Caribou National Forest
Snag Monitoring Report

May 2016

1 Background

The Caribou National Forest Revised Forest Plan (RFP) outlines monitoring elements on pages 5-16 to 5-19. The parameters to monitor are arranged based on desired future conditions (DFC) statements. This report addresses the parameter of “snag recruitment versus loss from treatment” on RFP page 5-16, the DCF statement it addresses is “Plant and animal diversity is increased by managing vegetation communities nearer to their HRV.” The question to be answered is, “Is the Forest providing habitat to assist recovery of listed species, preclude listing of sensitive species, and protect rare species?” Table 1 below displays the relevant section in the RFP table.

Table 1 *Snag Parameter from RFP monitoring table 5.4*

Parameter to Monitor	Monitoring Activity	Measurement Frequency	Indicator or threshold for management change	Reporting Frequency	Priority
Snag recruitment v. loss from treatment	Using methods such as aerial pest surveys, monitor changes in snag and down woody densities	5 years	>10% net loss of snags at the 5th code HUC scale	5 years	2

For the monitoring parameter “snag recruitment v. loss from treatment”, the RFP suggests monitoring methods such as aerial pest surveys or monitoring changes in snag and down woody densities. I discussed this question with others members of the Forest team to determine what the best method to proceed would be. How can we monitor recruitment verses loss without repeating plots? What was the intent of this monitoring parameter? What data do we have that can address the indicator of 10% net loss of snags at the fifth code HUC scale? Are there enough snags across the Forest to support woodpeckers and cavity nesting species?

The RFP set a guideline for the percent biological potential (BP) to be managed for based on land management prescription areas. The guideline set snag densities per 100 acres for each BP level based on forest type (RFP 3-27). It also set a guideline that managed snags should be >=12 inches DBH, or the largest diameter available in the stand and should be retained in clusters. The RFP set an overall snag management level of 66 percent and stated that doing so would maintain viability for woodpeckers and other cavity nesting species (RFP Appendix D-24).

The RFP also described the existing condition at the time of the signing of the decision. The existing condition was based on 197 Continuous Forest Inventory (CFI) plots. The data showed that the Forest was only at 25% of biological potential. That analysis was based on snags 11 inches or greater (RFP Appendix D-18-20). When the diameter limit was lowered to 8 inches in the aspen cover type, it brought the BP to 56% (RFP Appendix D-19-20). The CFI plots were also used to calculate snag levels by principle watersheds.

Based on the information found in the RFP, associated documents, and on input from others on the Forest, I looked at how to meet the intent of the monitoring requirement. Not only have the CFI plots not been re-measured since the plan was signed, but the Forest has adopted a new inventory plot protocol, and so direct comparisons could not be made. After some thought, I decided to look at snags a couple of ways. This report documents the methods used and the results of that effort.

2 Analysis

This section documents the two analysis methods that I used to assess the current condition of snag habitat across the Caribou National Forest. For each method, the analysis, results and a discussion are presented. I elected to assess snag habitat using aerial detection survey data, and data associated with the Caribou stands (Cstands) GIS coverage. How each data set was used is detailed in the following subsections.

2.1 Aerial Detection Surveys

2.1.1 Method

The RFP, as highlighted in Table 1, indicated that the Forest Health Protection aerial detection surveys (ADS) might be a useful for monitoring snags. The survey provides a consistent method of estimating tree mortality due to bark beetles and impacts of other forest pest on a yearly basis. One positive of using ADS data is that it is available on the internet to everyone (http://www.fs.usda.gov/detail/r4/forest-grasslandhealth/?cid=stelprdb5366459). There is also a spatial component to the data which gives us an idea of where on the landscape the snag habitat is located. Another positive is that it is collected each year, which can be used to show snag habitat trend.

Because ADS primarily records mortality due to bark beetles, which just affect conifer, it seems logical to compare current conditions estimated using this method against the condition of conifer dominated stands at the signing of RFP. To accomplish this I recalculated the conifer dominated biological potential (BP) from RFP Appendix D-20 table 20 to be 42%. This was done by using the conifer acreages found in RFP FEIS 3-86 (Weighted average of acreages times BP of each type).

ADS provides an estimate of the number of trees killed, acres infested and location of activity each year which are useful for estimating the number of snags on the forest. However, snags do not persist on the landscape indefinitely as they eventually fall and become down woody material. The longevity of snags is determined by many factors such as the size of the tree, species, cause of mortality, soils, climate, the occurrence of wildland or prescribed fire, and the occurrence of severe weather events such as heavy snows and high winds (Cluck and Smith 2007).

To estimate how long the annual tree mortality recorded in ADS would serve as snag habitat, a method was needed to estimate/model snag longevity. I reviewed, Fall Rates of Snags: A summary of the literature for California conifer species, the RFP, and applied some local knowledge. In the literature review I found a study on the fall rate of lodgepole pine killed by the mountain pine beetle in central Oregon. This study found lodgepole had a fall rate of about 10% per year (Mitchell and Preisler 1998) (see Table 2). This study of snag longevity seemed to be relevant to the Caribou National Forest, since 96% of the mortality on the forest from 2001 to 2015 resulted from mountain pine beetle. This is also consistent with observations I have made. I have been watching a patch of lodgepole pine killed by mountain pine beetle (MPB) for the last fourteen years. Based on these observations it seemed all the killed trees stood at least 5 years, after that about 5-10% loss per year, and only about 10-15% of the patch is still standing. The RFP estimated longevity based on species, the rate they used for lodgepole was similar to that observed by Beck and documented in the Mitchel and Preisler paper. The RFP estimated an extended longevity for Douglas-fir, which makes sense, as they tend to be larger trees.

Table 2 . Summary of Mitchell and Preisler 1998 (Oregon).

Species	# of trees	# of years observed	DBH range (inches)	Fall Rate	Fall Rate (half-life in years)	Differences in Fall Rate by DBH	Years until 1st Snags Fell
Lodgepole	450	15	8-16	10%/year 90% after year 14	9	Not Significant	5

ADS data has been downloaded and reviewed for the past 15 years. The number of estimated trees and affected acreages were recorded. In addition, the annual affected acreage GIS data was merged into one coverage. It is important to remember that ADS data primarily records the number and acres of trees killed by bark beetle species. The number of dead trees includes mortality from Mountain Pine Beetle, Douglas-fir Beetle, Spruce Beetle, Fir Engraver, and Subalpine Fir Mortality Complex. The data does not include the number of trees killed by fire, wind throw, defoliators, and Aspen decline complex.

Figure 1 *Douglas-fir snag that has persisted on the landscape for much longer than 15 years.*

To estimate the number of snags currently available on the forest I elected to use a 10% fall rate starting five years after the tree was recorded. I felt some percentage of snags would last at least 15 years, so I applied 5% retention to 2001. I felt this was a reasonable assumption given most of the mortality was from Mountain Pine Beetle (MPB) attack on lodgepole pine. However, I also recognize that many trees will last longer, especially other species like Douglas-fir. It was also assumed that most of the trees recorded with the ADS would be near the 11" diameter class used in the RFP analysis, since bark beetles tend to hit the larger diameter classes.

