# Update to the Management Indicator Species Assessment for Red-Naped Sapsucker

## Grand Mesa, Uncompahgre, and Gunnison National Forests

## March, 2014

# Contents

# Introduction

The Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG) amended their Forest Land and Resource Management Plan in 2005, to modify the list of Management Indicator Species. One species included in that list is the red-naped sapsucker *Sphyrapicus nuchalis* . An assessment of the then-current status of that species, recent trends in population, and known life history information, was developed and published in September, 2005 (Vasquez, 2005).

This document is intended to provide an update to that original assessment, to reflect known and anticipated changes in habitat, provide current monitoring , population, and trend data, and describe updates in published information on the species, especially as it impacts the GMUG. This document should be considered a supplement to the original assessment and should not be considered a stand-alone piece.

# Habitat

## Habitat Changes 2005-2014

In order to determine changes in overall habitat for the red-naped sapsucker since its inclusion as a Management Indicator Species in 2005, the habitat modeling described in the 2005 assessment was repeated on the current vegetation layer available in GIS. Documentation for the old model could not be located, so a new model (Appendix 1) was created based upon Table 1 in the 2005 document. This model was run against the FSVeg_Spatial vegetation layer, currently in use by the Forest, as of February 12, 2014.

The results of this model run show substantial decreases in habitat across the three suitability types for cover and nesting. This did not agree with known changes to habitats across the Forest, so further analysis was conducted. There seemed to be several possible reasons for the discrepancies. The primary one which needed to be investigated was that the habitat had indeed changed over this time frame and that the differences shown in the new model were accurate. There was also the possibility that the model was flawed, either in 2005 or in 2014. Another possible explanation was that the newer habitat layer was more accurate, as it receives corrections from a variety of sources, primarily field verification of the data. Such corrections include not just changes to data within vegetation polygons, but also may include redrawing polygon boundaries to represent changes or more accurately account for multiple cover types within previously heterogenous polygons.

The old vegetation model run GIS file was located and examined. It clearly showed the areas of the Forest attributed as each type of habitat, but lacked attributes which could be used to check components of the old model. This layer was therefore merged with the new vegetation layer upon which the new model had been run. This resulted in a layer which had current vegetation data as well as having habitat quality attributes from the both the 2005 and 2014 models.

Table 1. Acres of change of 2005 habitat types to 2014 habitat types.

| | | | **2014 Cover / Nesting Habitat Value** | | | |
|---|---|---|---|---|---|---|
| | | | High | Moderate | Low | Non-habitat |
| | | Acres of Habitat | 438577 | 364344 | 98813 | 2287827 |
| **2005 Cover/Nesting Habitat Value** | High | 466359 | -27782 | 16783 | 505 | 10494 |
| | Moderate | 457533 | 4975 | -93189 | 1640 | 86574 |
| | Low | 106187 | 293 | 2203 | -7374 | 4878 |
| | Non-habitat | 2305427 | 5321 | 8942 | 3335 | 84348 |
| | Net change | | -17193 | -65261 | -1894 | 84348 |

Appendix 2 shows a detailed breakdown of the various cover types which showed changes in results of the habitat modeling from the two time periods.

The primary cause of the discrepancy between 2005 and 2014 habitat quantities appears to be quality control of the vegetation data over time. For instance, the 2014 data shows that large areas of lodgepole that were labeled as suitable habitat in 2005 lack an aspen component as described in Table 1 of the 2005 assessment. Additional areas are currently typed as dominated by species which were not included in the table, such as bristlecone pine and spruce-fir. Natural changes to vegetation, such as increase in tree sizes, succession of conifers, or mortality of a stand, would be included in this category as well.

It is highly likely that the current model is different from the 2005 model in one aspect. The 2014 model included willow that was “adjacent” to other suitable habitat types as described in Table 1. For the purposes of the 2014 model, this meant that the willow polygon needed to be touching the other suitable polygon. The literature, however, indicated that a buffer distance may be more appropriate, and such a buffer may have been used in 2005. Without the original vegetation layer from the 2005 modeling, there is no way to know the exact buffer distance, if any. As a result, willow habitats may not be included in the 2014 model where they were in 2005. While this impacts the results of the model run, it does not actually change the habitat.

Finally, some portion of the change was in fact alterations of habitat caused primarily by timber harvest or fire. Some of this already existed in 2005 and would fall into the “quality control” error category, but harvest of timber, primarily aspen for the purposes of this model, has occurred over time and continues to occur. This accounts for approximately 4605 acres of aspen previously in the high cover/nesting category, and 102 acres of moderate quality cover / nesting habitat. This aspen is expected to regenerate to first moderate then high quality habitat over time. Other habitat types such as lodgepole and ponderosa showed only small changes from timber harvest, and removal of aspen from other types occurs rarely on this Forest.

