson Range within the county.
Elko County – Surveyors mapped 528 MPB killed whitebark and limber pine trees on 223 acres. The majority of this mortality occurred in the Ruby Mountains
Eureka County – Surveyors mapped 16 MPB-killed limber pine trees on 8 acres.
Lander County – Nine whitebark pine trees were mapped on 5 acres in scattered patches along the upper elevations of the Toiyabe Range.
Mineral County – Surveyors mapped 5 MPB killed limber pine trees on 2 acres.
Nye County – Surveyors detected 204 MPB-killed whitebark and limber pine trees on 104 acres. This is a 62% increase in mortality in this host type in comparison to 2013 data. Most of it was found in numerous small to medium-sized spots mapped throughout the highest elevations of the Toiyabe, and Monitor Ranges with the vast majority of the affected areas in the Arc Dome, and Table Mountain Wilderness Areas.
Washoe County – There were 2,636 western white and whitebark pine trees on 813 acres mapped in 2014, this represents an almost a 700% increase in acres from what was detected in 2013. The 2014 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.
White Pine County – A total of 1,704 western white, whitebark and limber pine trees were mapped on 897 acres. This represents a 21% increase in MPB-caused tree mortality in 2014. Most mortality was observed in small to medium-sized patches that were scattered along the tops of the Egan Range, throughout the Snake Range (including Great Basin National Park and Mt Moriah area), throughout the Schell Creek Range, including scattered small pockets throughout the White Pine Range.

Mountain Pine Beetle in Lodgepole Pine

In 2014, MPB activity in lodgepole pine in Nevada decreased by 81% of 2013 mortality figures with 83 killed trees on 26 acres.

Elko &Washoe County –83 trees on 26 acres were observed in small scattered areas throughout the Carson Range from north of Marlette Lake into the Mt. Rose Wilderness area and east into Little Valley. One new pocket was identified south of Hobart Reservoir as well. Mortality is expected to increase in 2015 with the ongoing drought conditions. Below is the trapping data from Mt. Rose for 2014.

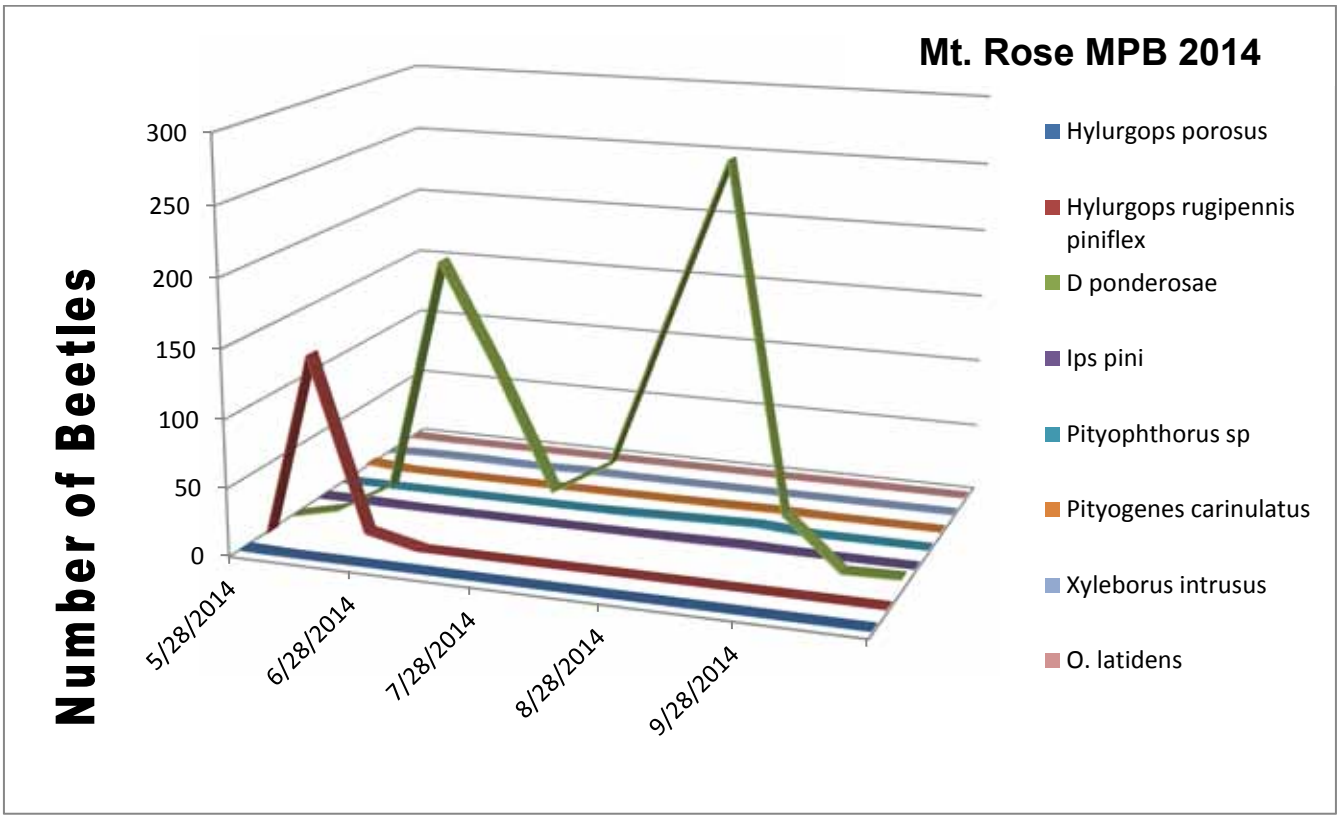

Figure 16 - Mt Rose Ski Area MPB trap catch data for summer 2014 with peak MPB catches from early-July and mid-September which covered 2 flights during the season. This data is mainly to track population trends of MPB and does not compare this activity to other beetles trapped. However, there are secondary beetle being trapped which can be indicators of increased bark beetle activity.

