Carlton Complex Wildfires

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A Rapid Initial Assessment of the Impact of Washington State's Largest Wildfire

Pacific Biodiversity Institute

Front cover: The Carlton Complex fires burning at night along the Methow River – courtesy of Josh Tarr.

The Cougar Flat portion of the Carlton Wildfire Complex burning above Pearrygin Lake State Park.

Irrigated pastures, grazed by livestock, were not burned, while the fire burned rapidly through the dry, shrub-steppe above.

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Katrina Fisk helped with edits to this report. This report draws on data provided to the public by the US Geological Survey, GEOMAC and GAP websites. It also used data provided by Washington Dept. of Fish and Wildlife, the Washington Wildlife Habitat Connectivity Working Group and data collected by Pacific Biodiversity Institute. The GIS analysis conducted in this project would not have been possible without software and maintenance donations from ESRI – the world's leader in GIS.

Contents

Background

The 2014 Carlton Wildfire Complex is composed of four wildfires that eventually merged together. These fires were ignited from a lightning storm that swept through the Methow Valley on July 14, 2014. The Cougar Flat Fire, French Creek Fire, Gold Hikes Fire and the Stokes Fire grew into one large wildfire on July 20th and was named the Carlton Complex. The current burned area (as of August 21) is estimated to be 256,108 acres with 98% containment. Currently, nearly 65% of the wildfire is within the Methow River watershed and the other 35% is in areas that drain directly into the Okanogan or Columbia Rivers (Figure 1). The fire grew rapidly from the initial ignition locations and increased dramatically during hot temperatures and strong winds on July 17 and 18 (Figure 2). The effects of the fire can be clearly seen in a Landsat 8 satellite image taken on July 31 (Figure 3), while the fire was still burning but after the fire had burned over 250,000 acres. The Cougar Flat Fire started in an area managed by the Washington Dept. of Fish and Wildlife (WDFW) near the boundary with National Forest land, the French Creek Fire started on Washington Dept. of Natural Resources (DNR) land and the Golden Hike and Stokes Fires started in an area with a mosaic of DNR, WDFW and private lands.

Methods

This rapid assessment of the Carlton Complex was informed by GIS analysis of the area within the fire perimeter in relationship to land ownership, land cover, land use, vegetation and wildlife datasets. It was conducted using ArcGIS software donated by ESRI.

Fire perimeter data was obtained from the U.S. Department of the Interior, U.S. Geological Survey GEOMAC website (http://www.geomac.gov/index.shtml0.

For each analysis below (ownership, land cover and wildlife) we used two or three different independent data sources. The reason for doing this is that there are inaccuracies in each data source and each data source maps the landscape in different ways. By analyzing the variety of data available, it is possible to compare and contrast the information and to draw more robust conclusions. In most cases there is substantial coincidence between data sources. The areas of coincidence give more confidence in the reliability of the information.

Land ownership information was based on the following data:

- The US Bureau of Land Management's public land ownership GIS database
- A GIS parcel database maintained by the Okanogan County Assessor

Analysis of the existing land cover and vegetation data in the burned area was based on data from three sources:

- Land cover base data developed by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG)
- The National Land Cover Dataset (NLCD), developed by the USGS
- Vegetation data developed and maintained by Pacific Biodiversity Institute staff

Analysis of impacts on wildlife was based on data from three sources:

- Washington Dept. of Fish and Wildlife.
- Washington Wildlife Habitat Connectivity Working Group.

- Pacific Biodiversity Institute.

Land Ownership within the Fire Perimeter

The four fires started and burned primarily on state lands during the first day but overall, the fire burned primarily through private lands. Over 98,700 acres of private land burned in the fire (Figure 4, Table 1). State lands managed by the DNR and WDFW comprise over 27% of the fire area and federal lands, primarily managed by the USFS comprise over 31% of the fire area.

Table 1. Land ownership within the fire perimeter from a GIS analysis of public land ownership data from the US Bureau of Land Management's public land ownership GIS database

Owner Name	Acres	% of fire area
Private	98,720.0	38.59%
U.S. Forest Service	80,156.6	31.33%
Dept. of Natural Resources	48,572.0	18.99%
State Dept. of Fish and Wildlife	21,208.7	8.29%
Bureau of Land Management	6,293.0	2.46%
Colville Confederated Tribes	590.2	0.23%
Water (within perimeter – but did not burn)	150.9	0.06%
State Park	136.2	0.05%

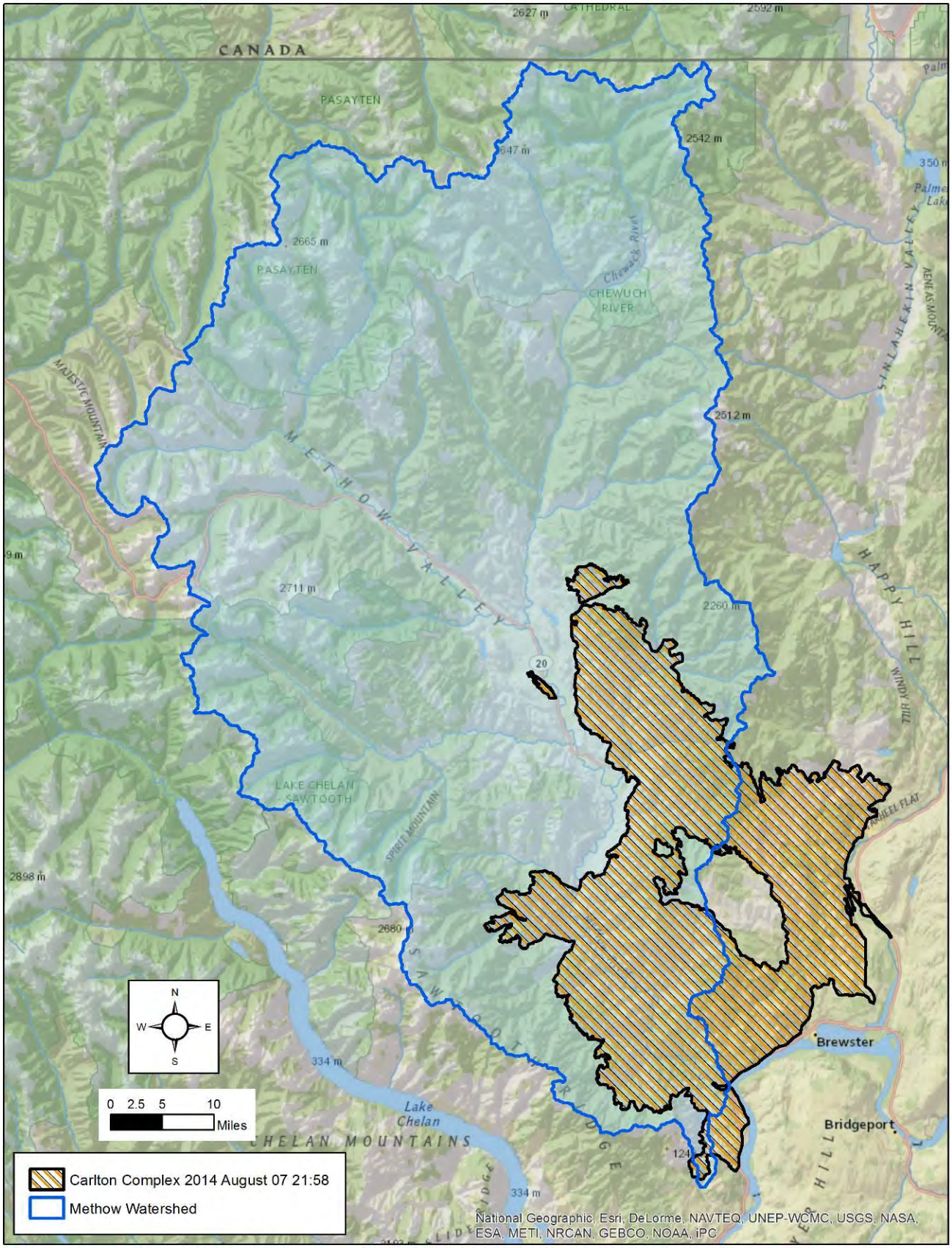
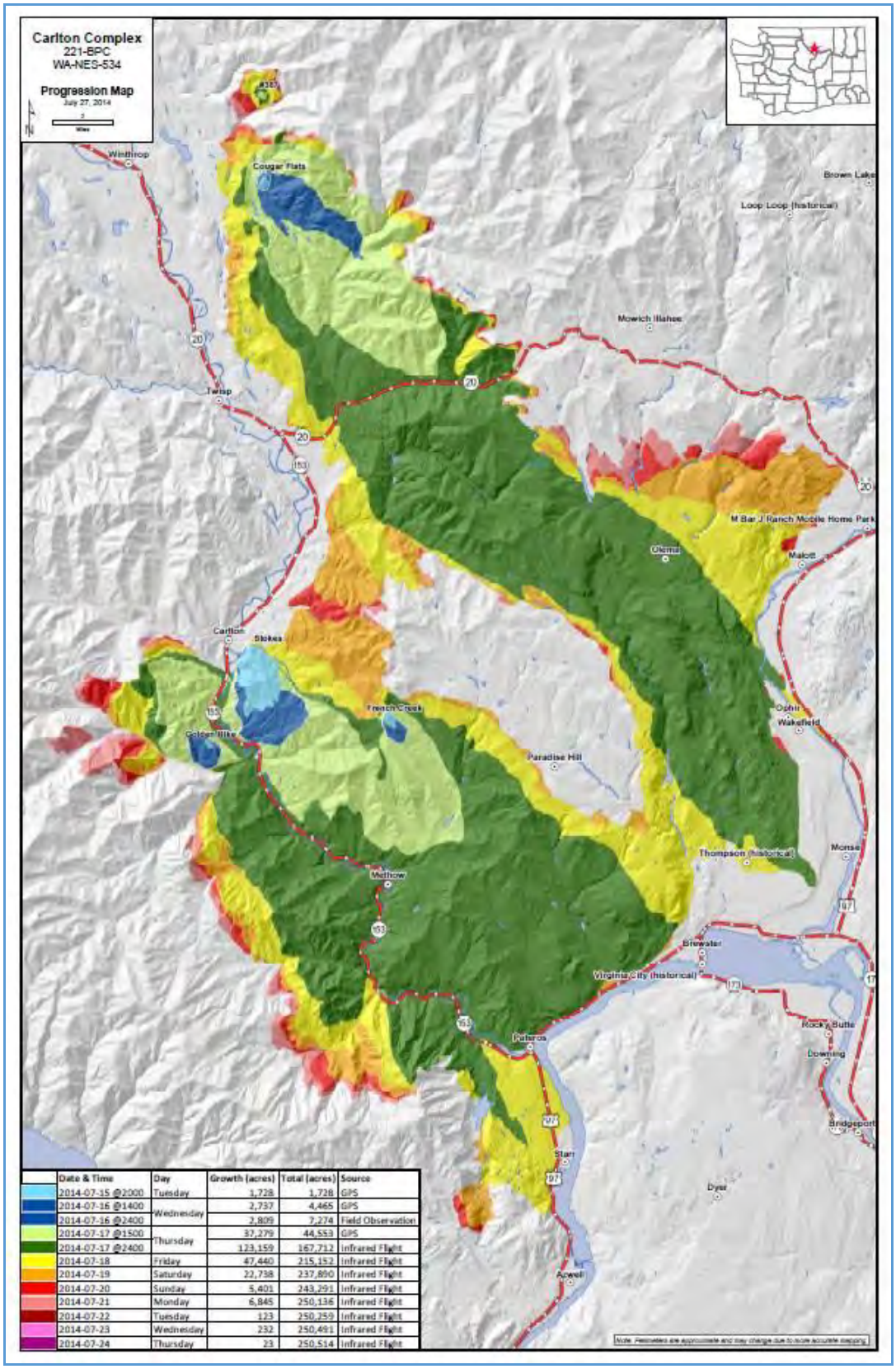


Figure 1. Location of Carlton Complex in relationship to the Methow River watershed.



Date & Time	Day	Growth (acres)	Total (acres)	Source
2014-07-15 @2000	Tuesday	1,728	1,728	GPS
2014-07-16 @1400	Wednesday	2,737	4,465	GPS
2014-07-16 @2400		2,809	7,274	Field Observation
2014-07-17 @1500	Thursday	37,279	44,553	GPS
2014-07-17 @2400		123,159	167,712	Infrared Flight
2014-07-18	Friday	47,440	215,152	Infrared Flight
2014-07-19	Saturday	22,738	237,890	Infrared Flight
2014-07-20	Sunday	5,401	243,291	Infrared Flight
2014-07-21	Monday	6,845	250,136	Infrared Flight
2014-07-22	Tuesday	123	250,259	Infrared Flight
2014-07-23	Wednesday	232	250,491	Infrared Flight
2014-07-24	Thursday	23	250,514	Infrared Flight

Figure 2. Fire progression map. Source: Carlton Complex Incident Command.