One additional item which came up during the analysis was that spruce-fir dominated cover type was not included in the model. In some areas of the Forest, spruce-fir and aspen occur on a gradient from pure aspen to pure spruce-fir, with all possible mixtures in between. Those mixes which are dominated by aspen are included in the aspen cover type portion of the model, but those portions dominated by spruce-fir, even those that contain substantial percentages of aspen, are not included. From the text and 2005 model results, it appears that this was deliberate. However, red-naped sapsuckers may utilize such habitats (D. Garrison, pers. obs). Spruce-fir with an aspen component of habitat structural stages 3 and 4, similar to that modeled for lodgepole, covers approximately 300,000 acres on the Forest.

There are limitations to this type of measurement of habitat quantity. Willows occur in many cover types, including those not specifically included in the model, at scales below the resolution of the vegetation layer. These areas are potentially useful to the species even if they do not appear in the model. Additionally, aspen or cottonwood may occur as a component of other cover types, and may be used for nesting. It is important to note that assessments of habitat suitability at the project level require field verification and surveys for the species to be accurate, and that the analysis in this document is only intended to be a Forest-level monitoring.

## Ongoing Habitat Changes

Aspen is by far the largest (by area) component of high quality cover/nesting habitat on the Forest. Only a fraction of the aspen stands on the Forest are pure aspen, however, with much of it containing some conifer. Smith and Smith (2005) documented substantial increases in basal area of conifers in mixed aspen/conifer stands on the Uncompahgre Plateau over the preceding 20 years, with an associated decrease in aspen basal area. Alsanousi (2012) modeled aspen declines on the Plateau of 40% to 80% in terms of tree numbers per hectare based on current growth conditions. Continued succession of conifer species in mixed stands decreases available nesting habitat, at both the individual tree and stand scales. However, suitability of individual trees does increase with time as trees reach maturity and develop heart rot needed for cavity construction.

Additionally, large areas of the Forest were impacted by Sudden Aspen Decline (SAD), resulting in widespread mortality from cankers and insects after drought apparently weakened trees in 2000-2004. Alsanousi (2012) documented that only 54% of the trees included in his study area were live healthy trees, with 25% of the standing stems dead and 21% rotten. Additionally, affected stands showed decreased ability to regenerate, as opposed to healthy stands which are burned or harvested, which typically regenerate rapidly. The syndrome was not restricted to the GMUG, and at its peak in 2008, 17% of the aspen cover statewide showed effects of SAD (Worrall et al, 2010). Since that time, the spread of SAD has been substantially reduced due to increased rain and snowfall. Much of the change in stand composition due to SAD has yet to be reflected in the vegetation layer as of this time, but likely will as data is collected, verified, and incorporated into the database. It is expected that habitat quality in these stands will decrease over time, as dead or dying trees fall and are replaced with young aspen or other species, until such time as these stand regenerate, if ever.

Climate change may also impact availability of habitat in the long term. The Forest Service, at several levels, is attempting to understand the consequences of changing climate on ecosystems including those related to aspen. Morelli et al (2011) provide a detailed analysis of possible impacts to aspen. Further information may be found at http://www.fs.fed.us/ccrc/ with further information on impacts to birds at http://www.fs.fed.us/ccrc/topics/wildlife/birds/ . In the long term (hundreds of years or more), increases in temperature will likely shift aspen upward in elevation, with a resultant decrease in available land area. Decreases in available moisture may result in stress similar to what was seen in the SAD outbreak described above, and may also decrease available willow and cottonwood riparian habitats. This may be compounded by increased human uses of water for agricultural or domestic purposes. However, increased fire and atmospheric carbon dioxide may benefit aspen and counter other drivers.

Kulakowski et al (2004) compared historic (1898) aspen vegetation data with current data on the Grand Mesa, and determined that aspen occurs on from 22 to 61% more area that in the late 19th century. This suggest that the declines seen in the immediate past may be part of the historic range of variability, and therefore available habitat for the sapsucker may be greater now than in previous eras.

## Management Response to Aspen Decline

The Forest has conducted research on regeneration of aspen stands impacted by SAD, including the Terror Creek Applied Silvicultural Assessment in impacted stands on the Paonia Ranger District, in part to determine at which point in the decline mechanical treatments such as harvest are still effective in regenerating a healthy sapling stand. Publications of research findings are pending as of the date of this document.