2.1.2 Results

ADS data from 2001 to 2015 was collected and a 10% fall rate after five years was applied. Using this data I estimate there are approximately **5.8** standing snags per conifer dominated acre on the forest (see **Table 3**). ***Table 4*** displays the total number of trees killed and acres affected by each damage agent.

Table 3 *Summary of Aerial Detection Survey Data. The number of trees reported each year are in thousands (M).*

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
# Killed (M)	5.3	7.1	5.1	22.1	27.1	6.9	86.2	126.2	817.5	937.0	588.2	73.0	30.1	65.6	11.2
% standing	10%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	100%	100%	100%	100%
# standing (M)	0.3	0.7	1.0	6.6	10.8	3.5	51.7	88.3	654	843.3	599.2	73.0	30.6	65.6	11.2
Estimated total number of dead conifer standing on the Forest currently (sum of # standing)													**2,428,922**		
Estimated number on conifer snags/acre (There are 419,635 acres of conifer dominated stands)													**5.8**		

Table 3 shows from 2001 to 2003 mortality was low with annual mortality averaging 5,833 trees each year, then the Forest began to see a marked increase in mortality (as predicted by the RFP). Mountain pine beetle (MPB) populations reached epidemic levels in 2007. The epidemic peaked in 2010 when

nearly one million (937,008) trees were killed, mostly by MPB. MPB activity dropped in 2012 to 73,006 trees killed, since then it has continued to taper off. This means that we can expect the number of insect related snags per acre to begin to drop as the trees killed during the epidemic level years begin to fall.

Table 4 *Aerial Survey Data by damage agent, 2001-2015.*

Damage Category	# trees killed	Acres
Mountain Pine Beetle	2,703,664	386,539
Douglas-fir Beetle	29,042	15,998
Subalpine fir complex	75,769	43,105
Spruce Beetle	667	678
2001-2015 Total	**2,809,142**	**446,320**
15 Year Average	**187,276**	**29,755**

Figure 4 and **Figure 5** in Appendix I show where the aerial detection recorded tree damage across the forest from 2001 to 2015. **Figure 4** shows all the damage types by VMU, which are similar to the Principle Watershed Inventory (PWI) units used for the RFP analysis. **Figure 5** shows the different damage agents that were recorded. On this map you can clearly see that the MPB activity was mainly on the Montpelier and southern half on the Soda Springs Districts. You can also see that there has been extensive defoliation by Western Spruce Budworm on the northern part of the Soda Springs R.D., which has been going on for a number of years. This likely has resulted in some mortality and spiked topped trees, which would create snag habitat. However, this was not accounted for in the numbers above since there was not good way to estimate the mortality level. The same is true for the aspen decline, which was mapped.

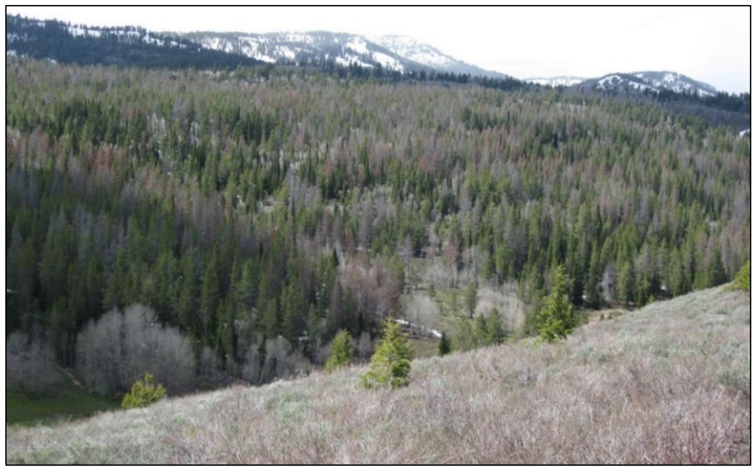

Figure 2 Mountain Pine Beetle (MPB) mortality near Nieber Spring, 2011. *It easy to see the various years of mortality, gray have been dead a couple years, red dead a year or so and straw color trees are currently infested. ADS attributed MPB mortality reflects previous year attacks, needles of dying trees typically take up to a year to change color and be detectable by observers (Dudley 2016).*

2.1.3 Discussion

Based on the Cstands coverage there are 419,634 acres of conifer-dominated forest on the Caribou National Forest (56,365 ac spruce/fir, 286,980 ac Douglas-fir and 76,289 ac lodgepole). If we weight the 100% BP numbers for each cover type by these acres we can estimate that 100% biological potential (BP) for conifer dominated cover type for the Forest as whole is 9.6 snags per acre. The Forest currently has an approximate **5.8** snags/conifer dominated acre (2,428,922 trees killed & still standing/419,635 conifer dominated acres) created from beetle activity from 2001 to 2015. Therefore, conifer acres are currently at an approximate 60% BP on the Forest just from insect mortality. While the numbers are not directly comparable, it is clear that there has been an increase in snags since the signing of the RFP (from 42% to 60%).

With this data set, it is also possible to determine snag recruitment rates. For example, we can estimate that the forest produces an average of **0.45** conifer insect created snags/acre/year (2,809,142 trees killed/419,635acres/15 years) or 187,276 trees killed per year based on a 15-year average.

There are limitations to using ADS data to estimate the number of snags present on the forest at a given point in time because it requires estimating snag longevity, and it only accounts for groups of trees killed by beetles, it does not account for other mortality sources. However, it does provide a Forest-wide data set that is updated yearly, because of this ADS data may be most helpful because it gives us a better understanding of how snags resulting from insects change through time. With insects it tends to be boom or bust, there really is no such thing as average.