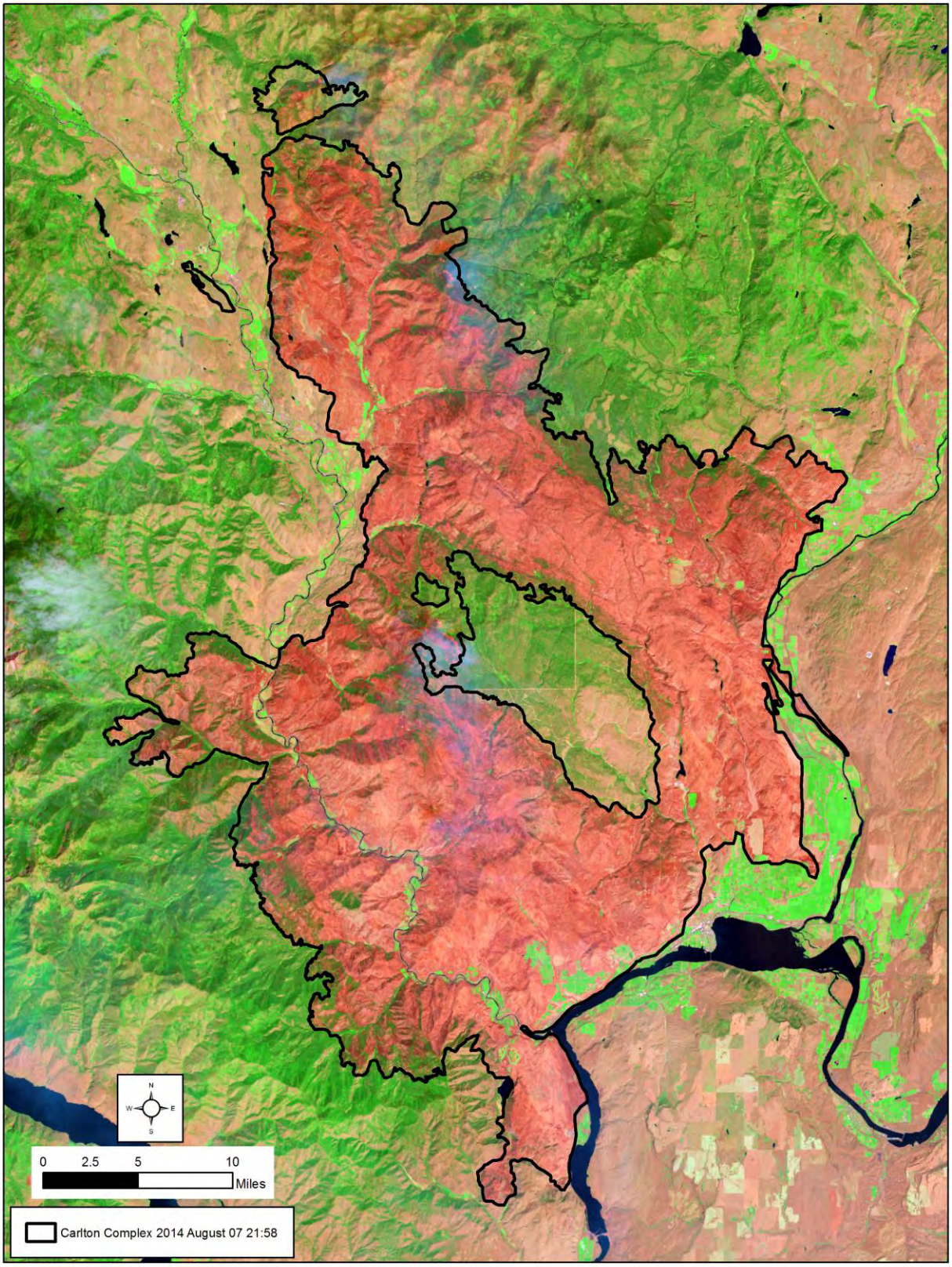


Figure 3. Landsat 8 satellite image from 2014 July 31, while the fire was still burning, but after the fire complex had reached over 250,000 acres in size.

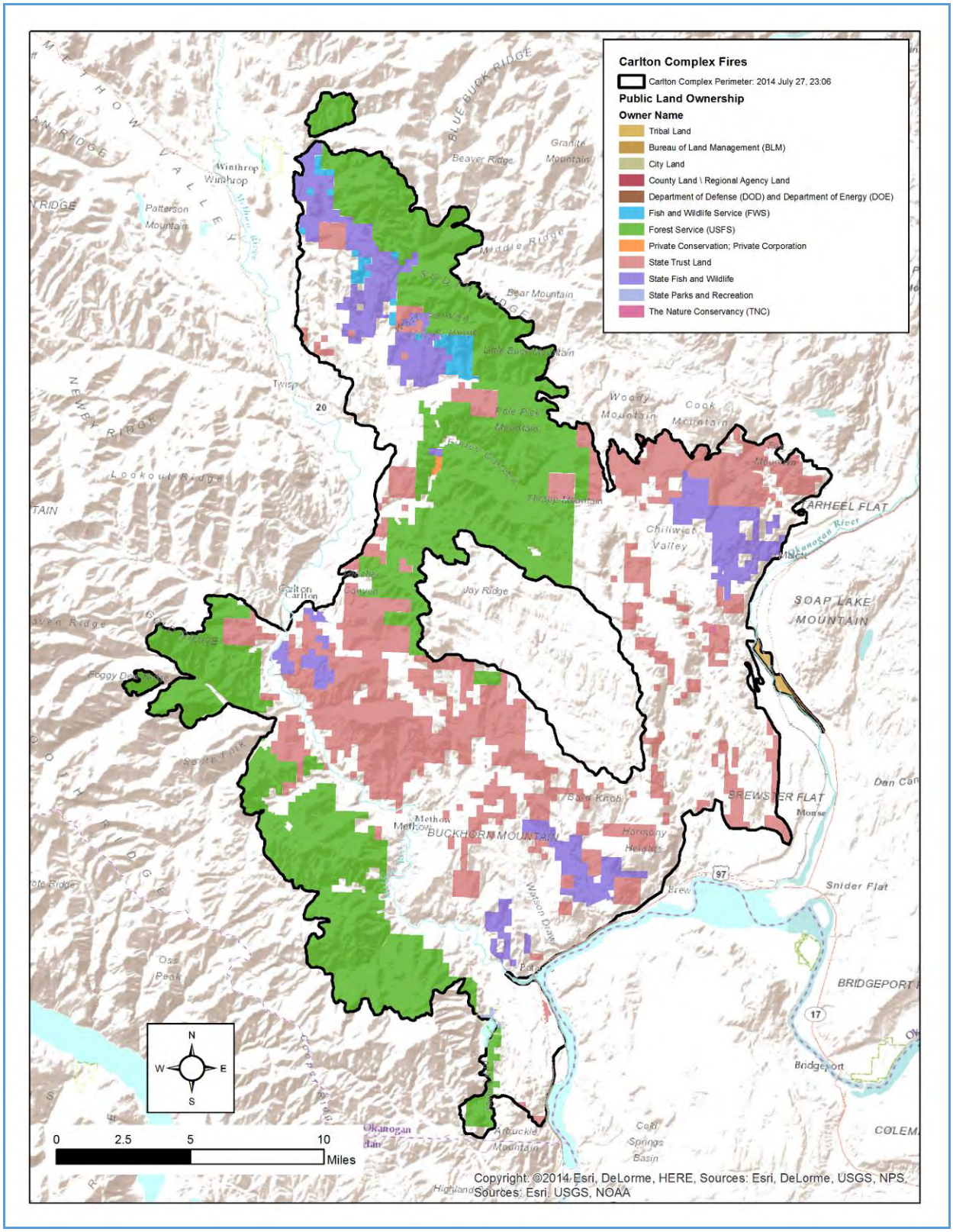


Figure 4. Land ownership pattern within the fire perimeter (PAD-US 1_3)

Human Impacts and Assistance with Recovery Mapping

Pacific Biodiversity Institute responded to a request by a local, grass roots organization – the Carlton Complex Assistance Network, to provide their volunteers with a set of detailed maps of the properties that were impacted by the fires in the Methow Valley (Figures 5-7). PBI also produced a list of affected property owners, organized by each major watershed within the fire area. From this analysis we learned that over 4,240 private parcels were within the fire perimeter. Not all these parcels burned in the fire, but most did. Of these parcels, 1,402 parcels had significant improvements (buildings) valued greater than $10,000 (according to an analysis of parcel data from the Okanogan County Assessor from May 2014). Another 256 parcels had improvements valued less than $10,000 but more than $500.

According to the Methow Valley News (2014 Aug. 21), the Okanogan County Sheriff has identified 231 structures that were destroyed by the fire. County staff and volunteers from the Carlton Complex Assistance Network are continuing to survey the fire area to assess the extent of damages. The damage to local residents and their property extends far beyond the houses that burned. Significant infrastructure including many miles of fencing that is very important to ranchers and orchardists were destroyed. Other improvements were also damaged. There are reports of significant losses of livestock and agricultural crops. Pasturelands that were needed to maintain livestock were blackened and forage was lost for the rest of this year. Overall, the impacts to the local community have been very significant.

Major electrical transmission lines were severely damaged by the fires. The Methow Valley and several other parts of Okanogan County went without electrical power for nearly 8 days. This long power outage caused additional disruption and significantly harmed local businesses and many local residents lost frozen and refrigerated foods and other items as a result of the power outage.

The following maps (Figures 5-7) are examples of what PBI produced at a high level of detail for the entire fire area for use by the Carlton Complex Assistance Network.

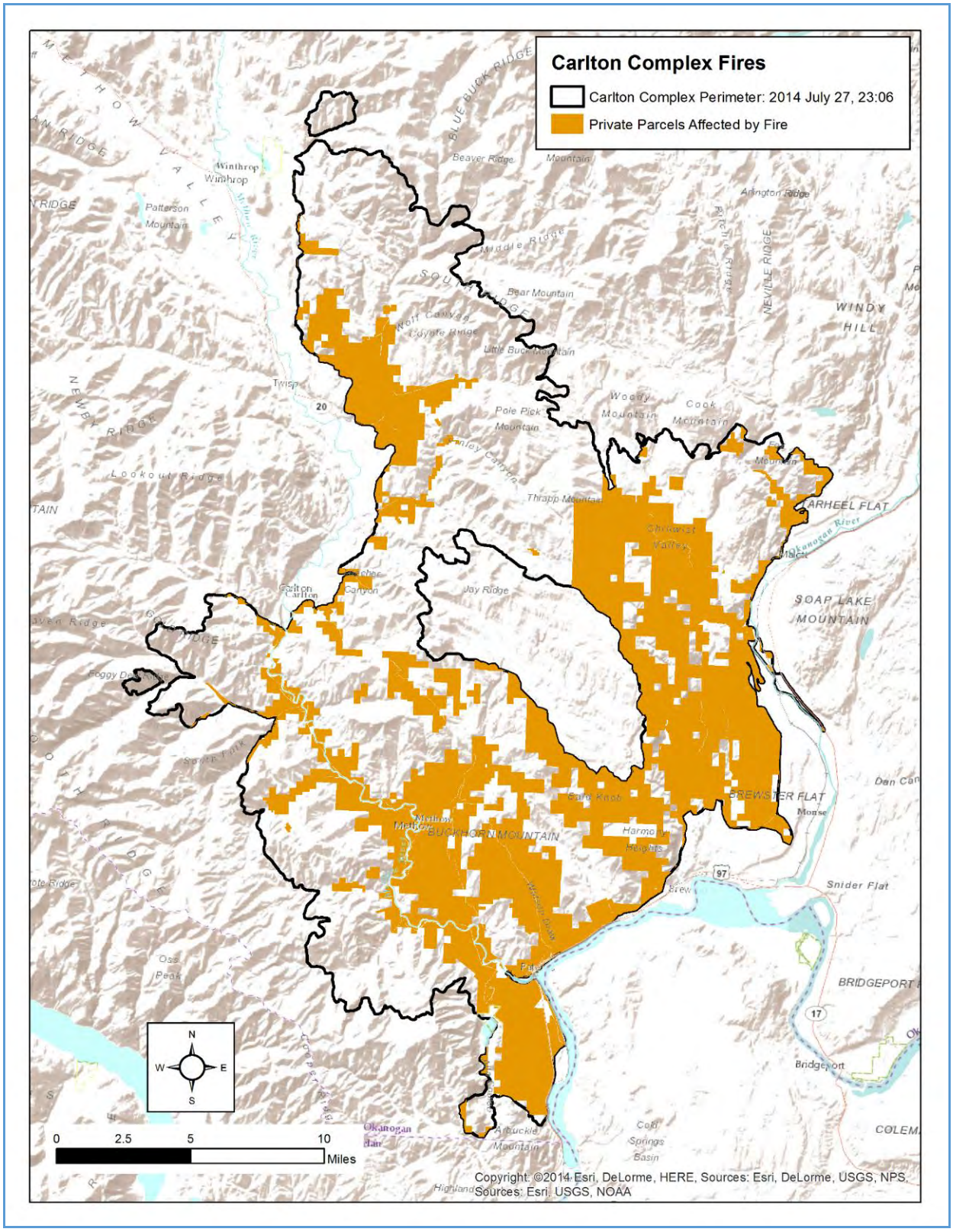


Figure 5. Private parcels within the fire perimeter (GIS analysis of Okanogan County parcel database).