Western Pine Beetle (WPB) in Ponderosa Pine

In 2014, ponderosa pine mortality was attributed to western pine beetle in four counties within the state of Nevada. See figure 16 for trapping data.

Douglas County – Surveyors mapped 15 WPB killed ponderosa pine trees on 8 acres located in the Carson Range within the county.
Clark County – In 2014, there were 51 WPB-killed ponderosa pine trees mapped on 30 acres in Clark County; this is a slight decrease in WPB activity. Below are graphs showing the results from trapping in Kyle and Lee Canyons 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 2014 field season to monitor any changes in beetle populations.
Lander & White Pine County – Surveyors mapped 7 WPB killed ponderosa pine trees on 4 acres.

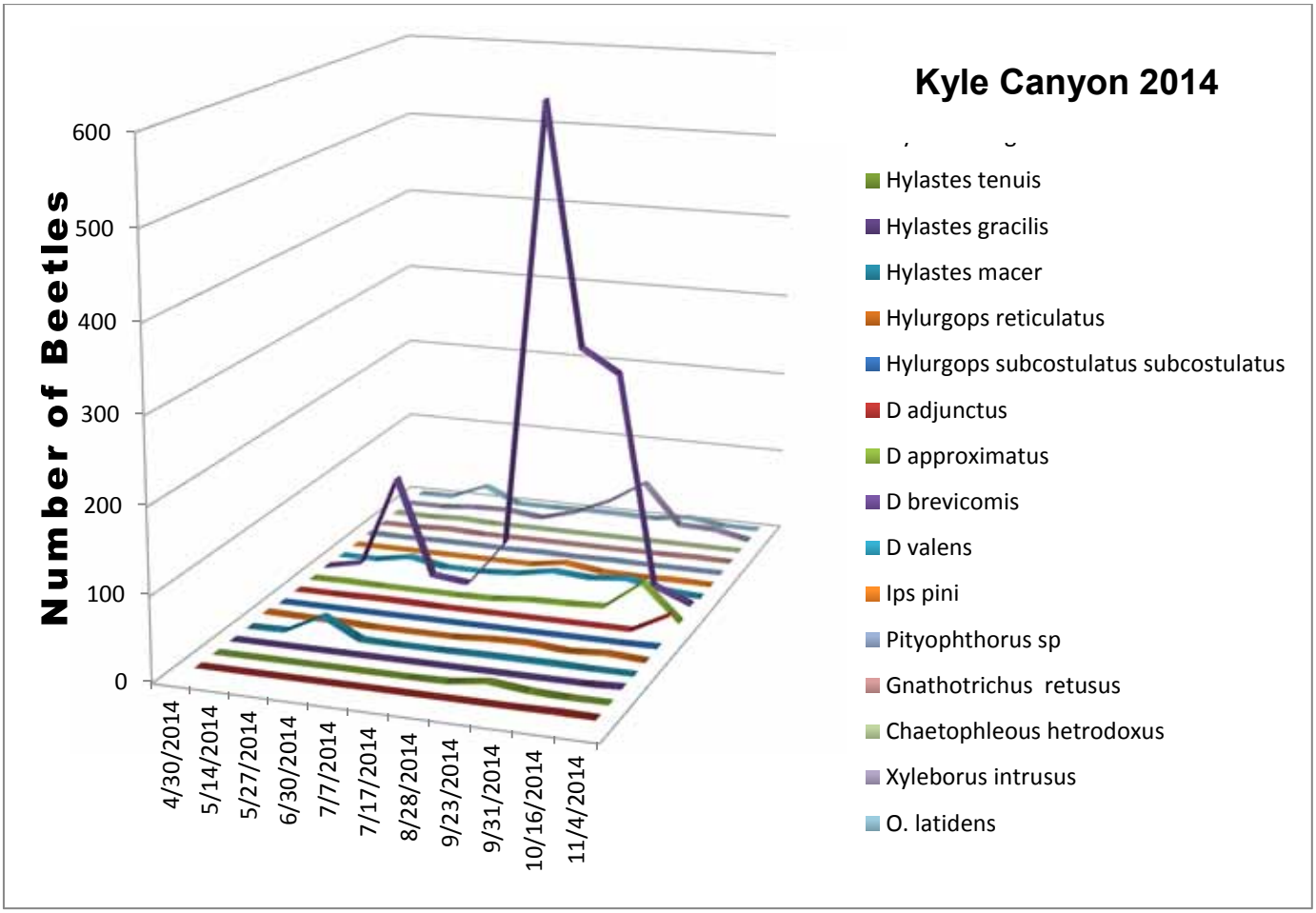

Figure 17 – Kyle Canyon trap catches summer of 2014 showing the dominance of D. brevicomis in early to mid-summer through early fall. This data is mainly to track population trends of WPB and does not compare this activity to other beetles trapped. However, there are secondary beetle being trapped which can be indicators of increased bark beetle activity. X. intrusus is an ambrosia beetle that shows a minor correlation to increased WPB peak activity but it is secondary in nature.

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.