The GMUG is currently preparing to conduct large-scale active management (http://www.fs.usda.gov/wps/portal/fsinternet/!ut/p/c5/04_SB8K8xLLM9MSSzPy8xBz9CP0os3hvXxMjMz8Dc0P_kFALA09zLzNDowAXYwMLE6B8pFm8kQEEOFoY-Ht4hPmF-UAFDIjRbYADOIJ1G_ibGHgahjk6WRq4GnkHm5oamMDMhujGLY_f7nCQX_G7HWw_btf5eeTnpuoX5IaGRhhkmQAAoYKgoA!!/dl3/d3/L2dJQSEvUUt3QS9ZQnZ3LzZfS000MjZOMDcxT1RVODBJN0o2MTJQRDMwODQ!/?project=42387&exp=overview) of stands affected by both spruce beetles and SAD. Large areas of impacted aspens are likely to be harvested or otherwise treated in the next decade in an attempt to both salvage usable wood and regenerate younger stands which may not come back through natural regeneration in these types of events. This will likely result in decreases in available habitat in the short term, with regeneration of suitable habitat in the long term.

# Monitoring

## Local

Some monitoring of this species has occurred within the GMUG in the past ten years.

Table 2. Breeding Bird monitoring detections on the Norwood Ranger District, excluding BBS routes.

| Habitat | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aspen (Lone Cone-Beaver Park) | N/A | 0 | 3 | 0 | 1 | N/A | 2 | 0 | 1 | 0 | 7 |
| Spruce-Fir (Columbine-Divide Road) | 1 | N/A | 0 | 2 | 2 | 0 | 0 | 1 | 1 | 0 | 7 |
| Ponderosa (Burn Canyon) | N/A | N/A | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Ponderosa (Craig Point) | N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

Little targeted monitoring occurred on the Paonia and Grand Valley districts. However, nest sites were documented as they were discovered, and this data may eventually help in refining habitat models in these areas.

## Rocky Mountain Bird Observatory

As noted in the 2005 assessment, much of the trend monitoring expected to be used for this species was predicated upon the Rocky Mountain Bird Observatory continuing the Monitoring Colorado Birds (MCB) program. However, this program was stopped after the 2007 field season (Blakesley and Hanni 2009), only two years after the initial assessment. RMBO then replaced it with the Integrated Monitoring in Bird Conservation Regions (IMBCR) protocol in 2008, which allows for population estimates at a variety of scales, and is more compatible with occupancy modeling of rare or difficult-to-detect species (RMBO 2014). This results in comparison of data sets from two different monitoring programs in order to detect changes in populations and trends within the GMUG and surrounding conservation region. Data was accessed on 1/14/2014 and 3/12/2014 (RMBO 2014a). During 2008-2013, IMBCR data was collected at a total of 43 sites/transects on or near the GMUG (Table 3).

Table 3. IMBCR data from the GMUG, 2009-2013.

| Year | # of transects | # transects w/detections | # of detections | Est population | Est density (birds per km$^2$) |
|---|---|---|---|---|---|
| 2009 | 10 | 4 | 6 | 45454 | 3.34 |
| 2010 | 9 | 2 | 5 | 52381 | 3.84 |
| 2011 | 11 | 4 | 4 | 23504 | 1.72 |
| 2012 | 10 | 2 | 3 | 17793 | 1.31 |
| 2013 | 34* | 5 | 9 | 14744 | 1.08 |
| Total | 43 | 11 | 27 | | |

*additional transects were done for Colorado Parks and Wildlife starting in 2013.

Table 4 shows similar data for the entire Bird Conservation Region, which includes much of western Colorado, northwestern New Mexico, northeastern Arizona, eastern Utah, and southwest Wyoming.

Table 4. IMBCR red-naped sapsucker results from Bird Conservation Region 16, 2008-2013.

| Year | Estimated population | Estimated density (birds per $km^2$) |
|---|---|---|
| 2008 | 145375 | .99 |
| 2009 | 141786 | .97 |
| 2010 | 265333 | 1.81 |
| 2011 | 170109 | 1.16 |
| 2012 | 114113 | .52 |
| 2013 | 205509 | 1.17 |

The data shown above is difficult to compare to MCB data reported in the 2005 assessment, as the IMBCR data is not stratified by habitat type and was collected using different protocols. In that document, MCB density estimates were reported from .08 birds per hectare in lodgepole to .602 birds per hectare in high elevation riparian habitats. Aspen values ranged from .040 to .314, an eightfold range. However, using a value of .08 in lodgepole as a value for calculating moderate habitat density, and .20 as an approximation of aspen/riparian high quality habitat density, a population estimate of 52,500 birds in those two habitat types on the GMUG is comparable to the values described above. It should be noted that all of the data, both MCB and IMBCR, is based upon very low numbers of detected birds (less than ten per year for IMBCR) and as such has large margins of error. Both data sets show wide swings from year to year, which may not reflect actual population changes or species densities. It is hoped that continuation of the IMBCR protocol over several more years will be more useful in showing trends.