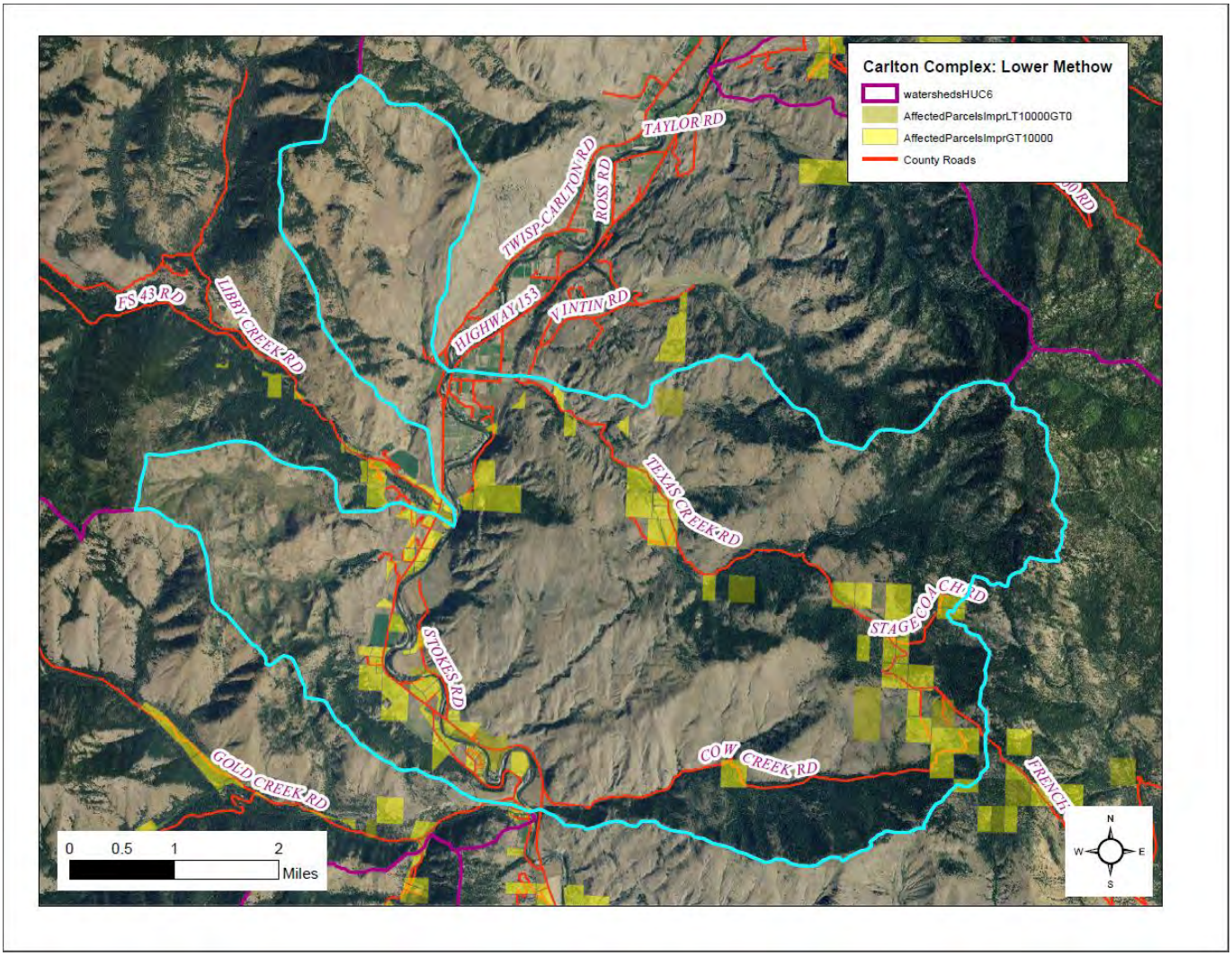


Figure 6. Example of Texas Creek – Carlton Area with private parcels highlighted with two levels of improvement value (Okanogan County parcel database). This map was produced for use by the Carlton Complex Assistance Network. The private parcels within the fire boundary were summarized by watershed (blue line on map) for use by CCAN volunteers.

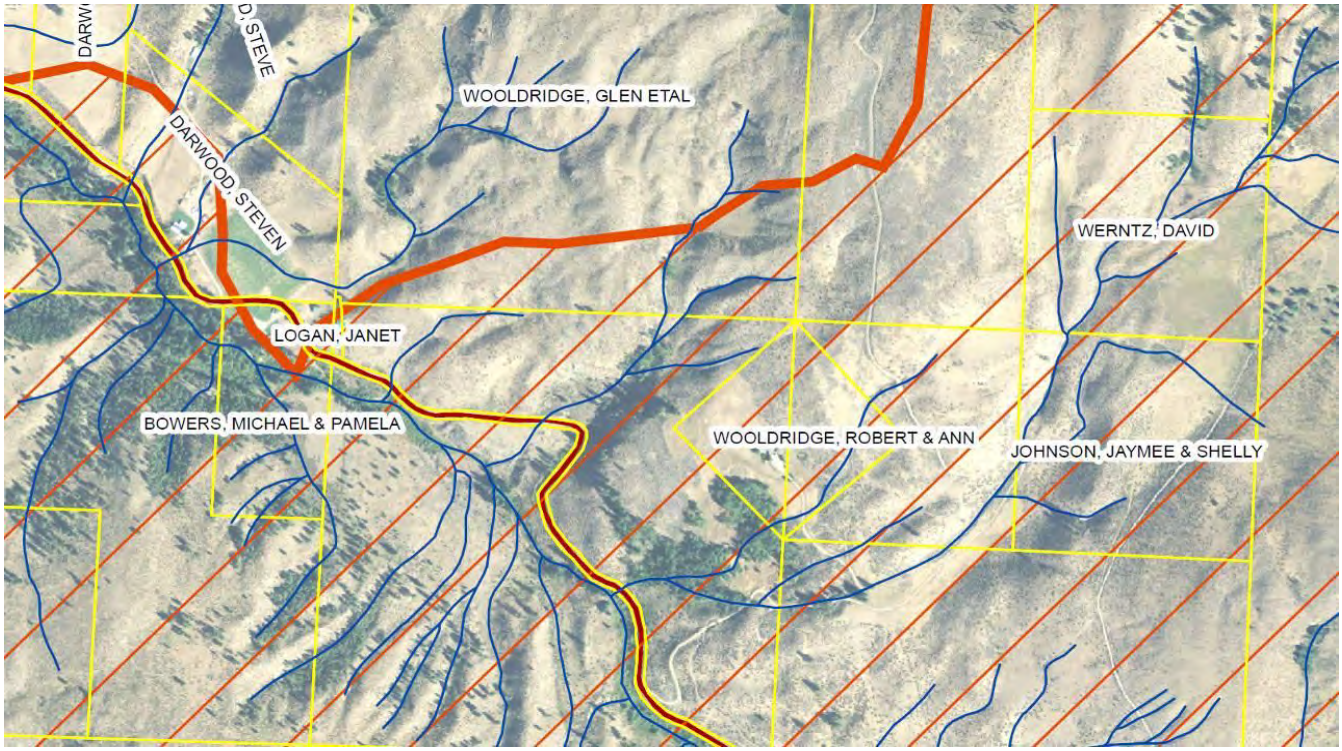


Figure 7. Details from part of a large map of the Texas Creek area with private parcels labeled by owner (Okanogan County parcel database). This map was produced for use by the Carlton Complex Assistance Network.

Land Cover and Vegetation within the Fire Perimeter

The Carlton Complex fires burned largely through shrub-steppe habitat, grasslands and other non-forested land cover types (Figures 8-11). We analyzed three land cover, land use and vegetation datasets. From our analysis of this data, it is apparent that the vast majority of the area burned in the Carlton Complex was non-forested land cover types and only about 25% was forested areas (Tables 2-4). The dominant vegetation types (over 61%) in the burn area are shrub-steppe vegetation (Table 4). Nearly all the forests that burned are ponderosa pine forests or mixed ponderosa pine and Douglas-fir forests – often characterized as “dry forests” (Tables 2 and 4).

The dominant vegetation types in the fire area (shrub-steppe and dry forests) are considered fire-adapted and fire-dependent ecosystems from an ecological perspective (Agee 1993, Weddell 2001, Knick 2005). These ecosystems need regular fire to maintain healthy composition and structure. The lack of fire has been documented to be a major cause of decline in ecosystem health in these areas. Therefore, from an ecological perspective, the primary natural ecosystems that burned in the Carlton Complex are well adapted to natural wildfires burning during the hot, dry part of the summer. The areas that burned in the fire may well experience a significant long-term benefit from the fire from the perspective of ecosystem health.

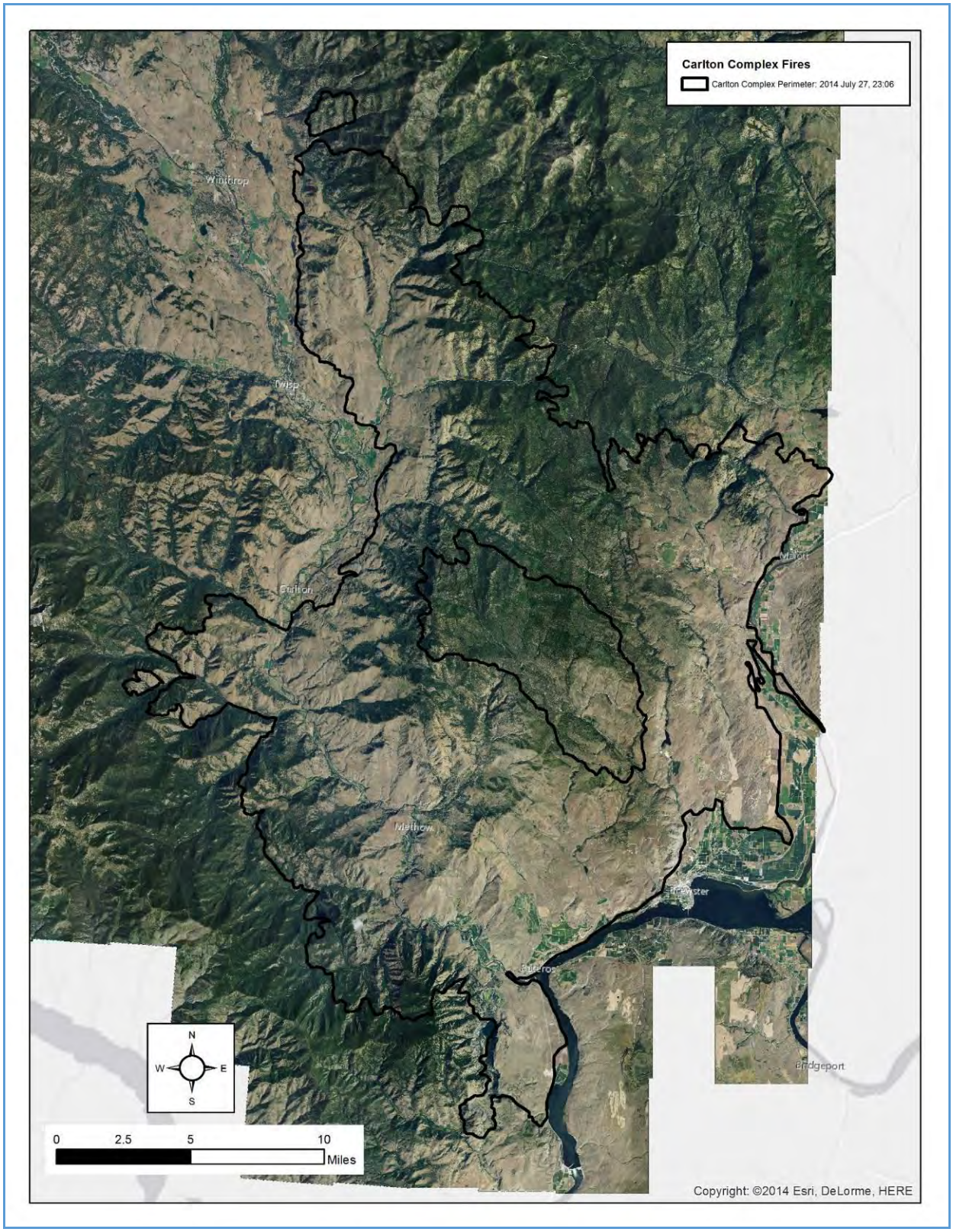


Figure 8. Digital orthophoto and the fire perimeter (USDA NAIP 2011)

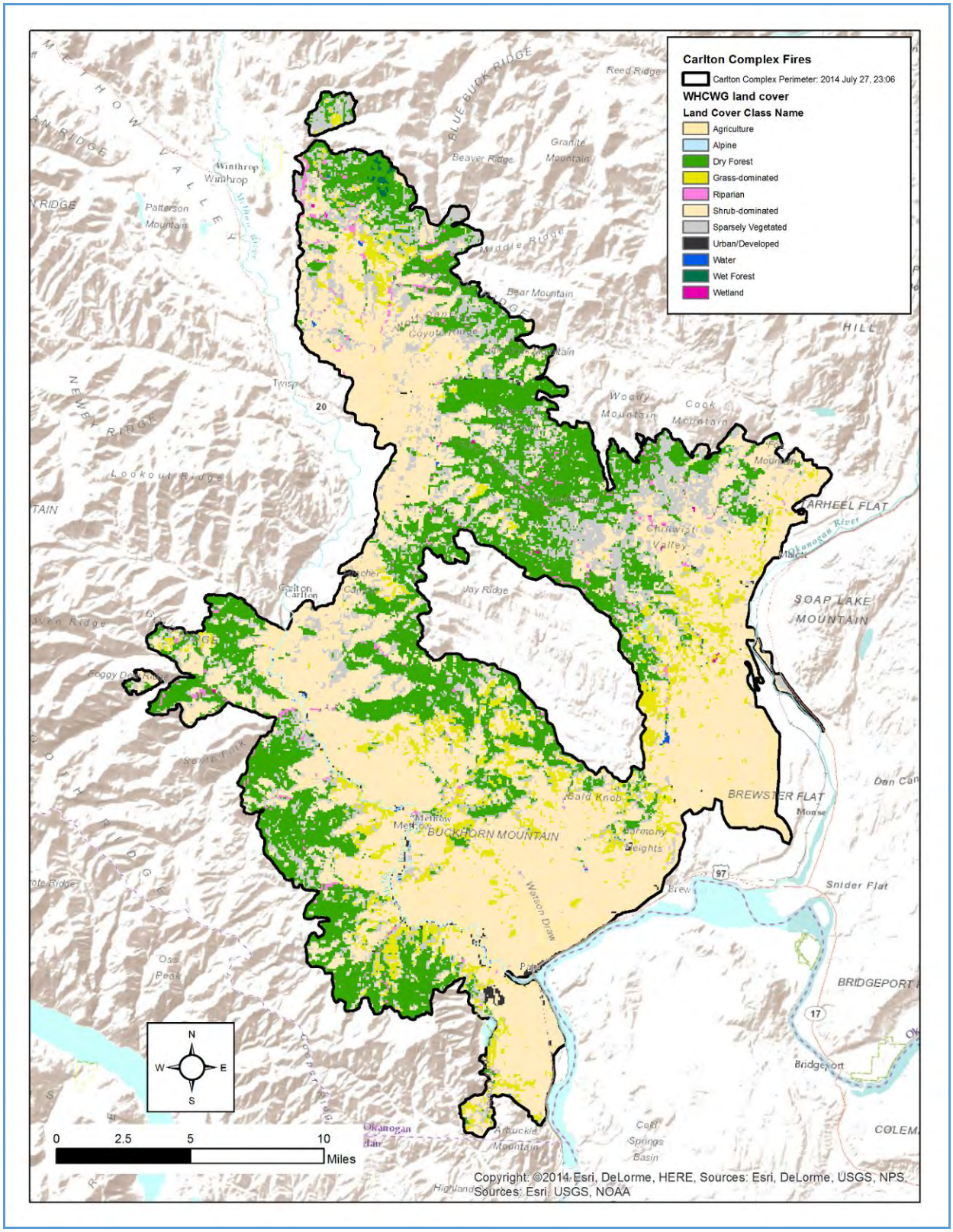


Figure 9. Land cover types within the fire perimeter (WWHCWG base layers 2011)

Table 2a and 2b. Land cover types within the fire perimeter (WWHCWG base layers 2011)

Land Cover Type	%
Shrub-dominated	46.01
Dry Forest	24.82
Sparsely Vegetated	14.75
Grass-dominated	6.58
Agriculture	6.05
Riparian	1.09
Urban/Developed	0.39
Water	0.15
Wet Forest	0.10
Wetland	0.04
Alpine	0.02
total	100.00

Land Cover Group	%
Non-forested	68.64
Forested	24.92
Hay, Pasture, Crops	6.05
Developed	0.39
total	100.00

A GIS analysis of the Washington Wildlife Habitat Connectivity Working Group (WWHCWG) land cover data reveals that 46% of the fire area is mapped as shrub dominated. Less than 25% is mapped as dry forest, about 15% is mapped as sparsely vegetated, less than 7% is mapped as grass-dominated, and about 6% in other categories. Minor amounts of the area are mapped in 6 other categories.