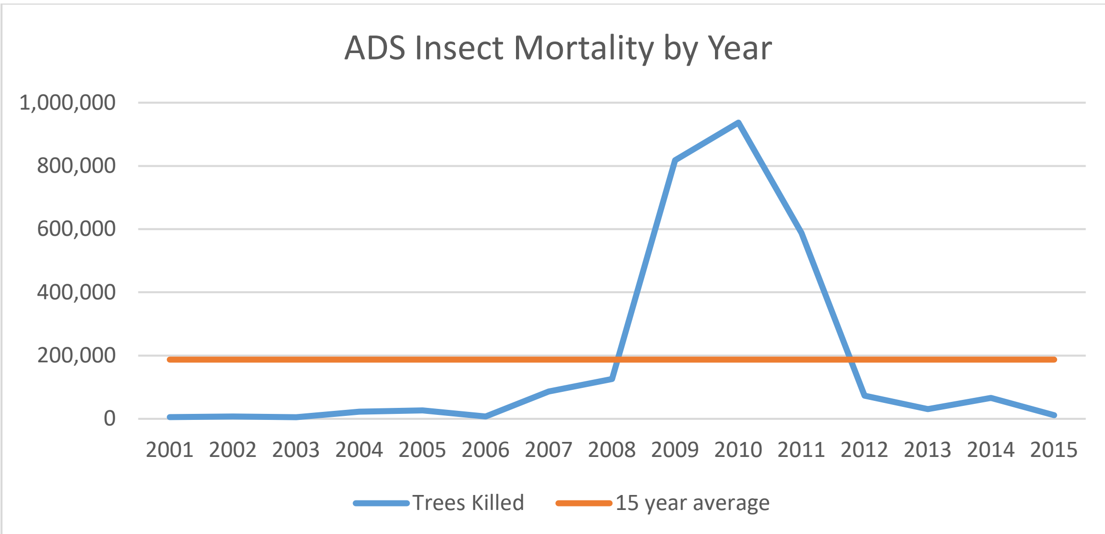

Figure 3 *Tree mortality by year as recorded by Forest Health Protection Aerial Detection Surveys. This graph shows that insect related mortality is episodic and no single year is very close to the fifteen-year average.*

Also, it is easy to focus on the mortality information in the ADS data, but there is other helpful information to be mined out of the data, which helps us understand snag habitat. For example, Western Spruce Budworm (WSB) activity has increased from 1,025 acres in 2013, to 121,335 acres in 2015. WSB affects Douglas-fir, subalpine fir, and Engelmann spruce. After several years of heavy defoliation by WSB, we can expect branch dieback, top kill, and even some mortality (Hagle, Gibson and Tunnock 2003). Even if mortality does not occur, affected trees are often more susceptible to attack by bark beetles, other insects and rots. All of which add habitat for woodpeckers and cavity nesters.

The mountain pine beetle and western spruce budworm activity in the last ten years is an example of the episodic nature of insect and disease outbreaks and the effect on snag habitat on the forest. This episodic cycle is natural, woodpecker and cavity nesters have evolved in this cycle of boom and bust. It is also important to remember that insects and disease are not the only disturbance agents that create snag habitat. Fire, wind and inter-tree competition all result in mortality and create snag habitat.

The drastic increase in Mountain Pine Beetle (MPB) from 2008 to 2011 provided an abundance of snag habitat that will flow through the ecosystem for years as snags and large woody debris. These pulses of snags are natural and the ecosystems have evolved with the episodic events. Boom and bust is very common in ecosystems, and our Forest is currently on the tail end of a boom in snag habitat brought on by mountain pine beetle. Ninety five percent of the forested acres on the Forest are mature to late seral. They also tend to be dense which puts them at risk to more of these type of disturbance in the future. The result is good for snag dependent species on the Caribou, as insects create more snags each year to replace those that fall or are removed.

2.2 Caribou Stand Analysis

2.2.1 Method

Another data source that I thought would be useful to estimate the number of snags on the Forest was the 2015 Existing Vegetation GIS coverage (Cstands) and the associated accuracy assessment plots (AAP). For the accuracy assessment, ninety-four plots were selected using a systematic random sample process across the Forest, and fifty plots fell in forested stands. Field crews visited the stands in the 2013-2014 field seasons and plot data was collected at four random plot locations within each stand. The data from the 200 plots was uploaded into Field Sampled Vegetation (FSVeg), and summary reports were generated for each Society of American Foresters (SAF) cover type. The plot data summary information can be post stratified to all stands in the GIS coverage based on attributes in the stands coverage.

Table 5 Number of Plots by SAF type.

SAF Cover Type	Number of Plots
Aspen (217)	60
Douglas-fir (210)	88
Spruce/Fir (206)	12
Lodgepole (218)	40

Our review of information in the Caribou RFP found there is direction to retain snags ≥ 12 inches diameter at breast height (DBH) or the largest diameters in the stand, for all forest types (RFP 3-26). In table 14 in the RFP Appendix (D-17) there is a list of the seven woodpecker species that were used to calculate biological potential, only two of which require trees 12 inches or larger. One species can use snags as small as six inches. It is clear that snags larger than 12 inches are not needed to meet habitat requirements for five of the seven species. The RFP 12 inch guideline was intended to insure that managers did not leave just small snags during projects, because bigger is better. Which is why the RFP guideline has the *12 inches or the largest diameter for the stand* statement. Therefore, smaller snags contribute to the biological potential (BP) for five of the seven species. While it would be ideal to be able to provide the number of snags directed in the RFP that were larger than 12 inches DBH, in some cases smaller snags need to be counted, especially in aspen stands, since some sites do not have the site capacity to reach 12 inches DBH.

In the RFP EIS analysis, they used the 11 to 12.9 (12' class) and larger diameter classes to estimate the number of snags for conifer types. For the aspen type, they did it two ways, using the same classes as the conifer and using 8 inches and larger classes.

Table 6 shows the summary of the snags per acre by diameter class and by SAF cover type. This shows that snags greater than 12 inches make up a small percentage of the available snag habitat.

Table 6 Snag count by diameter class and SAF type. *206 = Spruce/fir, 210= Douglas-fir, 217=aspen and 218=lodgepole.* ** #'s in ( ) =QMD*

DBH Class (inches)	206	210	217	218	All Plot average *
6 to 8.9	11	4	33	9	**14** (7.2)
9 to 10.9	7	1	5	11	**4** (9.8)
11 to 11.9	0	3	0	5	**2** (11.5)
12 to 99	5	3	1	6	**3** (19.8)
Total	**23**	**11**	**39**	**31**	**23** (14.1)

These per acre averages are from the FSVeg summaries of stands sampled. Because of the sample design, they can be multiplied by the acres (Cstands) of each SAF vegetation type across the Forest as a whole, or by Vegetation Management Unit (VMU) to estimate an overall snag density for the Forest or VMU. VMUs were used because the forest existing vegetation coverage was established using VMUs as boundaries, therefor their use was convenient. VMUs are watershed based and are very similar to the principle watersheds inventory (PWI) units (HUCS) used in the RFP analysis (see **Figure 4**).