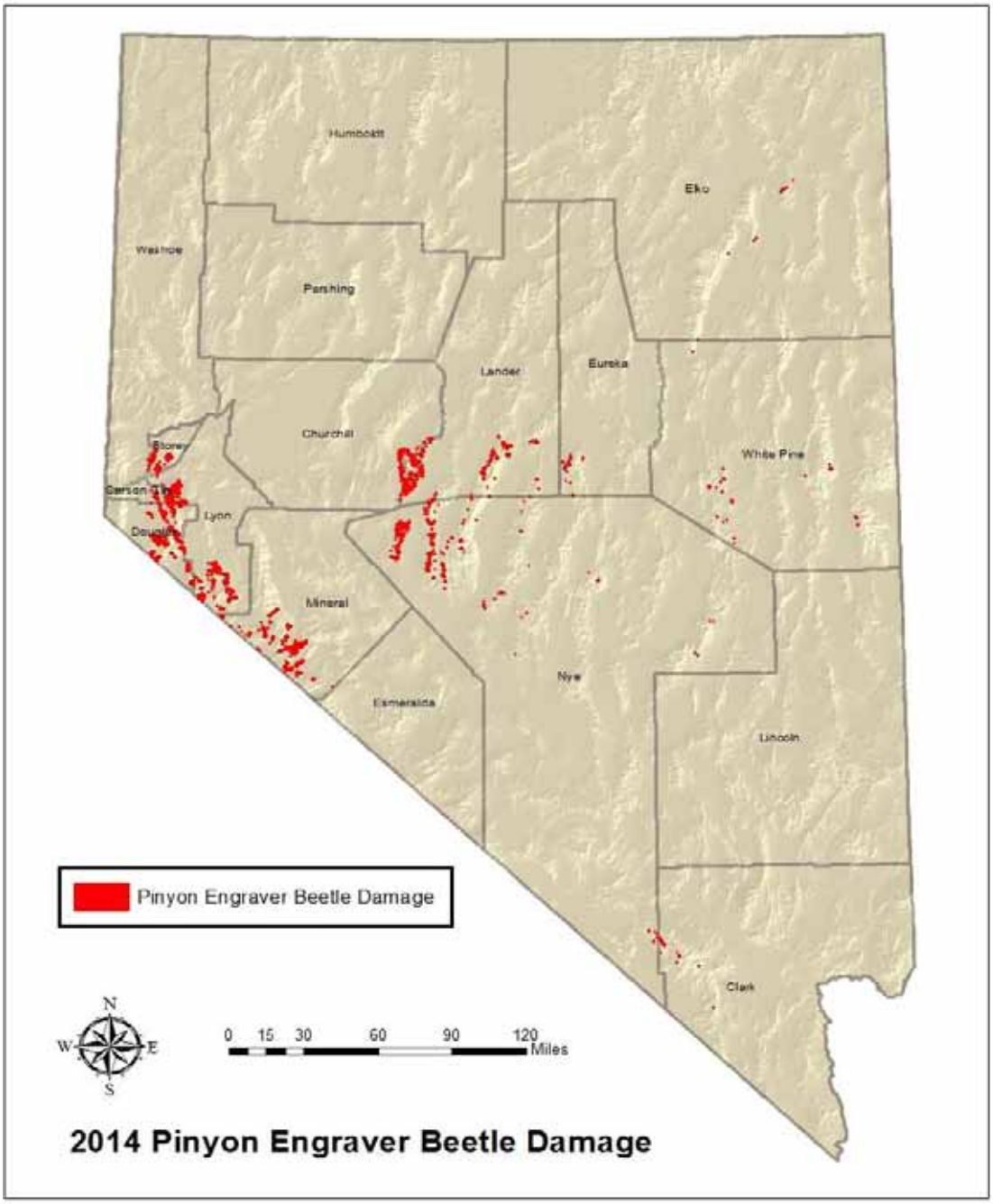

Figure 18 – Tree mortality caused by the pinyon engraver beetle in 2014 in Nevada.

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 2014, 67,995 trees were infested by pinyon *Ips*, affecting over 24,007 acres (Figure 19). This is a 860% increase in tree mortality compared to 2013 (7,025 trees were infested by pinyon *Ips*, affecting over 2,500 acres). In 2014, thirteen counties had recorded mortality from pinyon *Ips*. Douglas, Lyon and Mineral counties had the greatest number of trees killed which represents 85% of the state total.