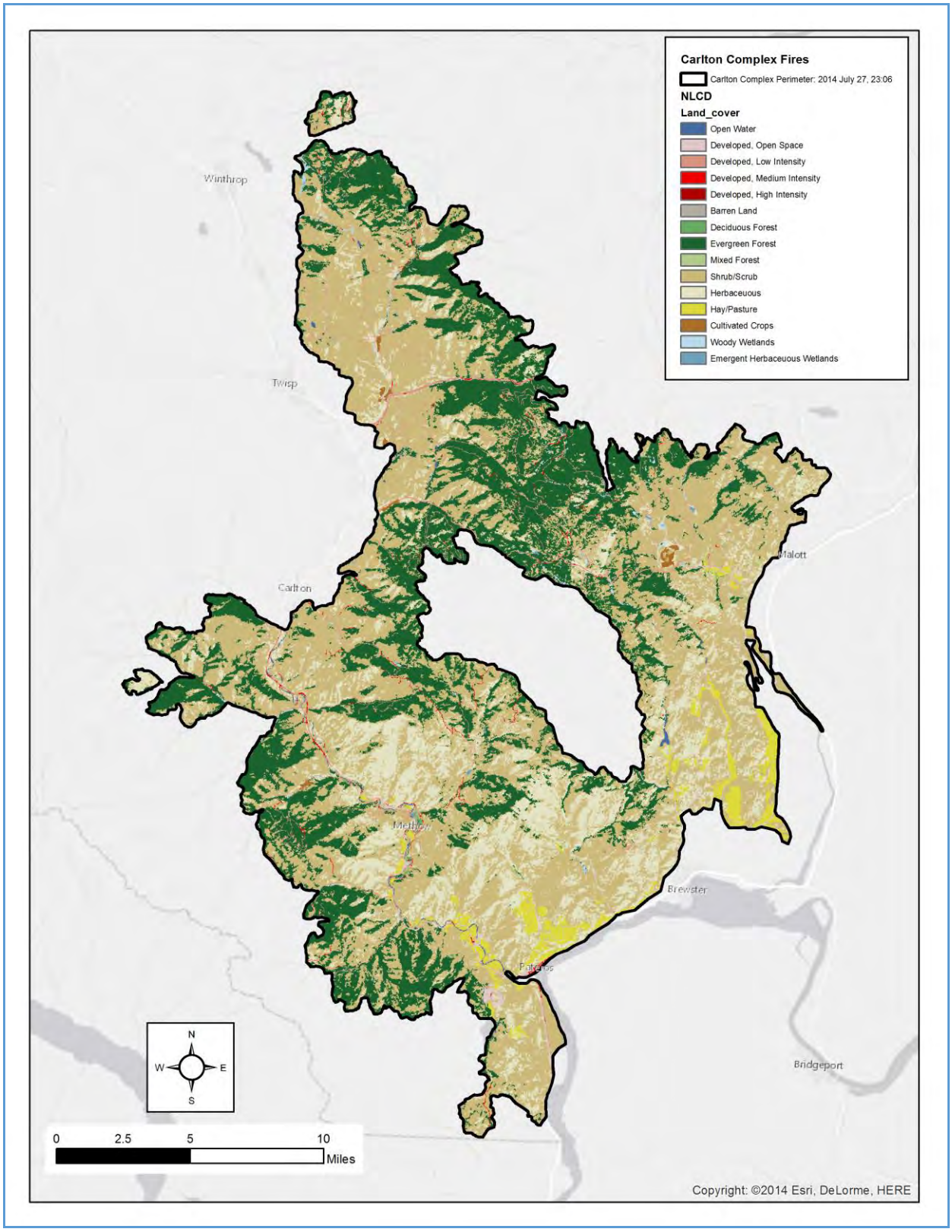


Figure 10. Land use, land cover types within the fire perimeter base on the National Land Cover Data (NLCD)

Table 3a and 3b. Land use, land cover types within the fire perimeter (National Land Cover Data)

Land Cover Type	%
Shrub/Scrub	50.29
Evergreen Forest	26.55
Herbaceous	16.55
Hay/Pasture	2.51
Developed, Low Intensity	1.85
Developed, Open Space	0.88
Woody Wetlands	0.35
Developed, Medium Intensity	0.28
Open Water	0.21
Cultivated Crops	0.17
Barren Land	0.16
Emergent Herbaceous Wetlands	0.09
Deciduous Forest	0.08
Developed, High Intensity	0.02
Mixed Forest	0.02
total	100.0

Land Cover Group	%
Non-forested	67.64
Forested	26.64
Developed	3.03
Hay, Pasture, Crops	2.68
total	100.00

A GIS analysis of the National Land Cover Dataset (NLCD) reveals that over 50% of the fire area is mapped as Shrub/Scrub. Over 16% is mapped as herbaceous. Less than 27% is mapped as evergreen forest. Minor amounts of the area are mapped in 12 other categories.

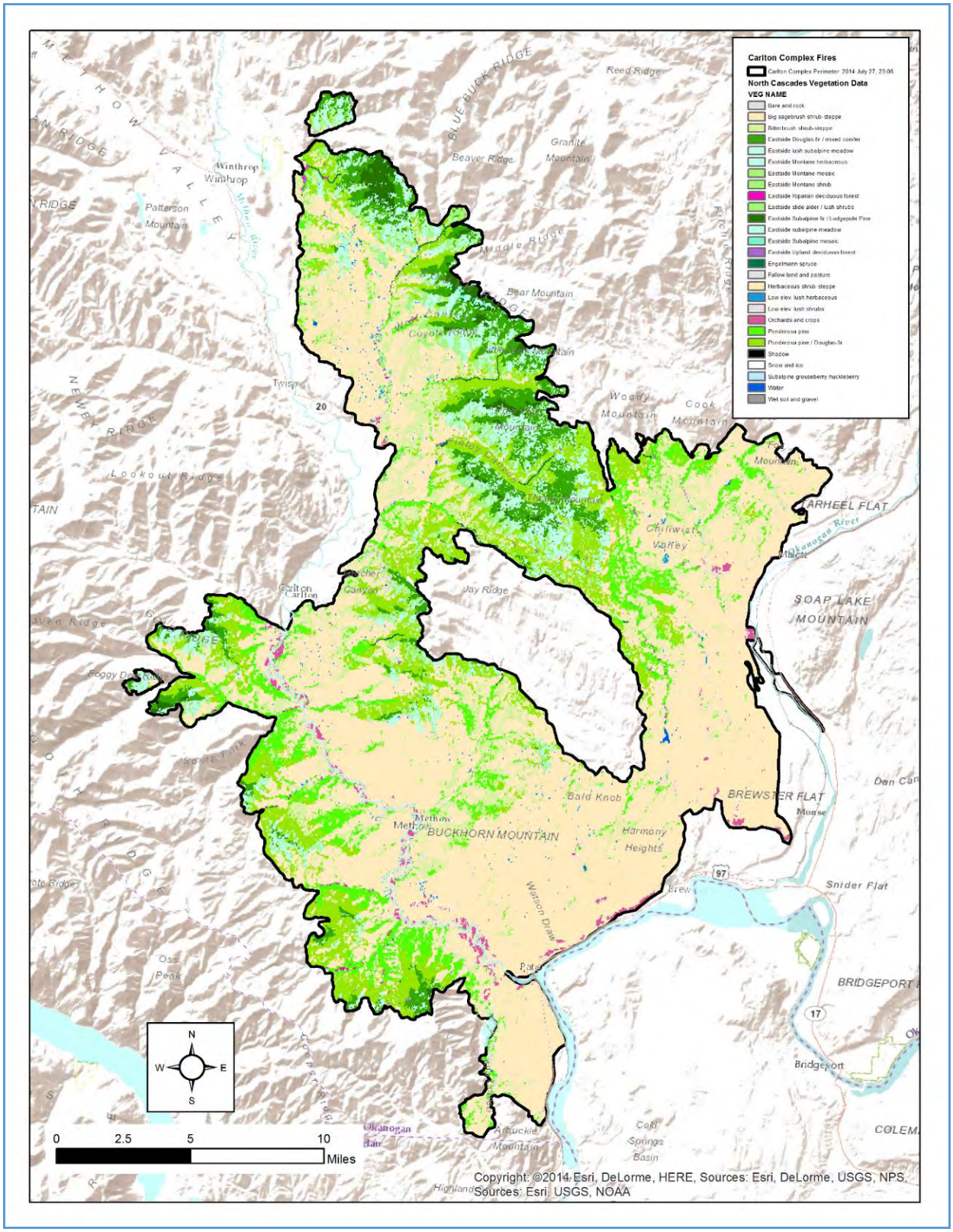


Figure 11. Vegetation types within the fire perimeter (North Cascades vegetation data – maintained by PBI)

Table 4a and 4b. Vegetation types within the fire perimeter (North Cascades vegetation data – maintained by PBI)

Vegetation Type	%
Herbaceous shrub-steppe	39.949
Ponderosa pine / Douglas-fir	11.787
Bitterbrush shrub-steppe	11.071
Big sagebrush shrub-steppe	10.325
Ponderosa pine	6.764
Montane herbaceous	5.456
Douglas-fir / mixed conifer	5.203
Montane mosaic	3.658
Subalpine fir / Lodgepole Pine	1.249
Fallow land and pasture	1.230
Orchards and crops	0.790
Bare and rock	0.774
Low elev. lush herbaceous	0.274
Not mapped	0.238
Engelmann spruce	0.213
Upland deciduous forest	0.169
Water	0.149
Subalpine mosaic	0.121
Subalpine meadow	0.111
Montane shrub	0.093
Wet soil and gravel	0.085
Low elev. lush shrubs	0.081
Slide alder / lush shrubs	0.077
Riparian deciduous forest	0.074
Snow and ice	0.047
Shadow	0.008
Subalpine grouseberry-huckleberry	0.004
Lush subalpine meadow	0.001
total	100.00

Land Cover Group	%
Non-forested	72.52
Forested	25.46
Hay, Pasture, Crops	2.02
Developed	0.00
total	100.00

Wildlife within the Fire Perimeter

There was an abundance of wildlife and significant key wildlife habitat within the Carlton Complex fire perimeter. The maps and table that follow provide a quick overview of some of the key species that may have been impacted by the fires.

Pacific Biodiversity Institute is launching a more in-depth, field-based study to determine the extent of the impacts. However, the results of that study will not be in for at least a year. We are receiving reports of many sightings of wildlife that did survive the fire.

What we know now is that several key species experienced significant potential impacts. It appears that some of the most impacted species are mule deer, western gray squirrels and sharp-tailed grouse (Table 5). A large portion (74%) of the fire perimeter is considered priority mule deer habitat, much of it winter range Table 5, (Figures 12-14). Thirty-nine percent of the priority mule deer habitat in the Methow is within the fire perimeter. Note: an area in the southwestern part of the fire boundary was not mapped in the PHS data for mule deer (Figure 12-13). Additional mapping of mule deer habitat concentration areas and potential connecting pathways was done by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG) and an overlay of this with the fire boundary is included in Figure 14.

About 43% of the priority habitat for western gray squirrels (a state listed threatened species) in the Methow was impacted by the fire and 52% of the burn area was composed of this type of habitat (Table 5, Figures 15 and 16). Additional mapping of western gray squirrel habitat concentration areas and least cost paths was done by the Washington Wildlife Habitat Connectivity Working Group. An overlay of this data with the fire boundary is included in Figure 16. A large portion of the known western gray squirrel sightings, hair-tube samples and nests in the Methow watershed are within the fire perimeter (Figure 17).

Perhaps one of the most impacted wildlife species in the Methow was the sharp-tailed grouse. About 87% of the priority habitat for sharp-tailed grouse (another state listed threatened species) in the Methow was impacted by the fire and 52% of the burn area was composed of this type of habitat (Table 5, Figures 18 and 19). Additional mapping of sharp-tailed grouse habitat concentration areas and least cost paths was done by the Washington Wildlife Habitat Connectivity Working Group. An overlay of this data with the fire boundary is included in Figure 19.

Table 5. Priority habitats for three important species affected by the Carlton Complex.