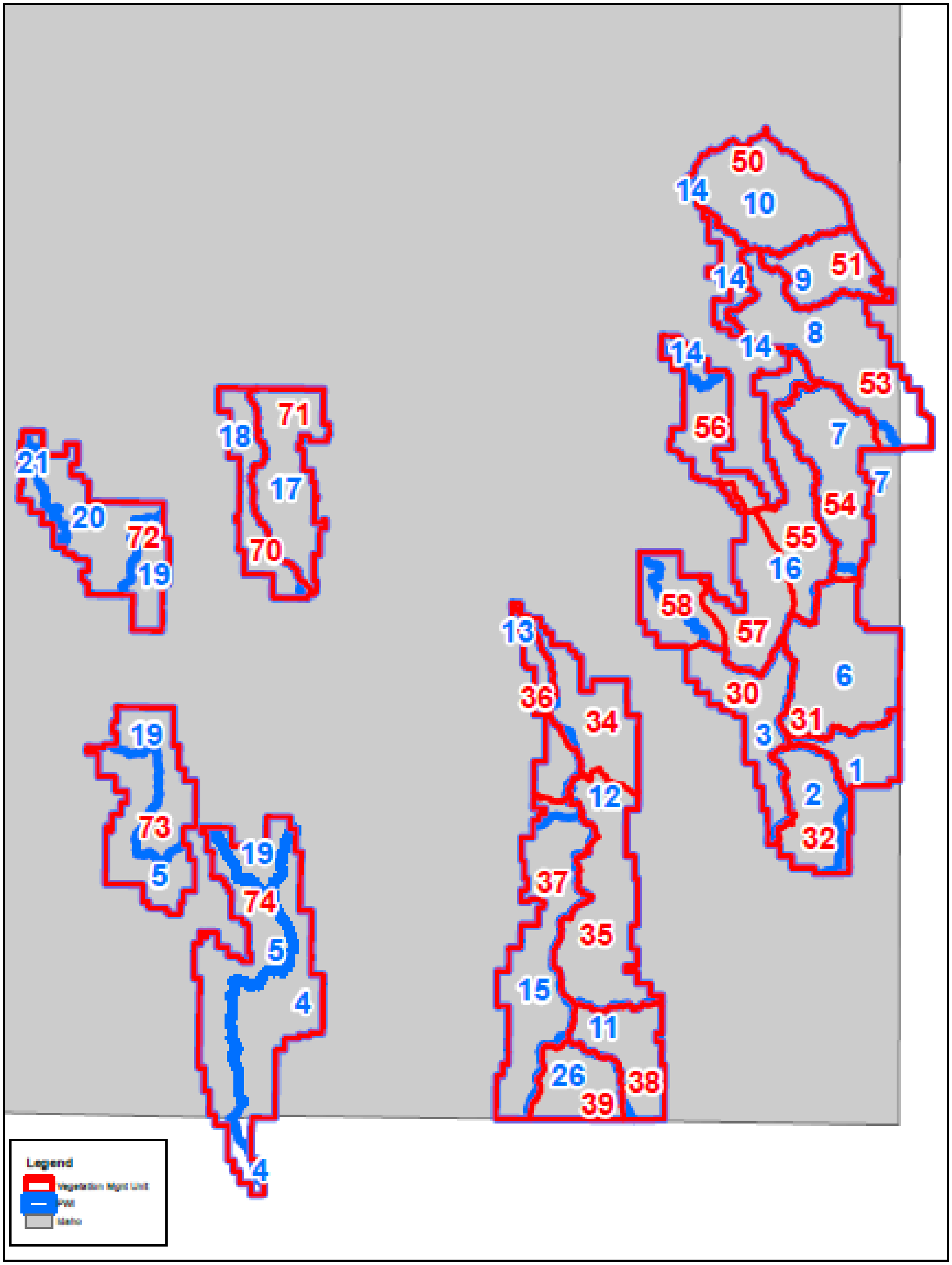

__Figure 4__ VMU and PWI comparison. Most of the VMUs and PWI match almost exactly, VMU 72, 73, and 74 each combine a several small PWI, PWI 12 and 16 were both split into a couple VMU.

Results

Table 7 shows the estimated biological potential (BP) for the Forest based on the AAP data and Cstands acreages, and using various different snag diameter classes. To calculate the percent BP, several steps were required. First, we calculated the weighted per acre average BP (9.23), to do this the 100% BP numbers from the RFP were divided by 100 then multiplied by the acreage of each cover type (Cstands), and divided by the total forested acreage. Then the number of snags for each chosen diameter class were calculated using FSVeg data reports, for each SAF type. A weighted average for the diameter class was then calculated. The weighted average was divided by the weighted 100% BP number to get an estimate of the percent biological potential for the diameter class for the Forest as a whole. The RFP EIS calculated that the existing condition was 25% BP using 11 inches and larger snags. This analysis shows that we are currently at an approximate 56% BP using 11" and larger snags. This indicates that snag habitat has improved across the Forest.

Figure 5 Many types of disturbance events create snags. Different disturbance types create different snag habitat. The large Douglas-fir snag in this picture was likely killed by the stress brought on by old age and heart rot (Phaeolus schweinitzii); this creates a different type of snag than a wildfire for example.

Based on information in the RFP to meet 100% of the needs of species that require 12" and larger trees we would need an average of 2.51snags/acre ≥ 12", the AAP data indicates that we have 3.03 per/acre. If you count all snags greater than 9", we are at 99% of biological potential. This indicates that the Forest is able to meet the needs of all seven woodpeckers analyzed by the RFP. There are enough large diameter snags to meet the needs of those that require them and there are enough snags in the smaller diameter classes to meet the needs of those that don' require snags that large.

Table 7 *Forest wide biological potential using various different size classes.*

SAF cover type code	**206**	**210**	**217**	**218**	**Total**	**Calc. % BP**
Acres	56365	286,980	161,465	76,289	**581,099**	
100% BP	9.78	9.78	8.28	8.77	**9.2**	
Snags per acre > 12" DBH	5	3	1	6	**3.0**	33%
Snags per acre > 11" DBH	5	6	1	11	**5.2**	57%
Conifer snags>11" & Aspen snags>9"	5	6	6	11	**6.6**	72%
Snags per acre > 9 DBH	12	7	6	22	**9.2**	100%

Table 8 shows the results of the estimated number of snags/acre (SPA) calculated for each vegetation management unit (VMU)/ Principle Watershed Inventory (PWI). As stated earlier, the VMU and PWI are very similar blocks of forest (where multiple VMU represent one PWI a simple average is displayed). The shaded portion of the table comes from the RFP (RFP EIS Appendix D-20) existing condition analysis. Most of the PWI show a large increase in SPA; however, one shows a small decrease in SPA, and two show a large decrease in SPA. The two PWI that show a large decrease in snags had high SPA at the time of the plan. This data should be used with caution because the RFP data is based on plots by PWI and the AAP data is based on cover type averaged by Cstand acreage in the VMU.