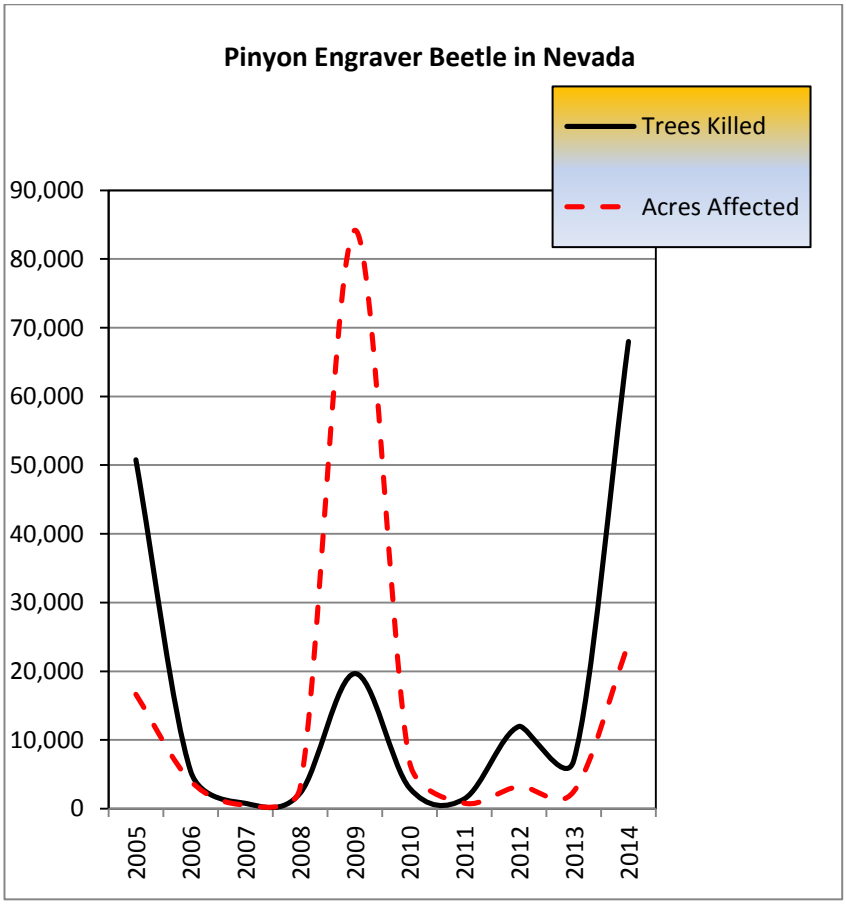

Figure 19 - Number of pinyon pine killed and acres affected by pinyon engraver beetle/pinyon *Ips* in Nevada and from 2005-2014.

Carson City County – In 2014, surveyor's mapped 37 pinyon *Ips*-killed pinyon pines on 17 acres.
Churchill County - In 2014, surveyor's mapped 5,402 pinyon *Ips*-killed pinyon pines on 1,328 acres. This is a dramatic increase from 2013 where very little damage was recorded and is likely caused by the ongoing drought.
Clark County – Surveyors detected 24 pinyon *Ips*-killed pinyon pine trees on 17 acres in 2014.
Douglas County – In 2014, surveyor's detected 18,814 pinyon *Ips*-killed pinyon pines on 5,521 acres. This represents a large increase in mapped tree mortality and acres affected (2013: 775 trees killed over 228 acres). 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.
Elko County – In 2014, there was a slight increase in mapped mortality in Elko County. Surveyors mapped 24 pinyon *Ips*-killed pinyon pines on 15 acres.
Eureka County – There was 450% increase in mapped tree mortality in 2013 including a 450% increase in affected acres mapped). In 2014, surveyors detected 110 trees on 56 acres in comparison to the 20 trees on 10 acres detected in 2013. Mortality continues to occur in scattered, small pockets at the lower elevations of the Monitor Range, especially in the areas heavily hit by pinyon needle sawfly.
Lander County – In 2014, there was a large increase in mapped mortality and acres affected by pinyon *Ips*. Approximately, 1760 trees on 974 acres were detected in 2014, in comparison to 96 trees were mapped on 48 acres in 2013. Damage is found in scattered pockets in the northwest Shoshones, and northern Toiyabe Ranges.
Lyon County –The number of detected pinyon *Ips*-killed pinyon pine increased dramatically in 2014 (from 1,124 trees in 2013 to 16,636 trees in 2014). The amount of affected acres followed this trend and increased from 369 acres in 2013 to 4,560 acres in 2014. Mortality was identified in eastern Pine Nut Mountains as well as the northern and eastern portions of the Pine Grove Hills.
Mineral County – In 2014, there was a dramatic increase in mortality due to the ongoing drought. Surveyor's mapped 22,664 pinyon Ips-killed pinyon pine trees on 10,643 acres as compared to 4,283 pinyon Ips-killed pinyon pine trees on1,482 acres in 2013. Mortality is primarily located in the Excelsior Mountains
Nye County – There was a 160% increase in pinyon Ips caused pinyon pine mortality in 2014 (detectable numbers went from 351 trees to 924 trees). Damage on 491 acres was identified in scattered pockets in the Grant and Quinn Canyon Range, Hot Creek, Monitor, Toquima, southern Toiyabe and Shoshone Mountains.
Storey County – In 2014, surveyor's mapped 788 pinyon *Ips*-killed pinyon pines on 158 acres.
Washoe County – In 2014 582 pinyon *Ips*-killed pinyon pine trees on 118 acres were mapped. Damage is located scattered throughout the county but concentrations were noted in the Virginia Highlands.
White Pine County – In 2014, ADS surveyors mapped 230 trees on 112 acres, representing a 38% decrease in tree mortality and 40% decrease in acres affected when compared to 2013 ADS data (368 trees killed on 187 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 Ward Mt area, Egan, Snake and Schell Creek Mountains.

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 29 photos below:

Figure 21 – White satin moth larvae (top left); female white satin moth (top right); egg mass (bottom left); and complete defoliation of aspen in North Canyon, Spooner State Park, NV 2012 (bottom right). Photos by Jeff Knight, State of Nevada Entomologist, NV Dept. of Agriculture.

In 2014, 34 acres of WSM defoliation were detected. This is acreage is the same from the 2013 ADS data. Carson City and Douglas Counties had 5 and 29 acres, respectively, of detectable WSM activity. There was defoliation noted in urban areas along Hwy 395 and some stands near Spooner Summit and Spooner State Park. In 2014, the area of previous defoliation in Nevada was mapped at approximately 34 acres in Washoe County in North Canyon of Spooner State Park and in Little Valley just west of and above Washoe Valley. Defoliation has seemed to have subsided. Field inspection is June, of 2014 showed very little to no WSM activity. It is surmised that in this area natural predators reduced the population to low levels.