Species - Habitat	Acres of habitat in the fire perimeter	% of fire area	Acres of total habitat in the Methow	Acres of habitat burned in the Methow	% of habitat in Methow that was burned
Mule Deer Priority Habitat		74%			39%
Western Gray Squirrel Habitat		52%			43%
Sharp-tailed Grouse Habitat		5%			87%

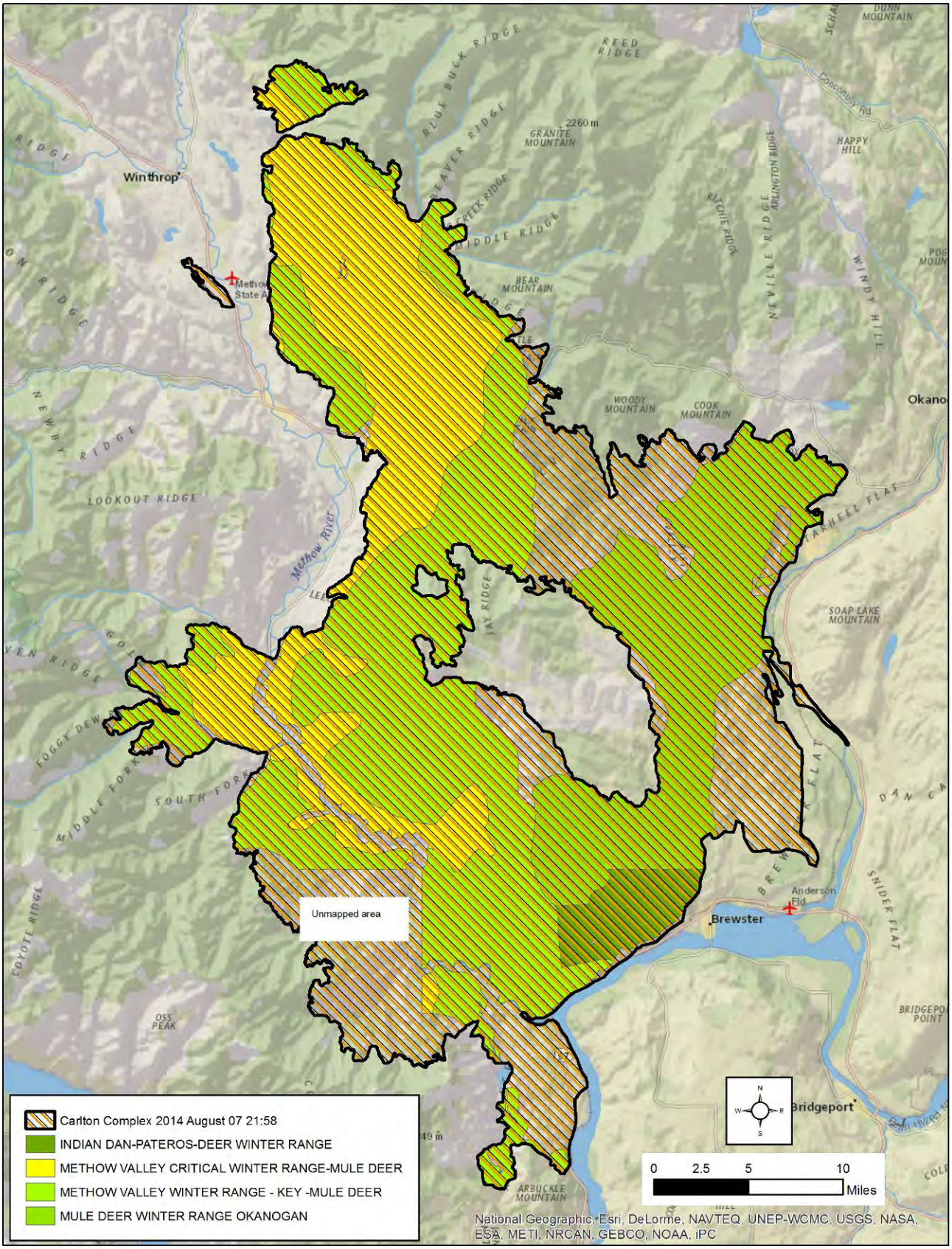


Figure 12. Mule deer winter range within the fire perimeter, (WDFW PHS data 2009)

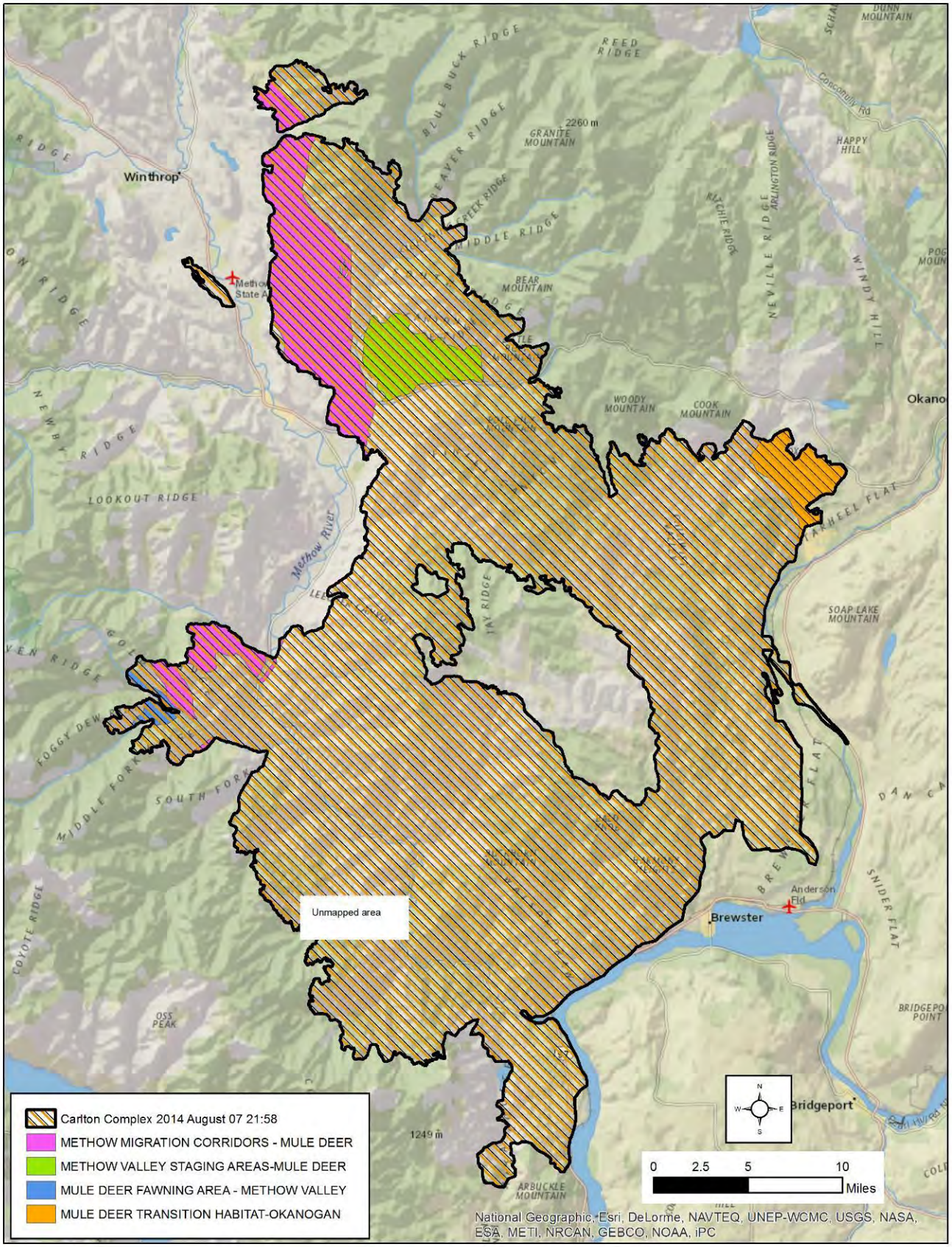


Figure 13. Other priority mule deer habitat within the fire perimeter, (WDFW PHS data 2009)

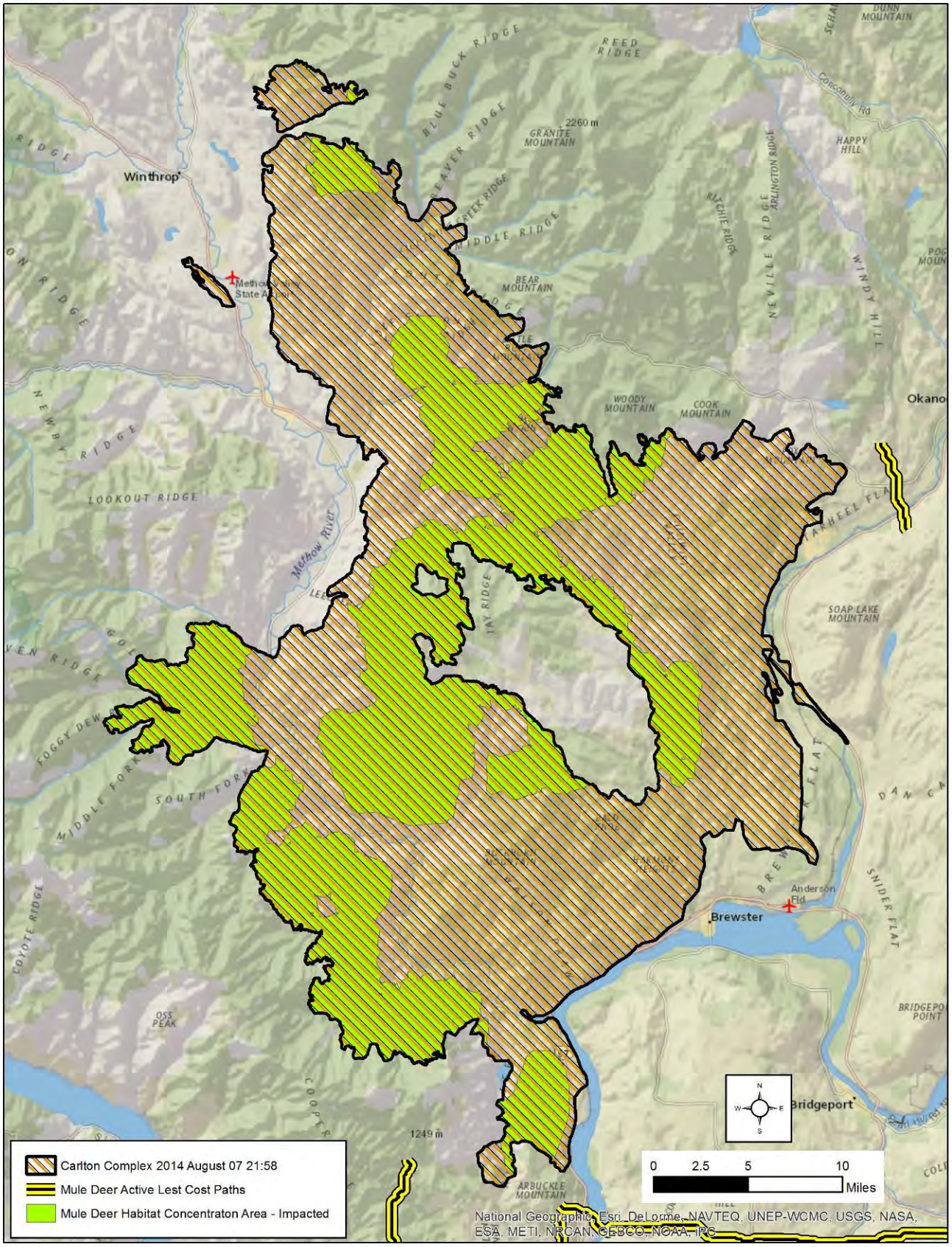


Figure 14. Mule deer habitat concentration areas and least cost paths, (WWHCWG 2010)

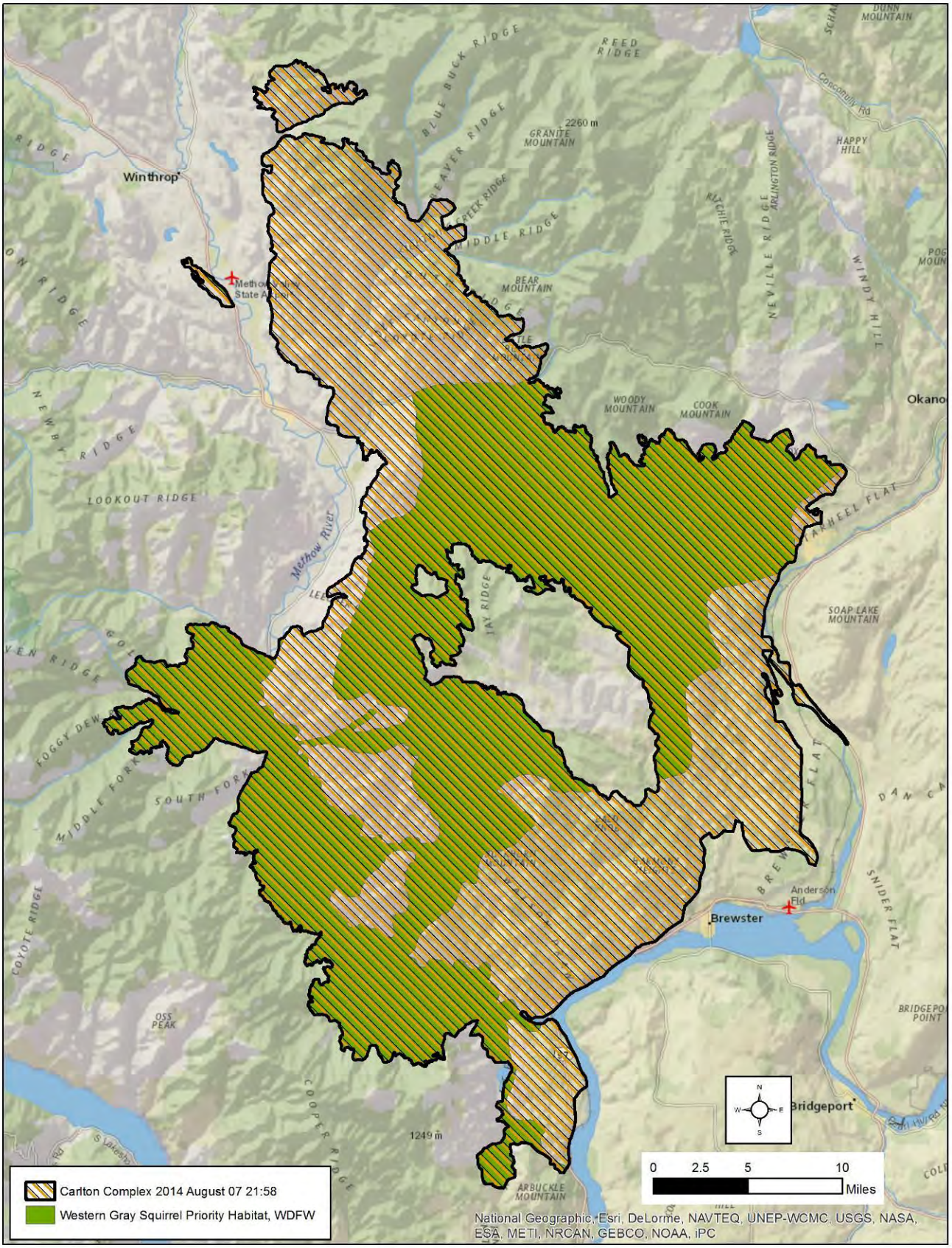


Figure 15. Western gray squirrel priority habitat within the fire perimeter, (WDFW PHS data 2009)