Table 8 *Estimated snags per acre by watershed/VMU.*

PWI #	PWI NAME	VMU	RFP SPA	Cstand SPA	Change	%Change
1	Geneva	33	0.9	4	3.10	344%
2	Montpelier	32	4.1	5.3	1.20	29%
3	Georgetown	30	1.5	5.3	3.80	253%
4	Weston	74	0	5.1	5.10	
5	Malad	73	4.2	5.1	0.90	21%
6	Crow Creek	31	2.9	3.5	0.60	21%
7	Stump Creek	54	6.3	6.1	-0.20	-3%
8	Tincup Creek	53	4	5.2	1.20	30%
9	Jacknife Creek	51	5.8	5.9	0.10	2%
10	McCoy Creek	50	11.3	6.3	-5.00	-44%
11	Bear Lake	38	0.3	5.3	5.00	1667%
12	Bear Lake Outlet	34 & 35	2.6	6	3.40	131%
13	Grace	36	1.6	5.7	4.10	256%
14	Grays Lake	52	11.6	3.5	-8.10	-70%
15	Cub River	37	4.1	5.2	1.10	27%
16	Blackfoot River	55, 56, 57 & 58	2.9	5.2	2.30	79%
17	Upper Portneuf East	71	2.4	2.8	0.40	17%
18	Upper Portneuf West	70	5.9	4.6	-1.30	-22%
19	Marsh Creek	72, 73 & 74	3.2	4.8	1.60	50%
20	Lower Portneuf	72	0	4.1	4.10	
21	Rattlesnake	72	0.2	4.1	3.90	1950%
26	Logan River	39	2.8	5.4	2.60	93%

2.2.2 Discussion

The post stratification of the Caribou stands coverage (Cstands) using the accuracy assessment plots (AAP) indicates that across the Forest, habitat requirements for woodpeckers and cavity nesters are being met. This information is Forest wide in nature, and when the Forest is broken into smaller and smaller pieces the quality of the data also goes down. Nevertheless, it does provide a good Forest wide assessment. It shows that the Forest should be able to meet 100% of the needs of the species that require 12 inch or larger snags, and it shows that the needs of those that can use smaller snags is also being met. This make sense since small trees dominate so much of the Caribou. It make sense that the RFP set a guideline to retain 12 inch or larger trees, because of this. Biological potential needs to be assessed for all diameter classes. Aspen especially struggles to make it to 12 inches before it reaches biological rotation age on many of the acres.

3 Conclusion

The number of snags/acre varied from 5.8 snags/acre using ADS data to 23 snags/acre using the Caribou National Forest existing vegetation coverage AAP data. Looking at AAP data for conifer snags greater than 11 inches, there are 5.2 snags/acre. This seems to match really well with the ADS data at 5.8, increasing the confidence that there are enough large snags to meet the needs of the wood peckers and cavity nesters that require larger snags. The AAP data suggest that across the forest there are lots of snags for wood peckers that can utilize smaller trees.

Within the Caribou National Forest 187,324 acres (32% of the forested acres) are susceptible to high levels (>25%) of overall tree mortality from 2013 to 2027, and 22% of the tree biomass is at risk to forest pests (USDA FS 2013). With the predicted risk of mortality, snags will likely continue to be recruited at or above existing levels. It seems like snags have increased since the signing of the RFP and will likely continue to do so, as always in pulses.

The trend for snag dependent wildlife species is positive, and will likely continue to be positive, given the current condition of the forest types on the Caribou. Based on ADS data there is an estimated 2.4 million snags across the Forest that have resulted from bark beetle mortality. The AAP data that I used expanded across all acres estimates that there are over 13 million snags on the Forest that are 6 inches or larger.

4 References

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I. Appendix I

Table 9 Estimated number of Snags by VMU and SAF Vegetation Type.

	Acres by SAF type							**Snags by SAF type**							
VMU	**206** Spruce/fir	**210** Douglas-fir	**217** Aspen	**218** Lodgepole Pine	**219** Limber Pine	**237** Ponderosa Pine	**Total Forested Acres**	**206**	**210**	**217**	**218**	**219**	**237**	**Total # Snags**	**Snags/Acre**
30	1,038.9	15,131.6	5,277.0	2,264.2			23,712	5,298	87,763	31,134	26,038	0	0	150,234	6.3
31	427.2	7,180.8	20,767.0	4,485.7			32,861	2,179	41,649	122,525	51,585	0	0	217,938	6.6
32	289.0	6,378.7	3,283.3	1,753.5			11,704	1,474	36,996	19,372	20,165	0	0	78,007	6.7
33	20.1	1,736.3	5,704.8	1,953.1			9,414	103	10,071	33,658	22,461	0	0	66,292	7.0
34	2,464.2	17,272.4	4,318.4	7,003.1			31,058	12,567	100,180	25,479	80,536	0	0	218,761	7.0
35	9,802.4	15,595.1	11,998.6	9,250.3	864.6		47,511	49,992	90,451	70,792	106,379	0	0	317,614	6.7
36	957.5	7,209.1	929.2	468.2	105.4		9,669	4,883	41,812	5,482	5,384	0	0	57,562	6.0
37	2,079.4	27,100.6	8,235.7	2,109.6			39,525	10,605	157,183	48,591	24,260	0	0	240,640	6.1
38	1,984.3	11,499.4	4,744.8	2,350.1	495.2		21,074	10,120	66,697	27,994	27,026	0	0	131,837	6.3
39	8,396.2	2,520.4	3,321.3	2,838.0	1,044.7		18,121	42,821	14,619	19,595	32,637	0	0	109,672	6.1
50	7,334.5	18,567.6	4,035.8	7,604.3	4.4		37,547	37,406	107,692	23,811	87,450	0	0	256,359	6.8
51	2,391.6	9,771.2	2,744.4	2,898.1			17,805	12,197	56,673	16,192	33,328	0	0	118,391	6.6
52	299.3	3,959.8	4,104.7	9.7			8,374	1,527	22,967	24,218	112	0	0	48,823	5.8
53	10,273.2	22,889.9	11,977.4	6,107.2			51,248	52,394	132,761	70,667	70,233	0	0	326,055	6.4
54	5,316.1	15,020.3	7,679.4	9,221.6			37,237	27,112	87,118	45,309	106,048	0	0	265,586	7.1
55	999.4	18,724.0	7,689.1	9,533.1	19.9		36,965	5,097	108,599	45,365	109,631	0	0	268,692	7.3
56		14,025.4	4,660.0	1,991.0			20,676	0	81,348	27,494	22,897	0	0	131,738	6.4
57	124.4	9,720.5	10,610.3	1,950.9			22,406	634	56,379	62,601	22,435	0	0	142,049	6.3
58		7,936.6	6,456.3	2,495.9			16,889	0	46,032	38,092	28,703	0	0	112,828	6.7
59				1.4			1	0	0	0	16	0	0	16	16.2
70	291.2	6,762.4	2,703.9		178.3		9,936	1,485	39,222	15,953	0	0	0	56,660	5.7
71	549.0	9,088.8	16,589.0				26,227	2,800	52,715	97,875	0	0	0	153,390	5.8
72	559.7	14,401.6	8,753.8			63.2	23,778	2,854	83,529	51,648	0	0	0	138,031	5.8
73	578.4	12,031.0	2,670.4		195.3		15,475	2,950	69,780	15,755	0	0	0	88,485	5.7
74	189.4	9,478.9	2,210.9		7.2		11,886	966	54,977	13,045	0	0	0	68,988	5.8
Total	**56,365**	**284,002**	**161,465**	**76,289**	**2,915**	**63**	**581,101**	**287,464**	**1,647,213**	**952,646**	**877,324**	**0**	**0**	**3,764,648**	**6.8**
	Conifer Dominated Acres			**419,635**											

Figure 6 Caribou National Forest, Aerial Survey Damage 2001-2015.