## Partners in Flight (PIF) Population Estimates Database

The Rocky Mountain Bird observatory website also provides links to population (Partners in Flight Science Committee 2013) and assessment (Partners in Flight Science Committee 2012) data from Partners In Flight, which is a cooperative venture related to bird conservation. Table 5 summarizes the estimated population data for the species.

Table 5. Estimated Red-Naped Sapsucker Populations at Varying Scales from PIF Data.

| Year | Global (all in North America) | United States | Bird Conservation Region 16 | State of Colorado | BCR 16 within Colorado |
|---|---|---|---|---|---|
| 2004 | 2,200,000 | 809,500 | 200,000 | 95,000 | 90,000 |
| 2013 | 2,000,000 | 1,000,000 | 300,000 | 150,000 | 150,000 |

The above data also indicate that the species occurs on the GMUG (see RMBO data above) at about the overall density of the species across its entire range (2.07 million kilometers according to PIF). Globally, this data shows a decline in the species of approximately 9% in the preceding decade, which contradicts US Geological Survey Breeding Bird Survey (BBS) data showing upward trends at the survey-wide scale in approximately the same time frames. However, data from both Colorado and BCR 16 show increases consistent with other data sets.

Partners In Flight also provides assessment of the status of the species at various scales. Table 6 below shows current assessment and some measures from the time of the previous assessment of this species. Descriptions are simplified for inclusion in the table. Complete descriptions may be found in Panjabi et al 2012.

Table 6. Factors Included in PIF Species Assessment for the Red-naped Sapsucker, and Assigned Values.

| **Category** | **2005 status** | **2012 status** | **Comments** |
|---|---|---|---|
| Population size (global) | 0.5 to 5 million | 0.5 to 5 million | See Table 5 |
| Breeding distribution (global) | 0.3 to 1 million $km^2$ | 1 to 4 million $km^2$ | Shows increase |
| Nonbreeding distribution (global) | N/A | 1 to 4 million $km^2$ | |
| Threats to Breeding | Slight to moderate decline expected | Slight to moderate decline expected | See details in habitat section |
| Threats to Nonbreeding | N/A | Slight to moderate decline expected | See details in habitat section |
| Population Trend (global) | N/A | Stable to small significant increase | See Tables 5 and 7 |
| Population Trend (regional) | Uncertain, stable, or small decrease | Significant large increase | See Tables 5 and 7 |
| Regional Breeding Density | Breeds in moderate mean abundance relative to the region(s) in which the species occurs in maximum density. | Breeds in moderately high mean abundance relative to the region(s) in which the species occurs in maximum density | Shows increase |

## USGS Breeding Bird Survey Monitoring Data

A second monitoring effort occurs on the GMUG, as part of the US Geological Survey's Breeding Bird Survey (BBS) program (Sauer, et al 2014). Table 4 in the 2005 assessment showed trend data for sapsuckers at 4 scales. Table 7 below shows those same population trends extended to the most recent year's data.

Table 7. Most Recent BBS Data for Red-Naped Sapsucker at Multiple Spatial Scales.

| **Location** | **1966-2012 Trend** | **95% CI** | **# routes** | **2000-2012 Trend** | **95% CI** | **RA** |
|---|---|---|---|---|---|---|
| Survey-Wide | 1.41 | 0.48-2.32 | 383 | 2.49 | -0.42-5.68 | 1.0 |
| Western BBS Region | 1.30 | 0.37-2.23 | 359 | 2.56 | -0.51-5.95 | 1.1 |
| Colorado | 2.96 | 1.49-4.61 | 67 | 3.16 | -1.08-7.68 | 0.7 |
| Southern Rockies | 2.36 | 1.08-3.67 | 110 | 2.22 | -1.27-5.79 | 0.4 |

The trends, while firmly positive, appear much lower than those for the periods ending in 2005. However, the 2005 data is actually for a suite of three sapsuckers (*S. nuchalis*, the red-breasted sapsucker *S. rubis*, and the yellow-bellied sapsucker *S. varius*), which mask the individual species' data.

Figure 1. Colorado Population Trend for the Red-Naped Sapsucker from BBS data.