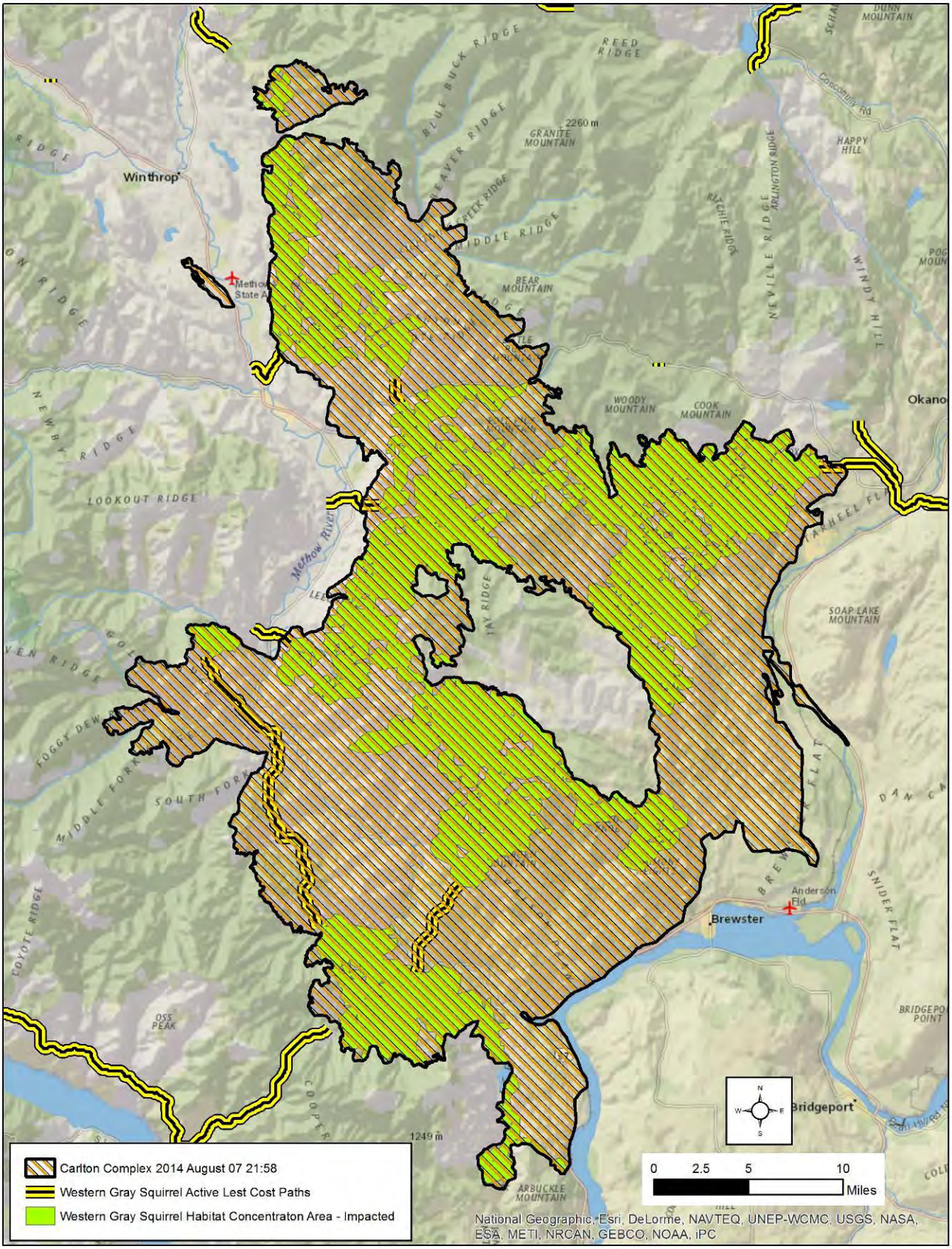


Figure 16. Western gray squirrel habitat concentration areas and least cost paths, (WWHCWG 2010)

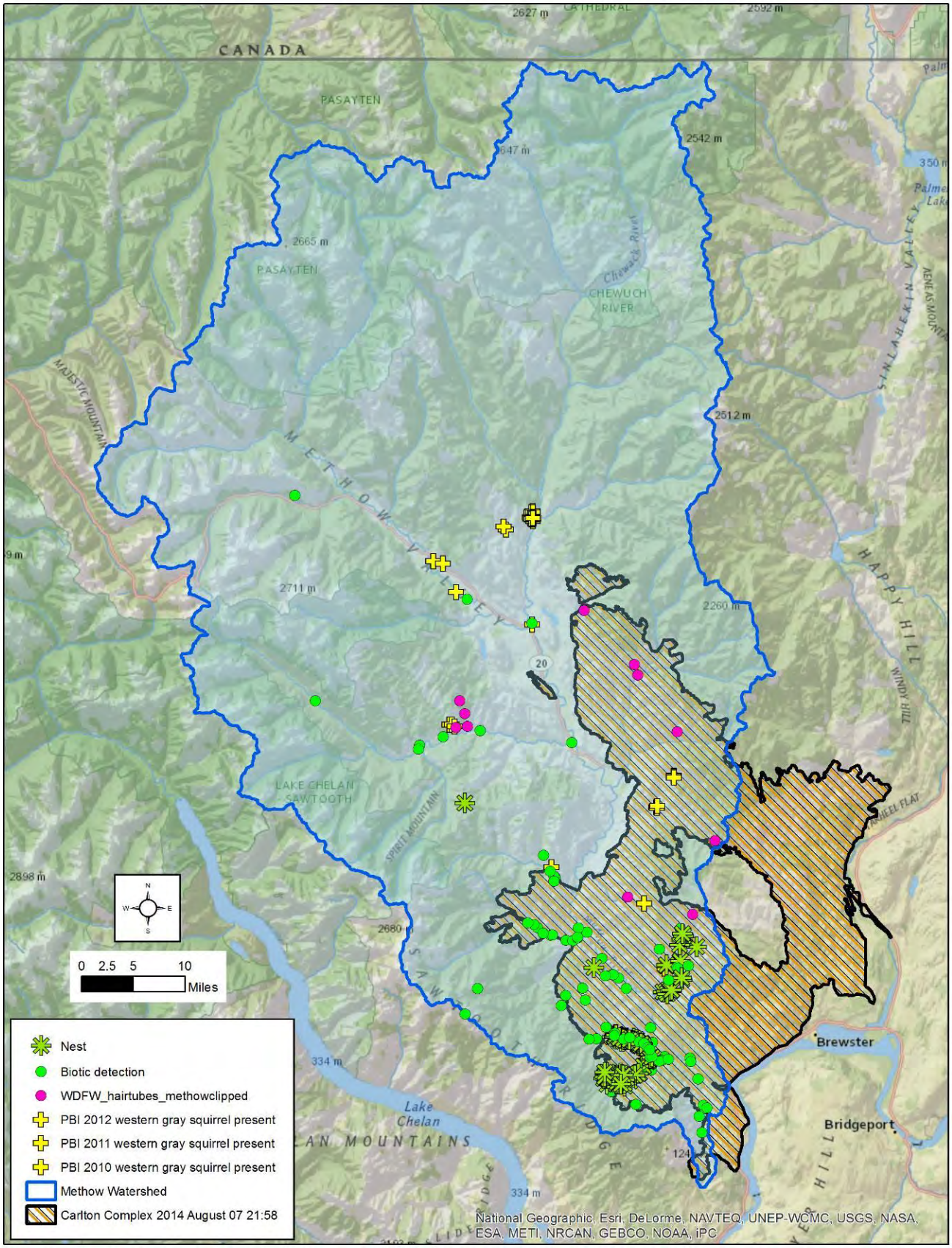


Figure 17. Western gray squirrel locations in Methow (sightings, hair samples, nests), (PBI and WDFW)

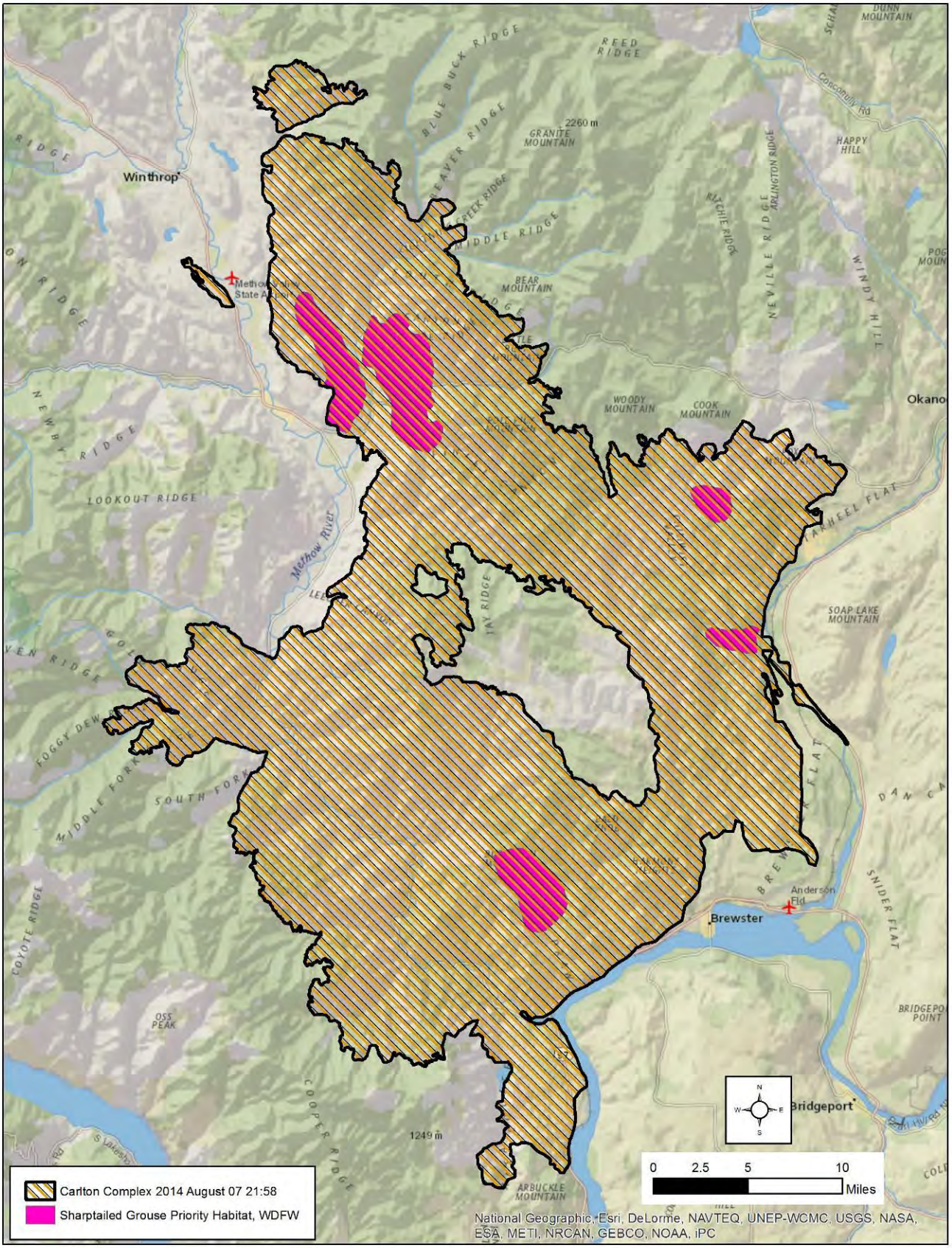


Figure 18. Sharp-tailed grouse priority habitat within the fire perimeter, (WDFW PHS data 2009)