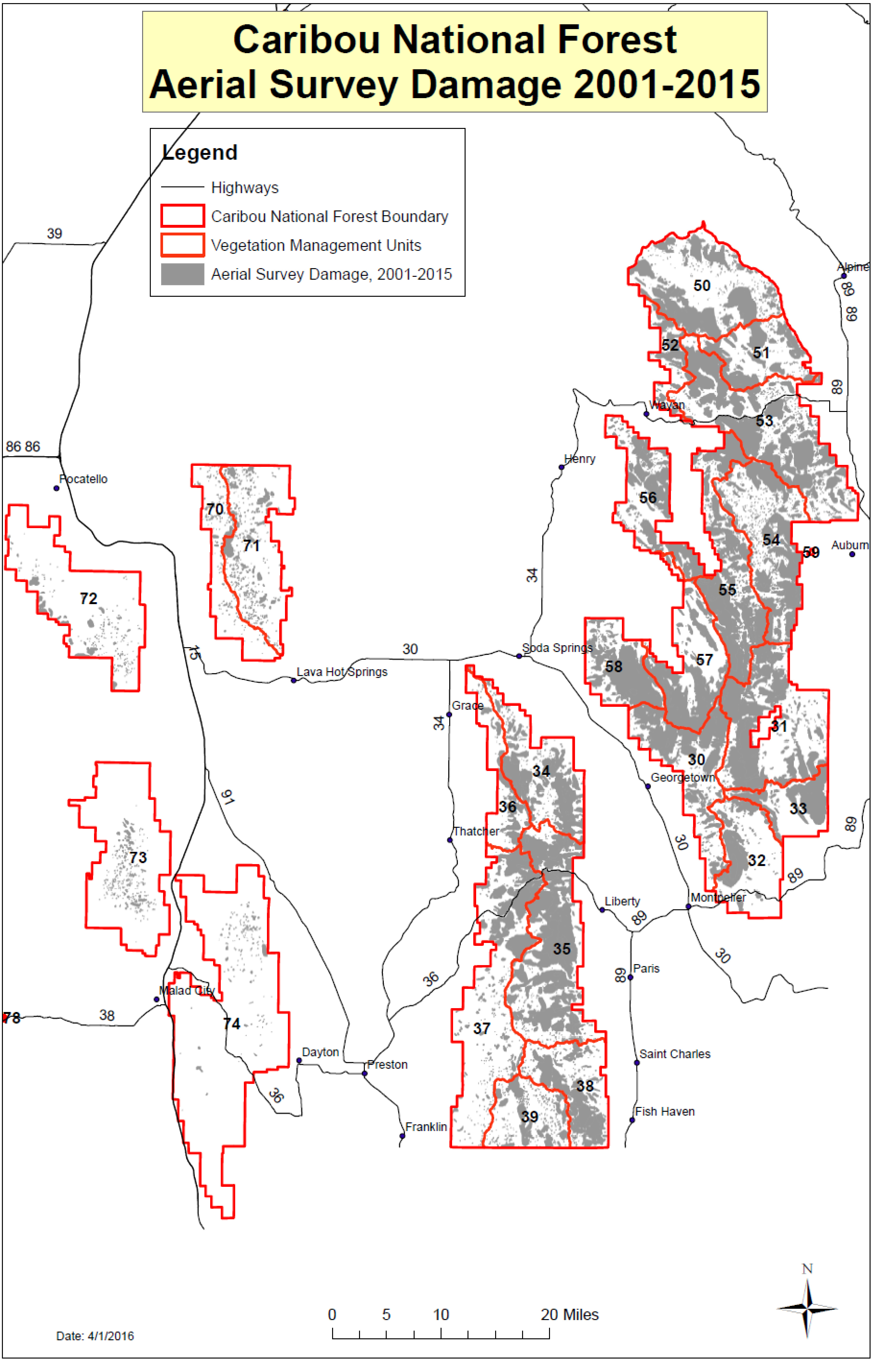

Figure 7 Caribou National Forest, Aerial Survey Damage by Category 2001-2015.