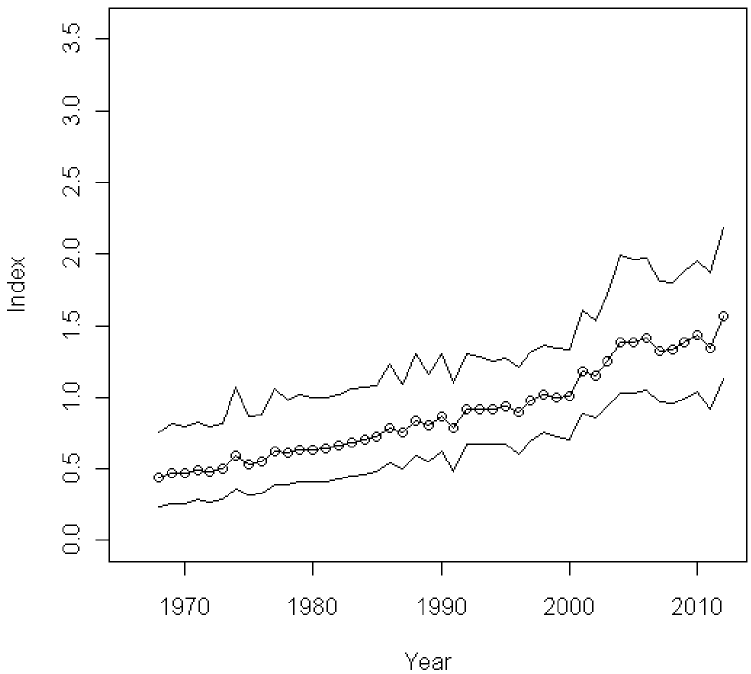
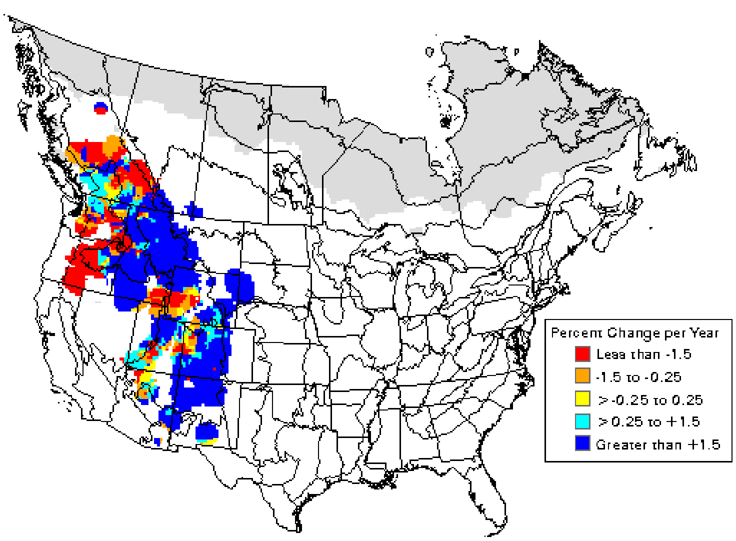



Figure 2 below shows the trend for the red-naped sapsucker spatially across its range. The GMUG is in an area with both positive and negative trends. Much of Colorado shows a highly positive trend, which is reflected in figure 1 above.



Fourteen BBS routes cross the GMUG  (Figure 3).  Data for nine of those routes to 2004 was shown in Table 5 and Figure 3 from the 2005 assessment.  The most recent data is presented in Table 8.  There is one route (Lake City 2) which appears to be recently changed but whose data for the new location are not available for the included time frame.  Individual route counts and trends are only available through 2011 as of the date of this assessment.

Figure 3.  Current (2013) Breeding Bird Survey Routes on the GMUG.