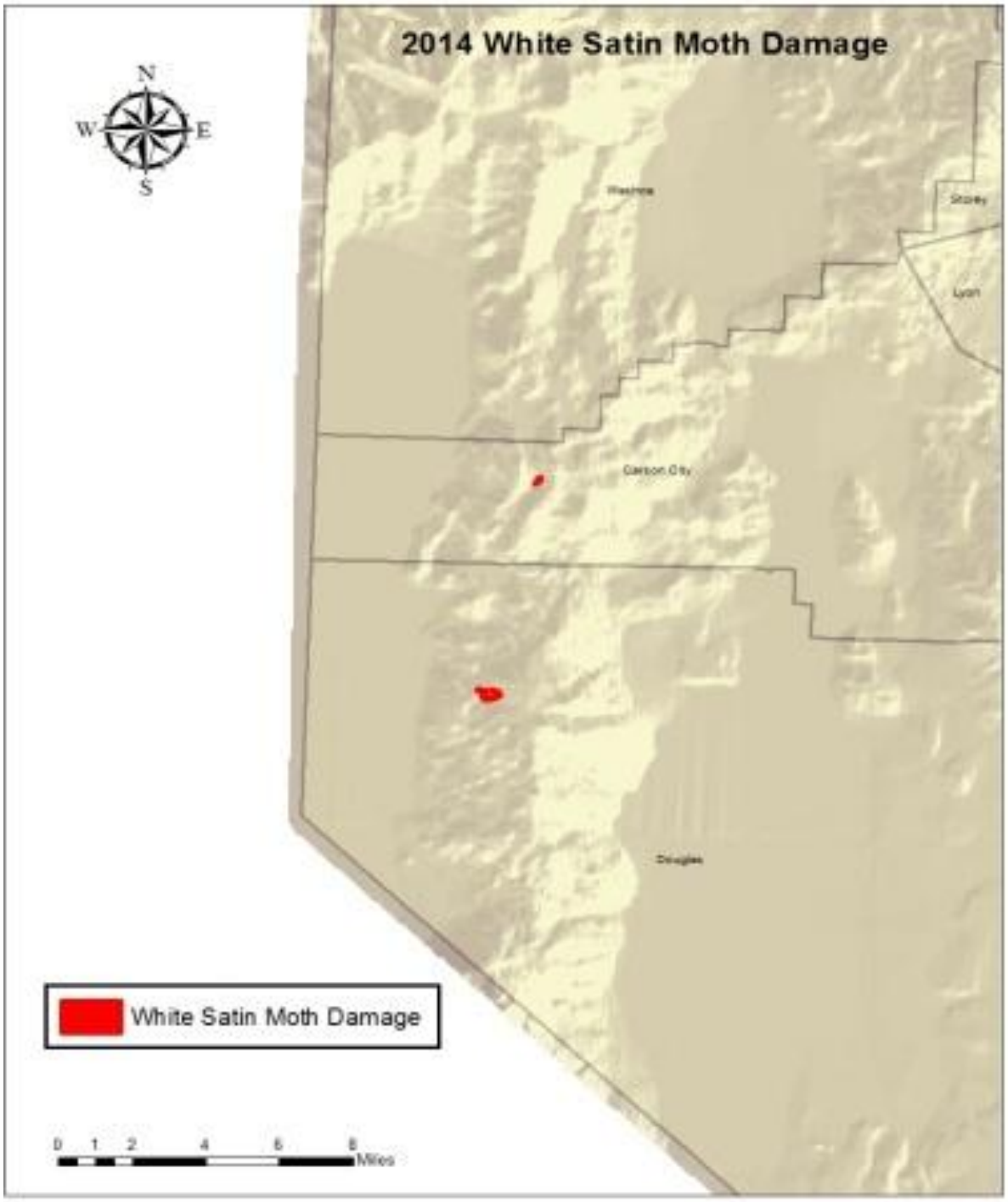

Figure 22– Tree mortality caused by the White Satin Moth in 2013 in Nevada.

European Gypsy Moth
Lymantria dispar

Hosts: various deciduous species

In 2014, 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 2014.

Figure 23 - 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 in the spring of 2014, 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 24 – 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 25- 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 26 – White Pine Blister Rust in sugar Pine
Photo – Jeff Haas

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 2014; however 2 pockets were found in the Montreux subdivision located off the Mt. Rose Highway. An additional site was identified in the south end of Washoe Valley, just north of Carson City, Nevada. All of these new sites were causing mortality in Jeffrey pine and appears to be endemic in nature. These sites will be investigated further in the summer of 2015 since it is rare to find this pathogen in Jeffrey pine.

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. Although it was not observed in aerial surveys in 2010, it has been seen in the northern Toiyabes in heavily frost damaged aspen stands.

Figure 30 - Symptoms of aspen leaf spot disease.

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.