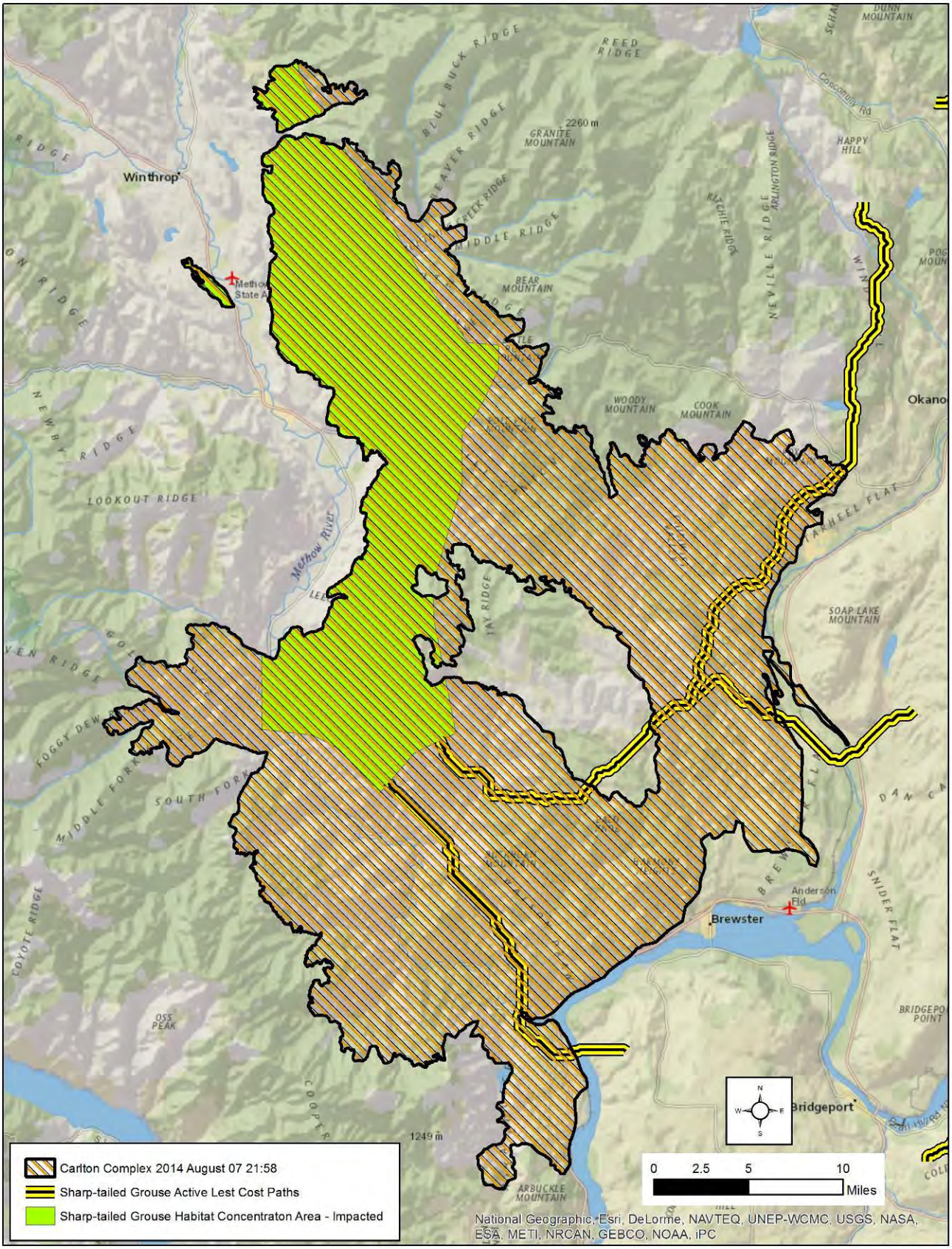


Figure 19. Sharp-tailed grouse habitat concentration areas and least cost paths, (WWHCWG 2010)

Western toad habitat and populations were impacted by the Carlton Complex (Figure 19 and 20). Likewise, bald and golden eagle nest sites, perches and congregation areas were within the fire perimeter (Figure 21). Black bear and Canada lynx habitat concentration areas and least cost paths impacted by the fire are illustrated in Figures 22 and 23. Many other wildlife species were also impacted by the fire. Those tracked in the WDFW wildlife sighting database are illustrated in Figure 24.

It is too early to assess the immediate or long-term impacts on all of these wildlife species. There will no doubt be adverse short-term impacts on nearly all of these animals. Some of the short-term impacts may be quite severe and may result in significant short-term reductions in the population size of some species.

The long-term impacts to wildlife will be largely determined by the effect the fire has had on habitat conditions. The ecosystems that burned in this fire are all fire-adapted. In most cases, the ecological condition of these ecosystems had deteriorated from a combination of fire exclusion, excessive livestock grazing, improper logging practices, and weed invasions. In many cases, the ecosystems affected by the fire needed fire to restore themselves to optimal health and productivity.

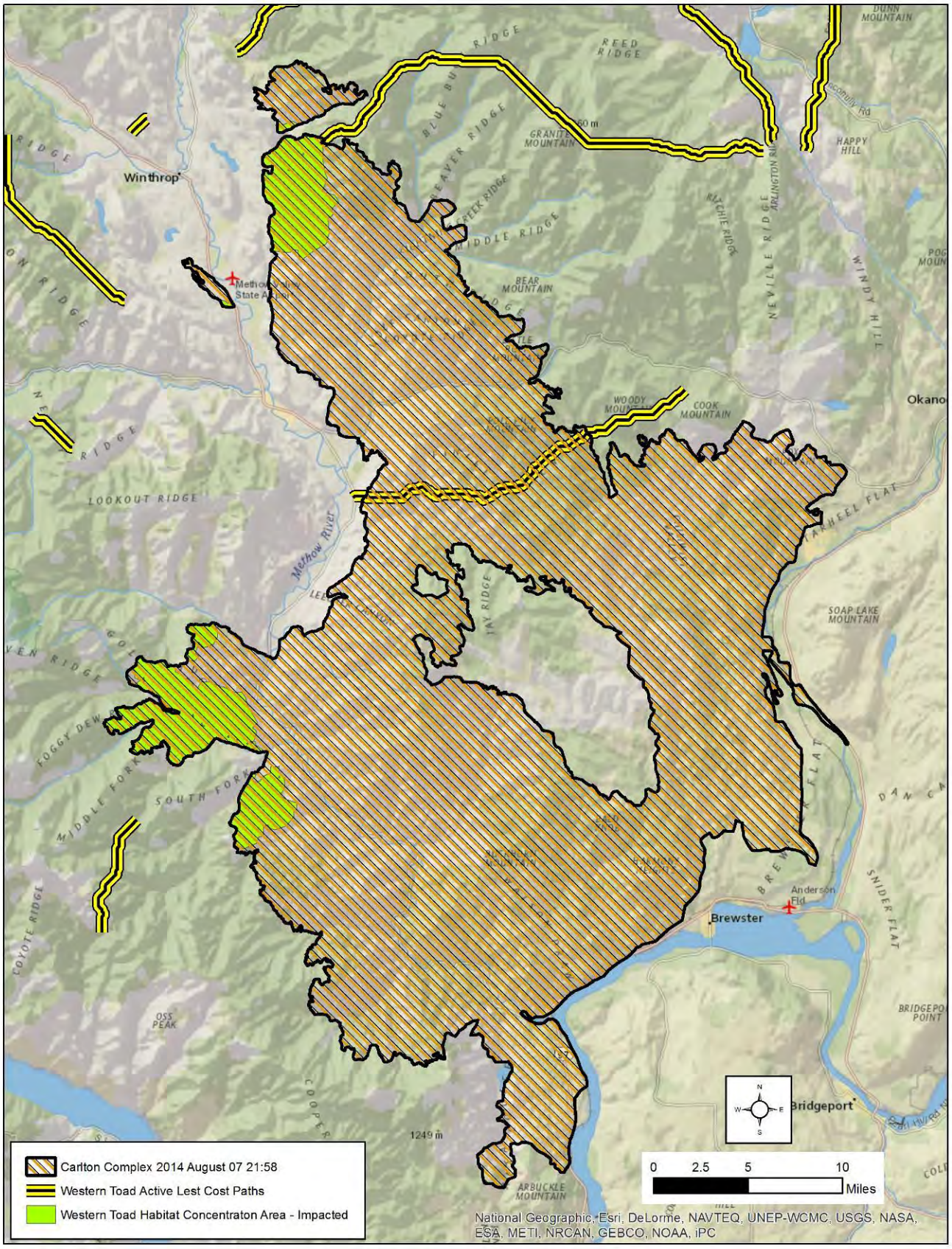


Figure 20. Western toad habitat concentration areas and least cost paths, (WWHCWG 2010)

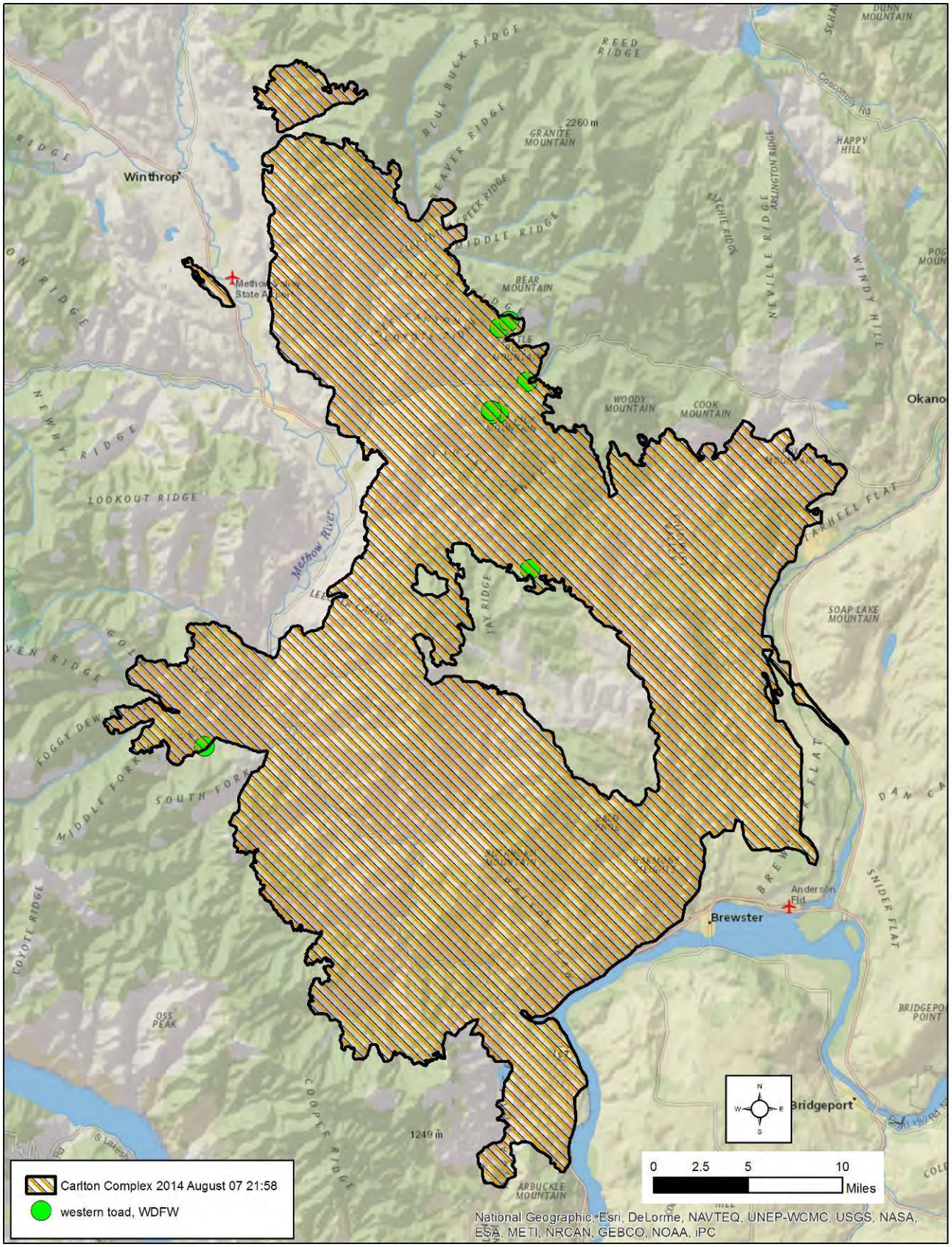


Figure 21. Western toad locations within the fire perimeter, (WDFW wildlife sighting data 2009)

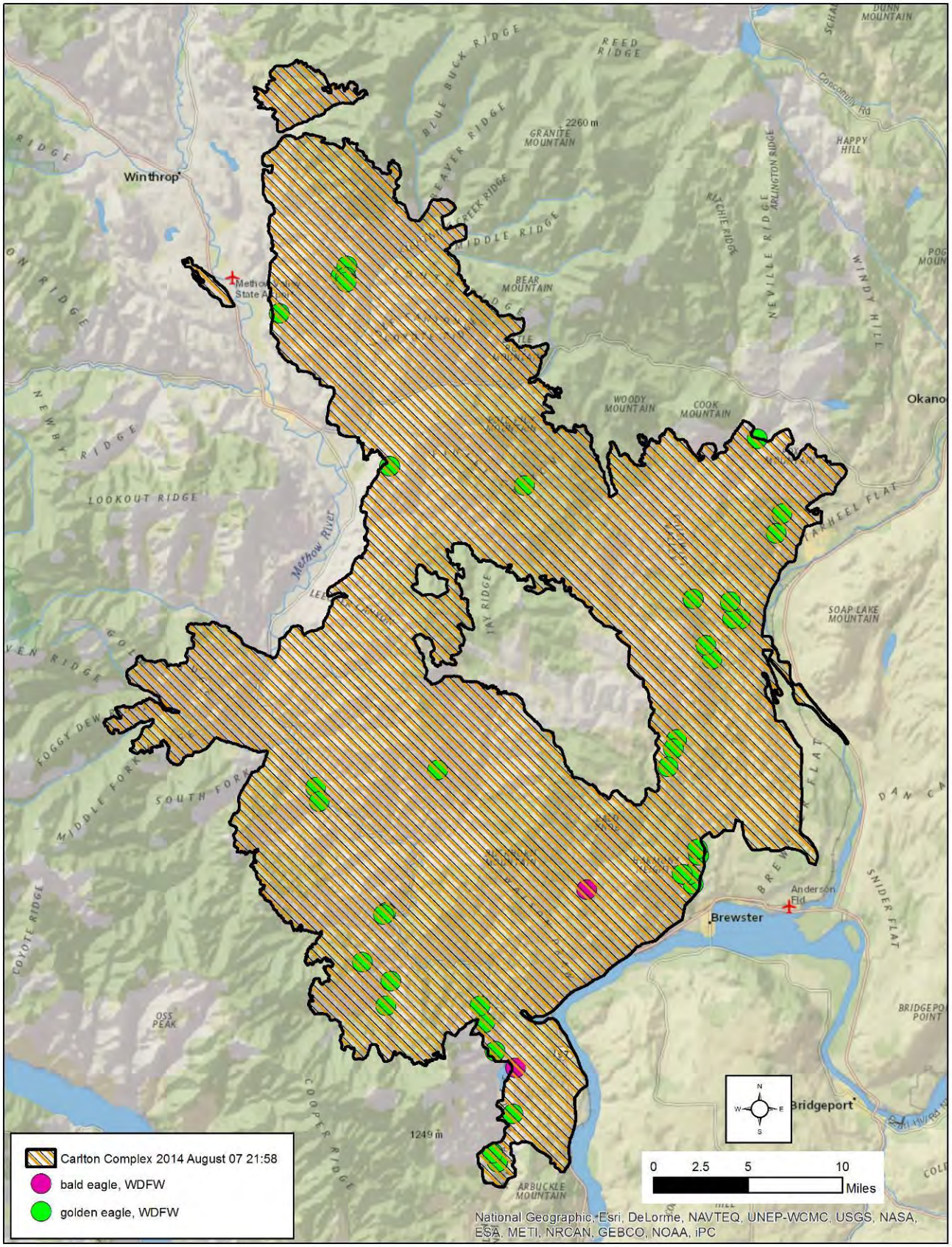


Figure 22. Eagle locations within the fire perimeter, (WDFW wildlife sighting data 2009)