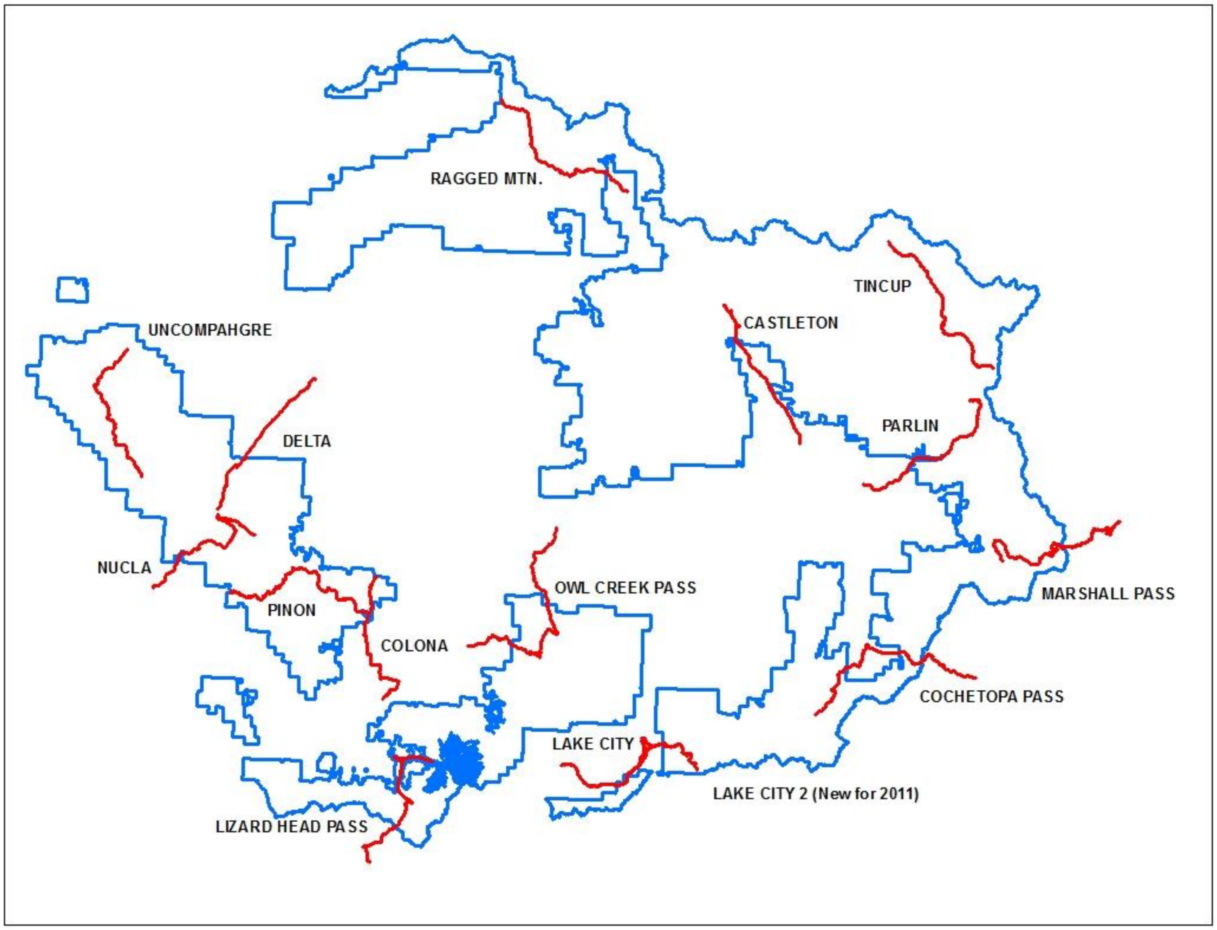
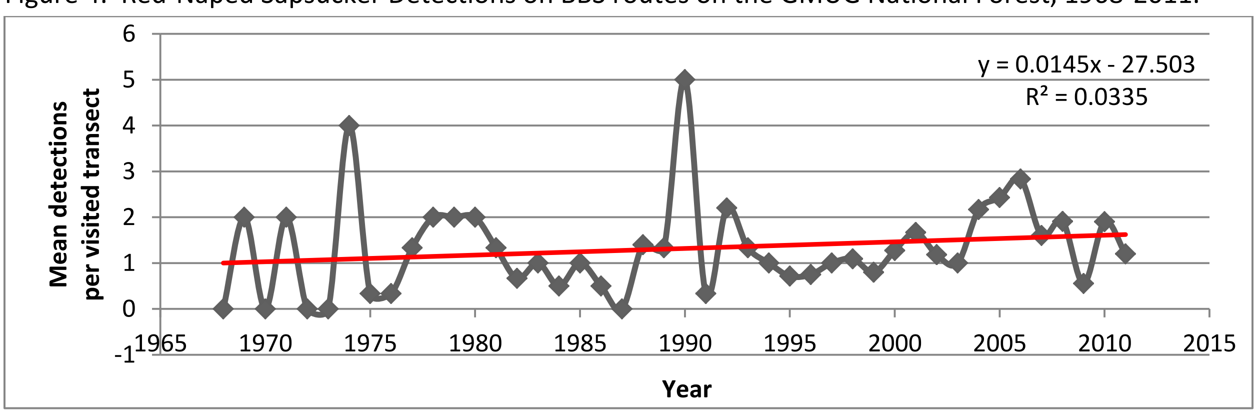


Table 8. Breeding Bird Survey Data for the Red-Naped Sapsucker on the GMUG.

| Geographic Area | Route Name | 1966-2011 Trend | P value | # Years Surveyed | Variance | Average Count per Year | Total Count for all Years |
|---|---|---|---|---|---|---|---|
| North Fork Valley / Grand Mesa | Ragged Mountain | 6.62 | 0.32147 | 18 | 6.6735 | 0.89 | |
| Uncompahgre Plateau | Colona | -0.11 | 0.97331 | 38 | 3.3259 | 1.95 | 74 |
| | Delta | -5.19 | 0.21269 | 26 | 4.1635 | 0.27 | 7 |
| | Uncompahgre | 3.67 | 0.46013 | 13 | 4.9716 | 2.23 | 29 |
| | Pinon | 1.48 | 0.88007 | 11 | 9.7974 | 2.27 | 25 |
| | Nucla | 16.46 | 0.54831 | 10 | 27.4255 | 0.60 | 6 |
| Gunnison Basin | Castleton | 3.23 | 0.61017 | 18 | 6.3334 | 2.28 | 41 |
| | Parlin | 3.5 | 0.32533 | 33 | 3.5542 | 1.67 | 55 |
| | Marshall Pass | 55.22 | 0.36071 | 12 | 60.4134 | 0.75 | 9 |
| | Tincup | 4.66 | 0.78010 | 14 | 16.7074 | 0.86 | 12 |
| | Cochetopa Pass | 8.33 | 0.31679 | 14 | 8.3202 | 1.50 | 21 |
| San Juan Mountains | Lake City | -19.16 | 0.24641 | 5 | 16.5312 | 1.40 | 7 |
| | Owl Creek Pass | 17.47 | 0.22059 | 11 | 14.2595 | 1.73 | 19 |
| | Lizard Head Pass | 42.43 | 0.47481 | 9 | 59.3765 | 0.56 | 5 |