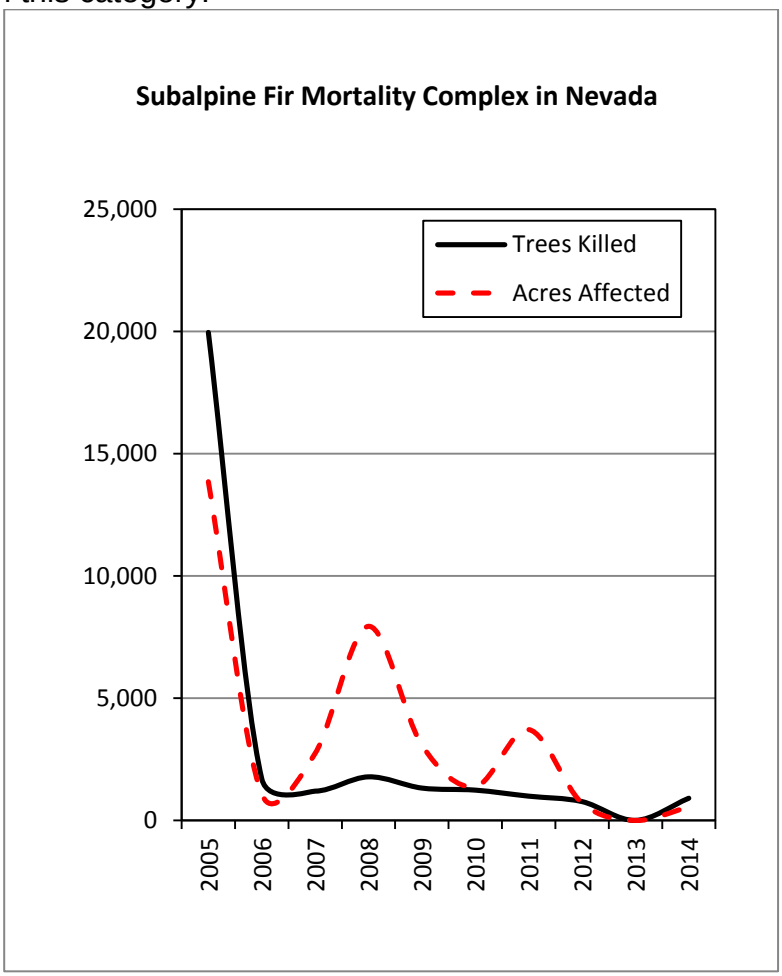

Figure 31 - Subalpine fir mortality complex 2005 - 2014

In 2014, mortality attributed to subalpine fir mortality complex increased from 2 acres in 2013 to 911 acres in 2014. All mapped 2014 ADS activity is located in Elko County.

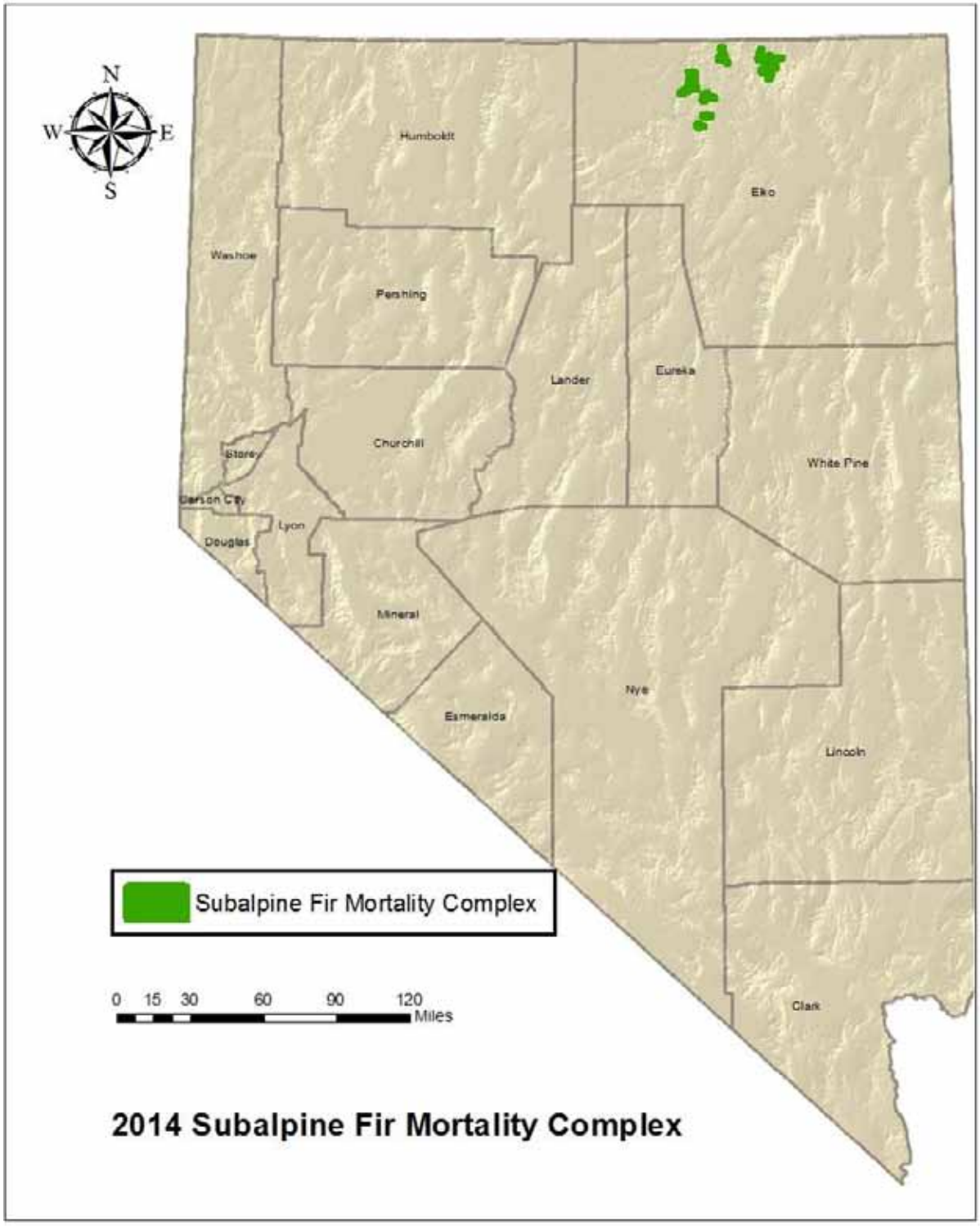

Figure 32 - Subalpine fir mortality 2014 in Elko County, NV.