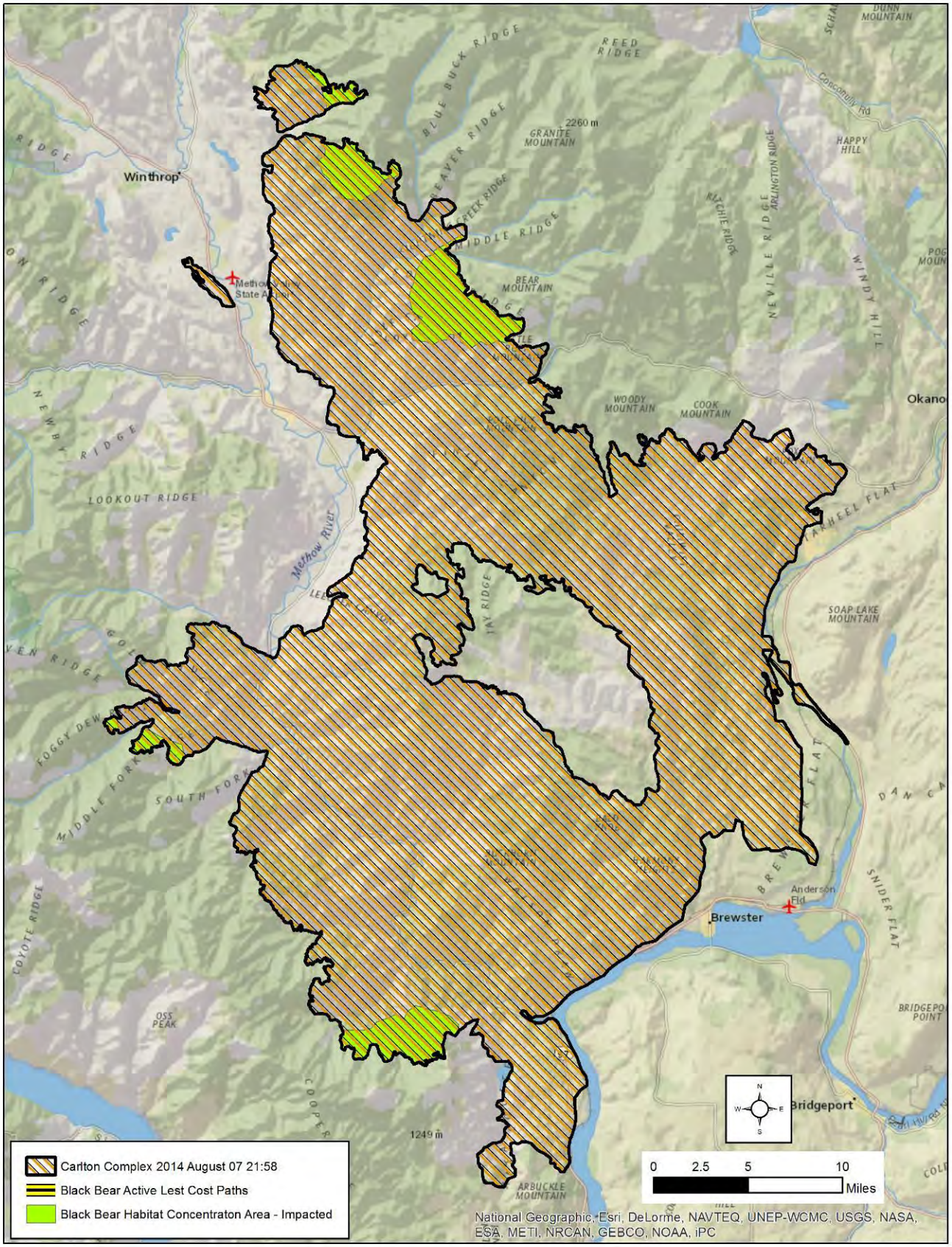


Figure 23. American black bear habitat concentration areas and least cost paths, (WWHCWG 2010)

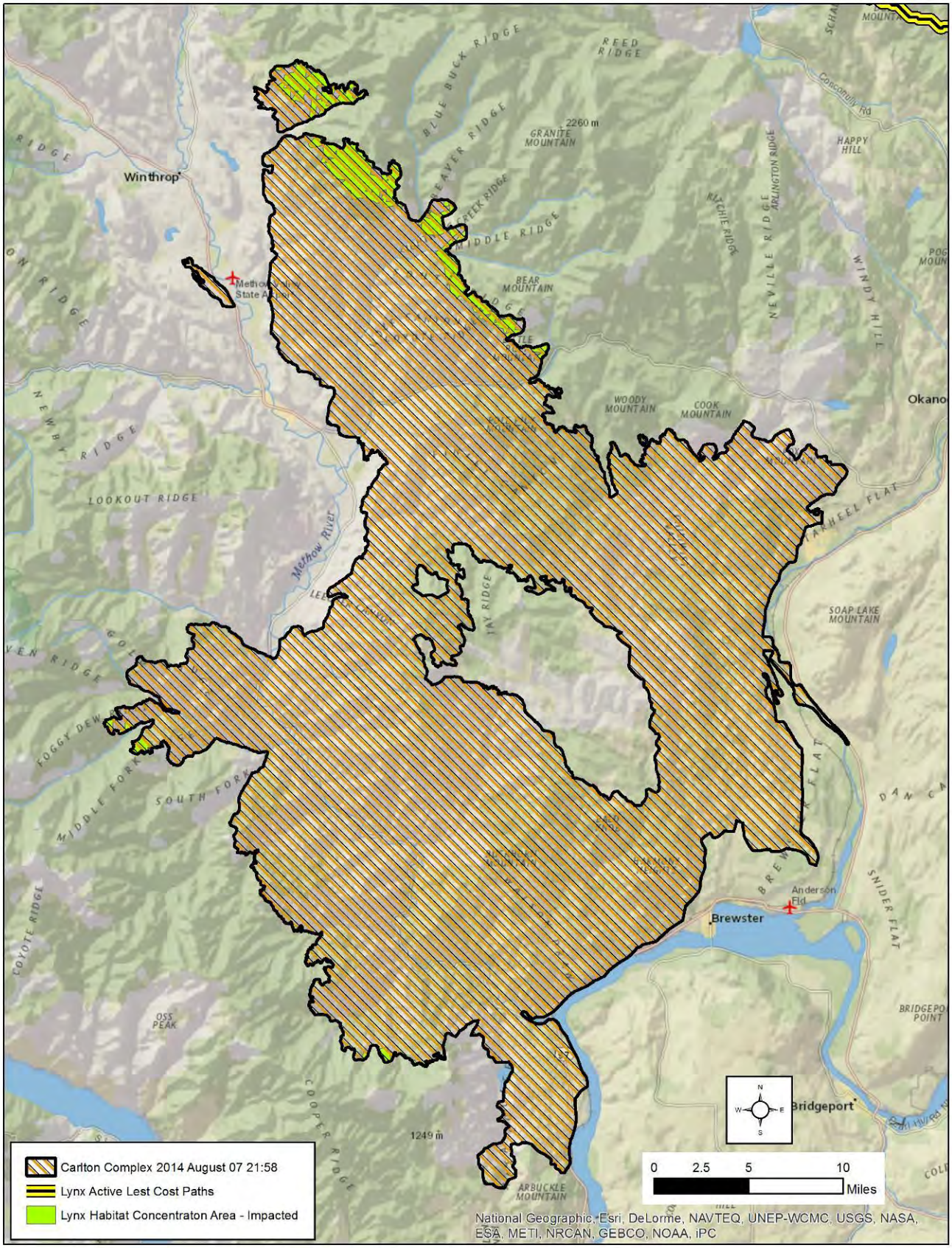


Figure 24. Canada lynx habitat concentration areas and least cost paths, (WWHCWG 2010)

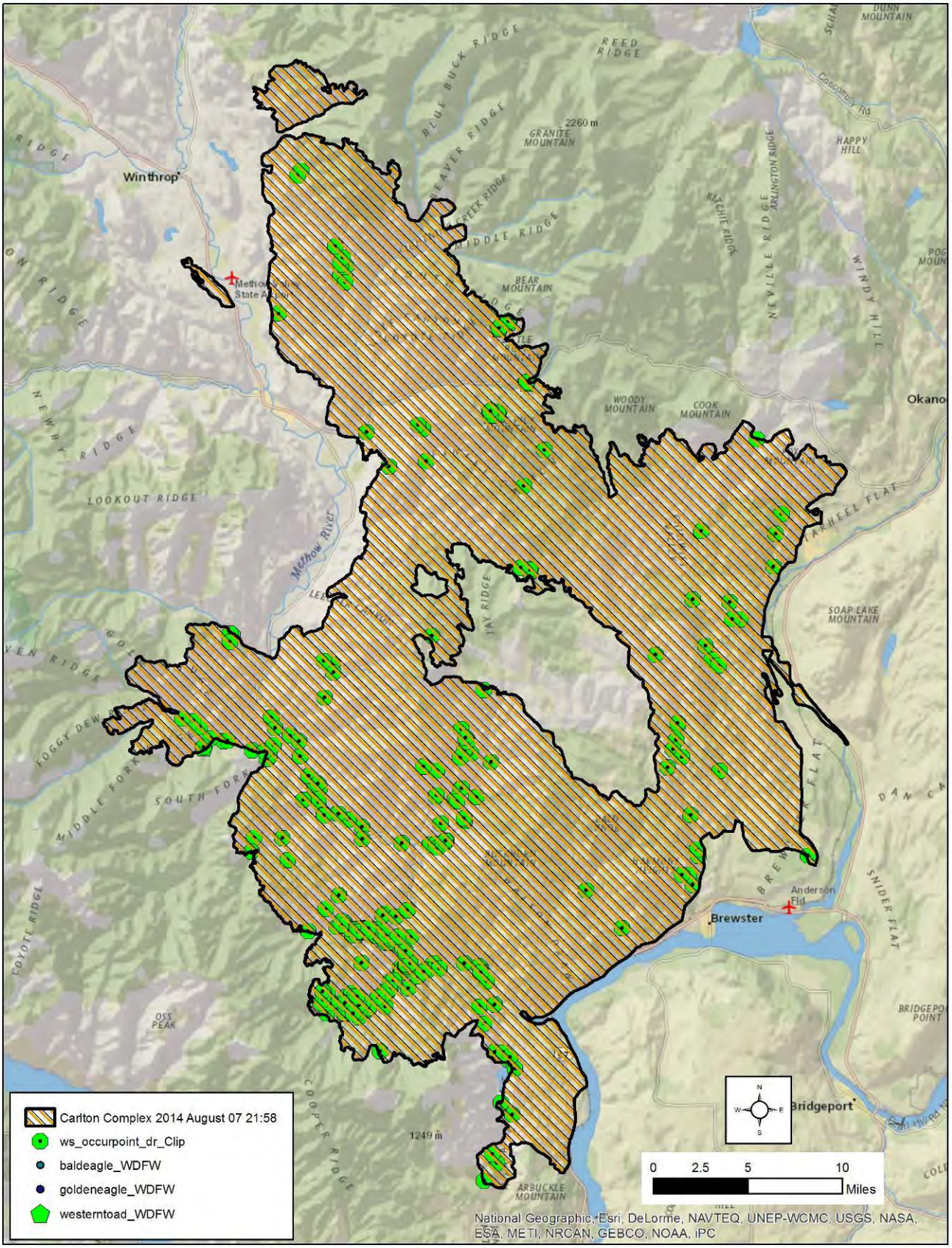


Figure 25. Priority species locations within the fire perimeter, (WDFW wildlife sighting data 2009)

Conclusions

My experience from studying ecosystem recovery after fire in north-central Washington for over 30 years is that nearly all of the burned area will recover fairly quickly on its own. And the end result will be healthier ecosystems than we had before the fire. This will ultimately benefit wildlife habitat and wildlife populations. We may see a short-term decline in wildlife populations, but ultimately many of the species will rebuild and become as numerous as before.

Figure 26. Photo of area in the Virginia Lake Fire (burned 2001) illustrating ecosystem recovery by the following spring in a severely burned shrub-steppe habitat.

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