The above data is based upon very small numbers of detections, so changes of even a few birds in counts result in large changes in trend data. Therefore, the above data should be used with caution as a tool to determine effects of management on the species on the Forest. Data at even the state level for this species is flagged by the USGS as a result of the low detection rates. When the above data is analyzed as mean detections per surveyed route (Figure 4), a semblance of trend data can be shown, with a slightly upward trend over time. Trend data presented above is calculated by the USGS, while the line shown in Figure 4 is a linear regression of the raw data presented above.

Figure 4. Red-Naped Sapsucker Detections on BBS routes on the GMUG National Forest, 1968-2011.



## Items of Note in Recent Published Literature Regarding the Red-Naped Sapucker and its Habitat

Aspen mortality and ecology studies on the Uncompahgre Plateau, as well as others across the western U.S. (especially Strand et al 2009) show a potential for significant habitat loss which would directly impact this species in the long term. Mortality from SAD, and its combination of factors, appears to have substantially changed the aspen landscape in western Colorado over the previous several years, directly reducing the availability of live trees for nesting over wide areas. Other tree diseases also cause direct and indirect effects to aspen and its availability for nesting. Sapsuckers may in fact benefit from outbreaks of insects in other tree species. Edworthy et al (2011) documented a substantial increase in abundance of sapsuckers that correlated with a pine bark beetle outbreak in British Columbia, during which the species maintained reproductive rates at pre-outbreak levels. This may be especially important in secondary habitats, such as lodgepole, on the GMUG and surrounding forests, which are showing similar outbreaks.

Red-naped sapsuckers are primary cavity-nesters, meaning that they are the ones which excavate the cavities they use for nesting. In aspen, those trees used by the species typically are infected with a heartwood rot fungus (*Phellinus tremulae*) which softens the heartwood of the infected tree, making excavation easier. Witt (2010) described characteristics of aspen infected with heart rot in regards to cavity-nesting birds, including the sapsucker, using Forest Inventory Analysis data from across the western US. He found that infected trees tended to be both larger and older than non-infected trees. Mean age of infected plots was also greater than uninfected plots. Hollenbeck, et al (2007 in a comparative study of aspen stands inside and outside of Yellowstone National Park, ) showed that while the stands inside the park were older and larger, with a greater abundance of larger snags, sapsucker mean abundance was equal both inside and outside the park.

Witt also determined that approximately 11% of aspen was infected with heart rot fungus, which could be used to provide a rough index of potential nest tree availability, and implies that availability of individual potential nest trees far exceeds the needs of this relatively low density species.

Losin et al (2006) studied the relationship between the heartwood rot and the location of cavities in aspen used by red-naped sapsuckers. His results indicate that cavity location was significantly biased towards the south-southeast. Trees with cavities had thinner healthy sapwood than trees without cavities which were infected with the fungus. Southern sides of infected trees showed the thinnest healthy sapwood, as well. These findings suggest that the nest site selection may be influenced by the depth of healthy sapwood through which birds must excavate to reach softer wood, with the resultant energetic savings.

Sadoti (2006) found a significant correlation between cavity orientation and nest productivity. Cavities in the half of the tree oriented to the south-southeast produced on average one more fledgling per nest than cavities in the other half of the tree. Sapsuckers also produced more chicks in nests in live trees (3.2 +/- 0.2) than in dead trees (1.7 +/- 0.7). Wiebe et al (2007) reviewed literature to determine cost-benefits of nest reuse versus new excavation for birds, and found a slight but significant increase in clutch size in re-used nests versus new excavation for the sapsucker.

## Recommendations

At the Forest scale, the sapsucker appears to be increasing over the long term, although data to support this is limited. At smaller scales, the bird appears to be in downward trends on the Uncompahgre Plateau and northern San Juan Mountains, as well as showing a recent short term decrease across the Forest. At larger scales, the species is increasing and continues to do so, although there are threats to its breeding habitat due to changes in aspen ecology from climate and associated insects and disease. Timber harvest and other direct management activities appear to play a very minor role at the Forest scale on this species and its habitat, although individual projects do impact habitat at individual home range scales. One way to more closely track direct and indirect impacts to this species would be to annually collect all known habitat change data (such as acres of aspen harvest) from project records, and maintain a database thereof.