Elko County – Approximately, 911 trees on 554 acres were detected in 2014. This infestation is located Jarbridge Mountains.

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.

In 2014, 1,057 acres of aspen dieback / decline was mapped in Carson, Douglas, Elko, Eureka, Nye and Washoe Counties. This is an 8% decrease from 2013 ADS data (1,119 acres).

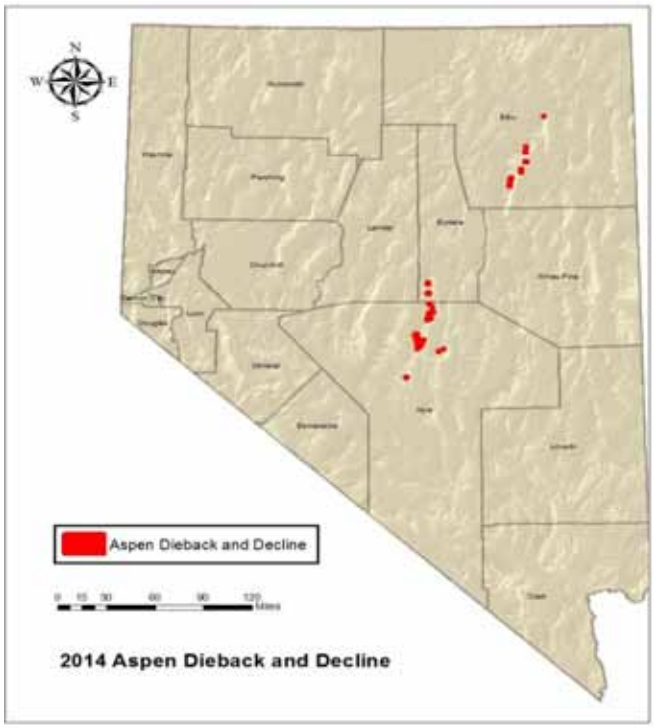

Figure 33 – Dieback & Decline of Aspen in Nevada 2014

Carson & Douglas County – In 2014 there were 15 acres of detectable aspen decline/dieback found scattered throughout the Carson Range.
Elko County – In 2014 there was 944 acres of detectable aspen decline/dieback.
Eureka County – Scattered pockets were found at the mid-to-high elevation ranges in the northern Monitor Range and a total of 12 acres were mapped.
Nye Counties – In 2014, surveyors detected 59 acres of aspen decline/dieback in Nye County. Dieback is found in pockets in the southern Toiyabe Range as well as areas throughout the Monitor and Antelope Ranges.
Washoe County – There was 25 acres of detectable aspen decline / dieback. This was found in scattered pockets in the Carson Range.

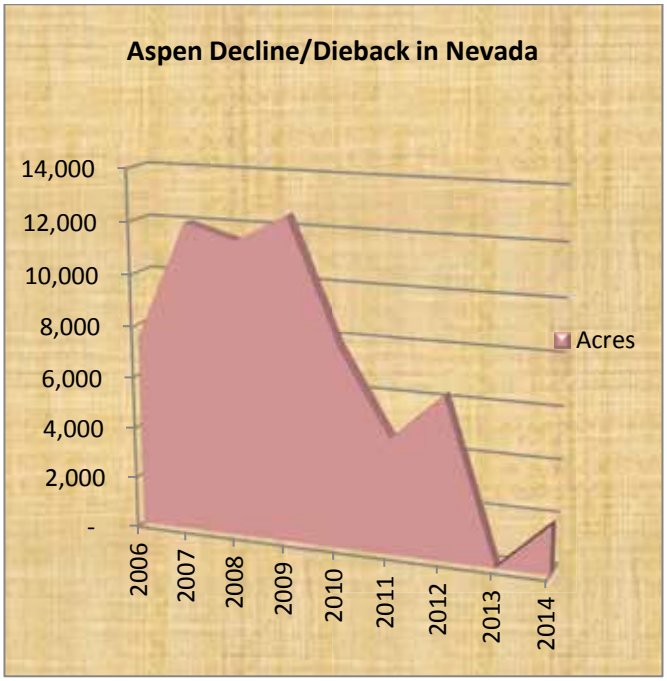

Figure 34 –Graph of Nevada aspen decline/dieback from 2006-2014.

ABIOTIC DAMAGE

Drought Damage

Host: curlleaf mountain mahogany

Extensive yellowing and loss of curlleaf mountain mahogany (*Cercocarpus ledifolius* Nutt. Ex Torr. & Gray) foliage was seen from 2007 through 2011 throughout the state. These evergreen leaves had turned yellow or red before dropping. In many areas, only small tips of green leaves remained on the trees. In many of the areas that were declining, mountain mahogany mortality has occurred in the centers of the large patches (Figure 42). In 2011, the mahogany appeared to recuperate, although many stands have dead centers. The amount of decline decreased in 2011 again (Figure 42).

In 2014, the statewide affected acreage mapped was 7,088 acres which is approximately a 50% decrease of the 2013 affected acreage. In 2014, the number of counties affected remained at four. Mineral County had the majority of damage followed by Lyon and Douglas Counties.