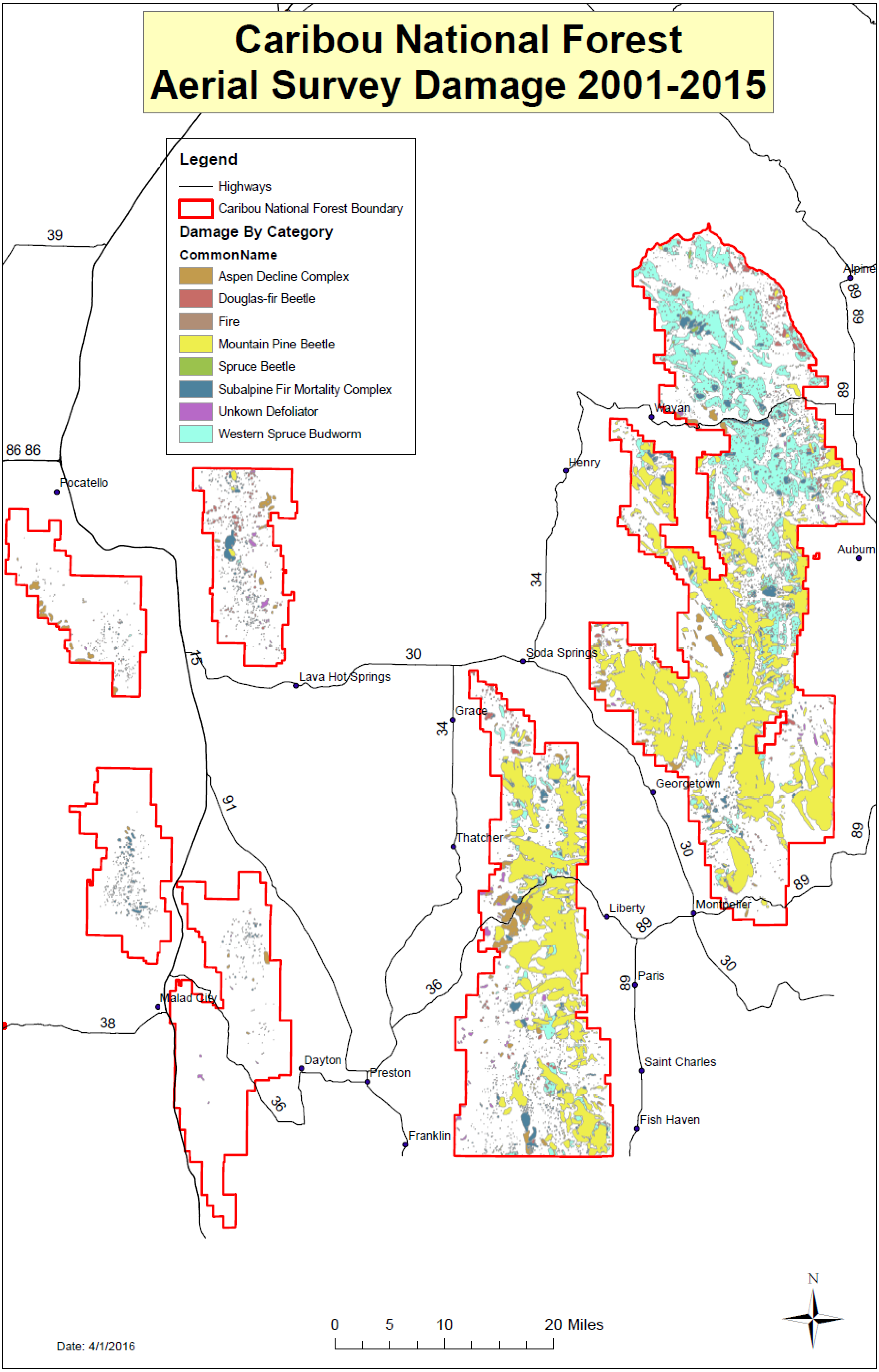

Figure 8 Montpelier Ranger District, Aerial Survey Damage by Category 2001-2015.

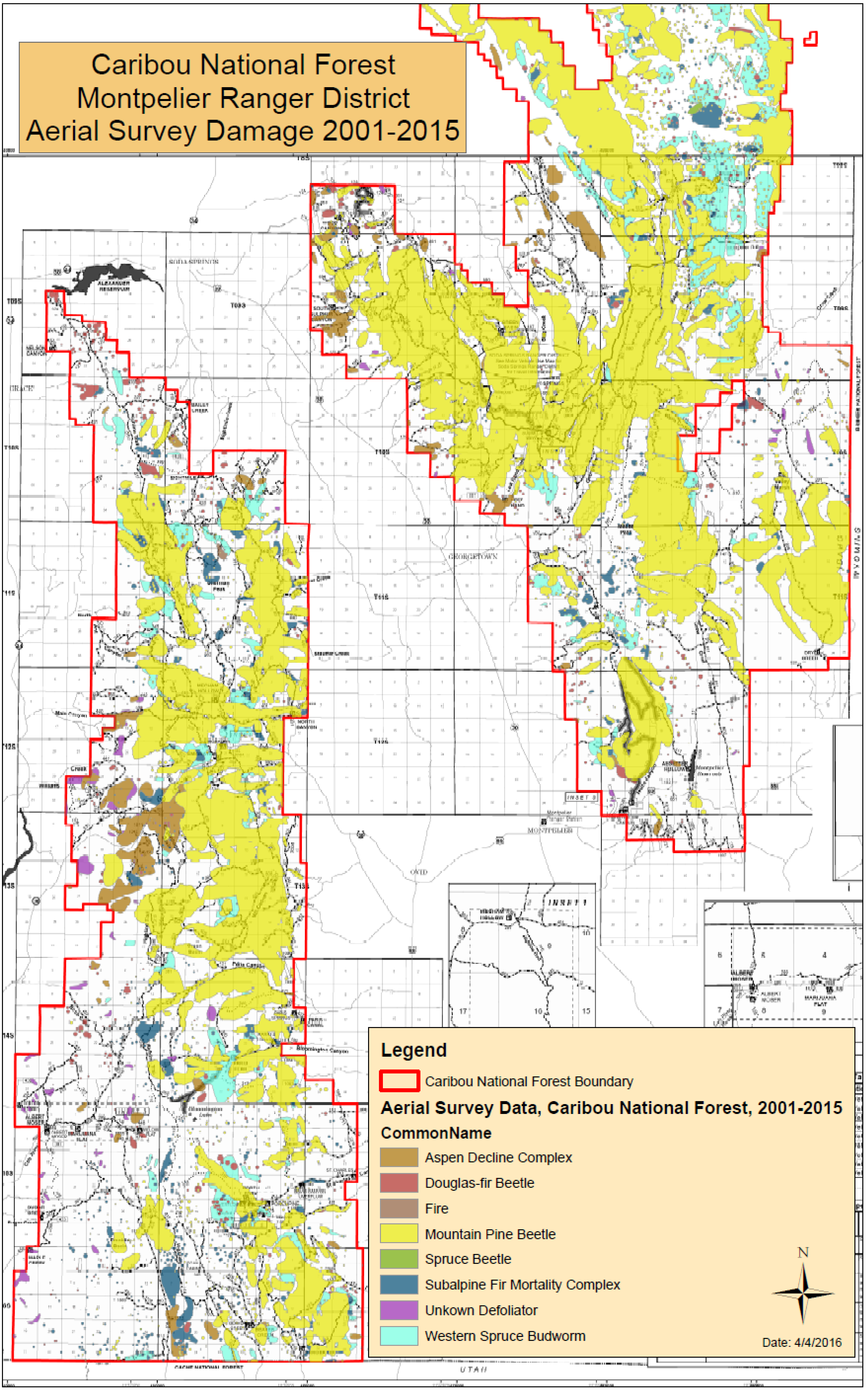

Figure 9 Soda Springs Ranger District, Aerial Survey Damage by Category 2001-2015.