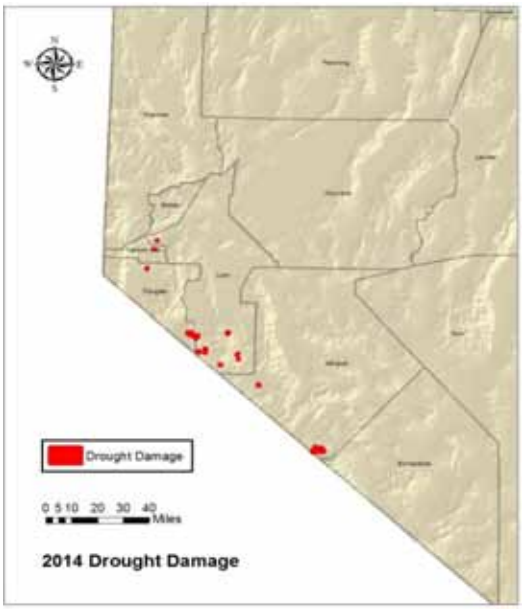

Figure 35 – Mountain Mahogany defoliation in Nevada 2014

Carson County – Surveyors detected 1 acre of decline in 2014
Douglas County – In 2014, detectable drought damage to mountain mahogany was mapped at approximately 472 acres. This was scattered throughout the county.
Lyon County – There was 980 acres of detectable mountain mahogany decline mapped in 2014.
Mineral County – In 2014 5634 acres were mapped in the county. This is the majority of the acreage mapped in the state of Nevada.

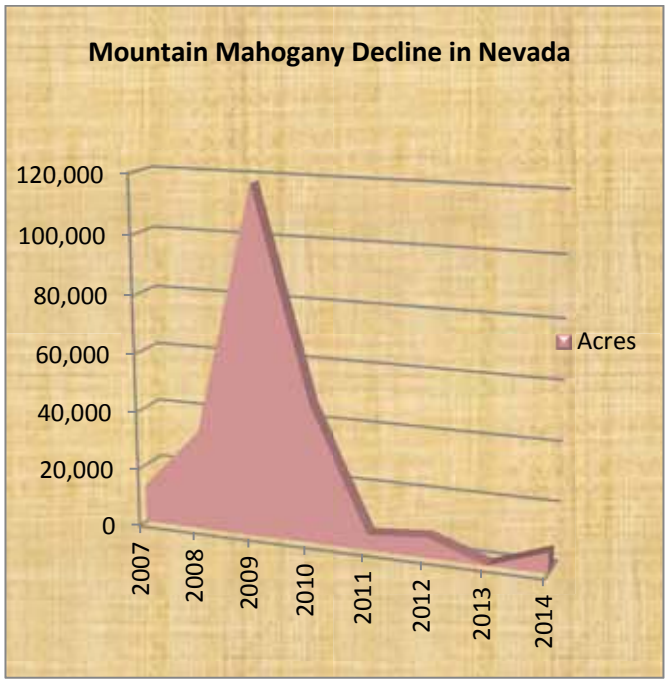

Figure 36 – Mountain mahogany decline from 2007 - 2014.

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 2014.

Wildfire Damage

In 2014, 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 59,252 acres burned statewide across all ownerships with very little damage to the forest resources of the state.

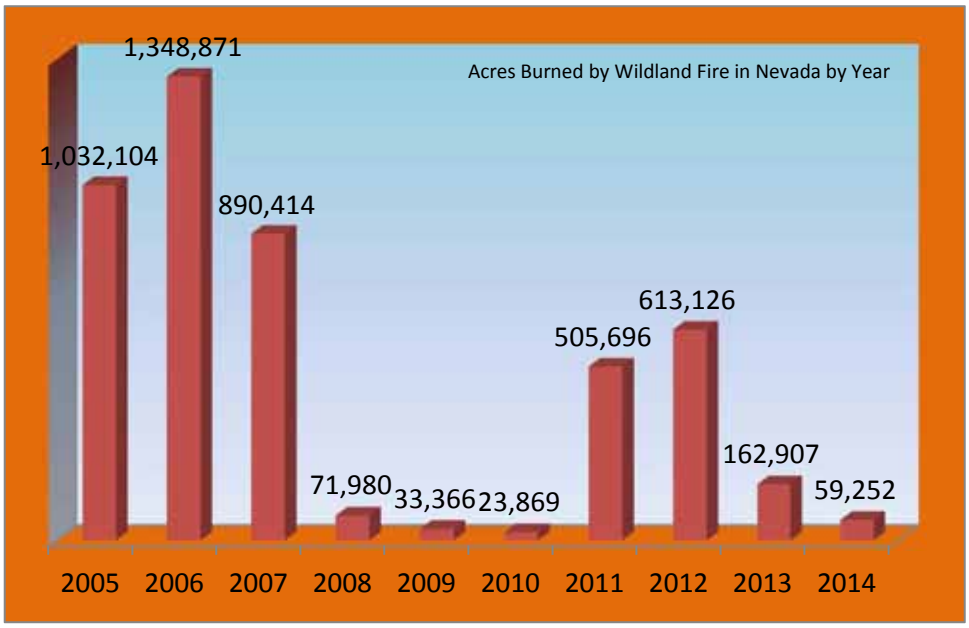

Figure 37 - Acres burned in Nevada 2005 - 2014

Frost Damage

There was no frost damage detected in 2014 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 Program had hired a Weed Geographic Information System Mapping Coordinator, Kim Williams, who significantly helped with monitoring weed populations in Nevada. There is no more funding for this work at this time. For more 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.