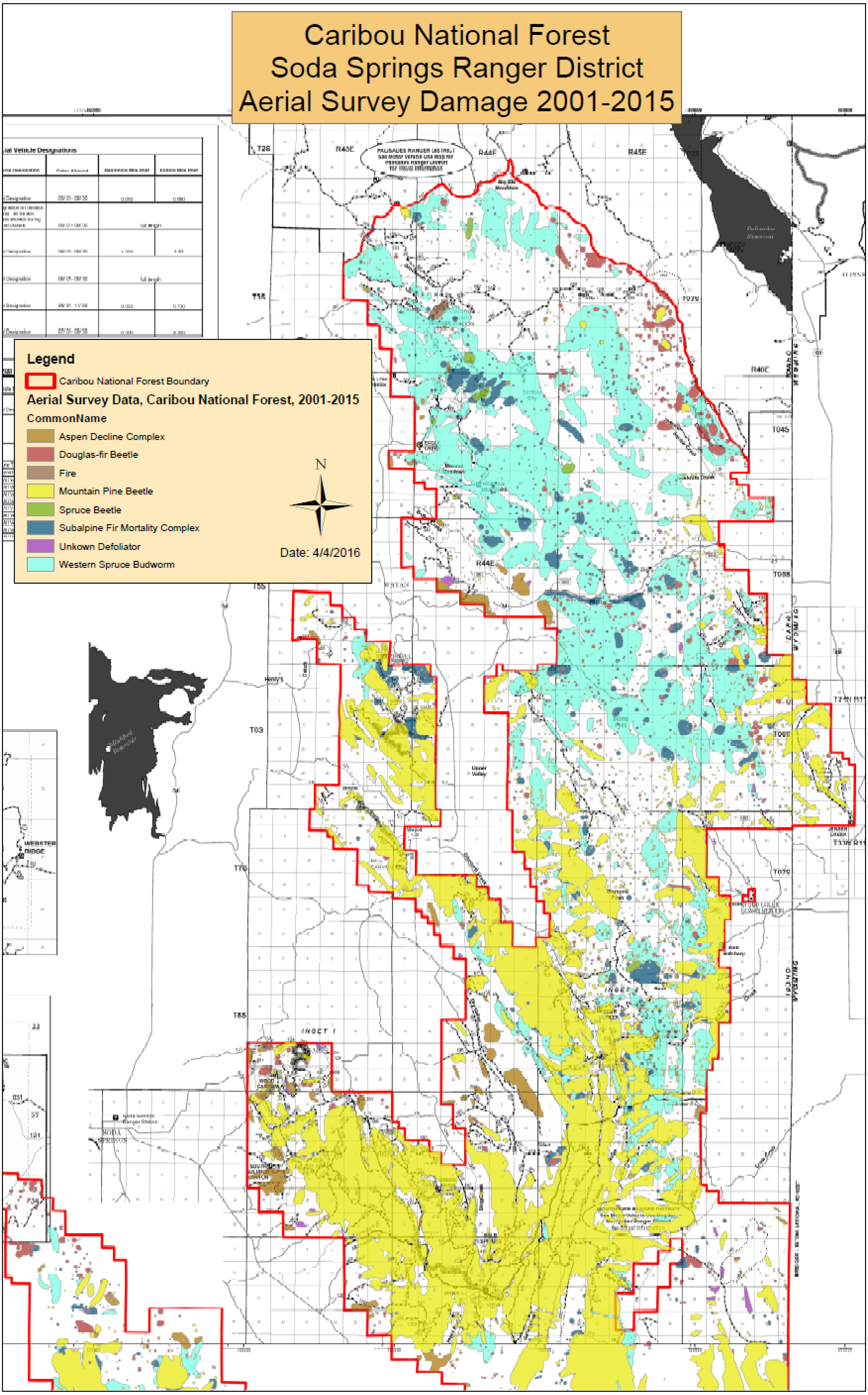

Figure 10 Westside Ranger District South End, Aerial Survey Damage by Category 2001-2015.

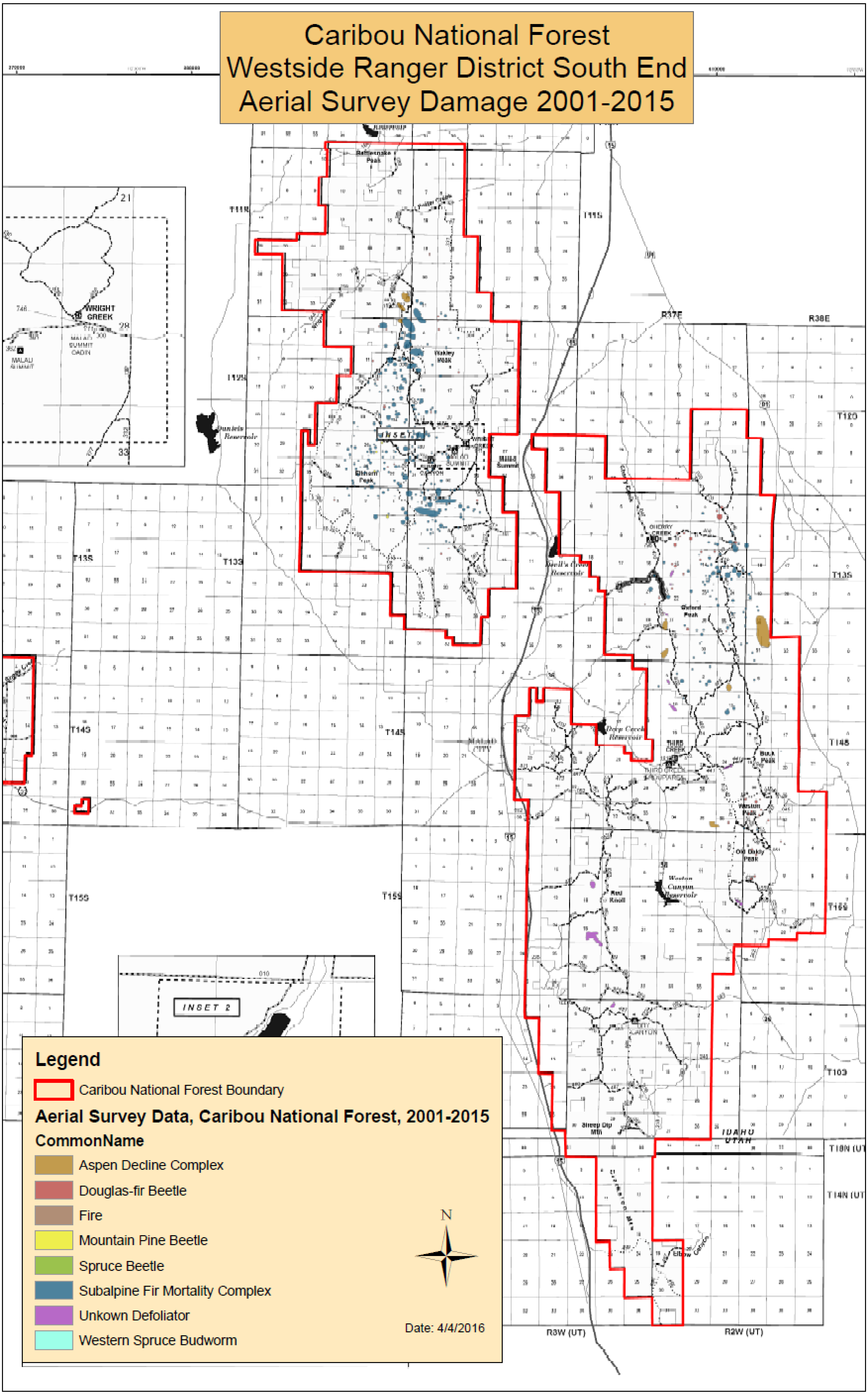

Figure 11 Westside Ranger District North End, Aerial Survey Damage by Category 2001-2015.