Monitoring data is necessary in determining trends of species, and it is especially important in low-density species such as this, where trends can easily be masked by already low numbers and random chance. Additional time on existing monitoring efforts such as IMBCR and BBS will continue to be valuable. Ensuring that local monitoring within these programs continues is essential to accurately tracking this species at such a small scale. Additional monitoring transects/sites within the two programs would also be useful . Additional research on nest site selection and associated stand characteristics would be valuable as well, and may be undertaken by the Forest as individual nest trees are located during district or project-level monitoring and survey efforts, and data accumulated in a central location for analysis.

Additional monitoring in spruce-fir types with included aspen may help determine whether the species is more widely using such habitats (as indicated by the Norwood monitoring data). Increasing quality control of the vegetation layer combined with measurements of stand characteristics around known nest locations will also improve understanding of this and may influence future habitat modeling.

If the Forest wishes populations to remain stable, efforts to replace aspen stands that are dying and losing utility for the species may need to occur at large scales and long time frames. Such efforts may be less useful if climate change factors continue to push aspen to higher elevations and reduce available acreage. Continued presence of fire on the landscape may also contribute to renewed aspen stand vigor in many locations. Where fire is inappropriate, large-scale salvage or mechanical treatments of dead and dying stands may, while having short-term negative impacts as nest sites are lost, result in longer-term benefits as younger stands grow to maturity. Healthy mature stands, however, which appear to be suitable for the species and self-regenerating, should be maintained intact. Where possible, current management guidelines for this species should be maintained, in the absence of research indicating such management is inappropriate. Additionally, if aspen habitat continues to decline due to conifer encroachment, removal of conifers may need to be considered, although this may conflict with current and future management of other species, such as the Canada lynx.

## References


Alsanoisi, A.A.M. 2012. Aspen Forests on the Uncompahgre Plateau: Current and Future Expectations. Master's Thesis. Colorado State University. http://digitool.library.colostate.edu///exlibris/dtl/d3_1/apache_media/L2V4bGlicmlzL2R0bC9kM18xL2FwYWNoZV9tZWRpYS8xODg0MTU=.pdf

Blakesley, J.D. and D.J. Hanni. 2009. Monitoring Colorado's Birds, 2008. Tech. Rep. M-MCB08-01. Rocky Mountain Bird Observatory, Brighton, CO. 39 pp. http://rmbo.org/v3/Portals/0/Documents/Science/2008/MCB_Report_2008_FINAL_v4.pdf

Blancher, P. J., K. V. Rosenberg, A. O. Panjabi, B. Altman, J. Bart, C. J. Beardmore, G. S. Butcher, D. Demarest, R. Dettmers, E. H. Dunn, W. Easton, W. C. Hunter, E. E. Iñigo-Elias, D. N. Pashley, C. J. Ralph, T. D. Rich, C. M. Rustay, J. M. Ruth, and T. C. Will. 2007. Guide to the Partners in Flight Population Estimates Database. Version: North American Landbird Conservation Plan 2004. Partners in Flight Technical Series No 5. http://www.partnersinflight.org/

Edworthy, A.B., M.C. Drever, and K. Martin. 2011. Woodpeckers Increase in Abundance but Maintain Fecundity in Response to an Outbreak of Mountain Pine Bark Beetles. Forest Ecology and Management 261 (2011) 203-210. http://www.sciencedirect.com/science/article/pii/S0378112710006079

Hollenbeck, J.P. and W.J. Ripple. Aspen Sang Dynamics, Cavity-Nesting Birds, and Trophic Cascades in Yellowstone's Northern Range. 2008. Forest Ecology and Management 255 (2008) 1095-1103. http://www.sciencedirect.com/science/article/pii/S0378112707007992

Kulakowski, D., T.T. Veblen, and S. Drinkwater. 2004. The Persistence of Quaking Aspen (*Populus tremuloides*) in the Grand Mesa Area, Colorado. Ecological Applications 14(5) 2004, 1603-1614. http://www.esajournals.org/doi/pdf/10.1890/03-5160

Losin, N., CH Floyd, TE Schweitzer, and SJ Keller. 2006. Relationship between Aspen Heartwood Rot and the Location of Cavity Excavation by a Primary Cavity-Nester, the Red-Naped Sapsucker. *The Condor* , Vol. 108, No. 3 (Aug., 2006) , pp. 706-710. http://www.jstor.org/stable/4151090

Morelli, Toni Lyn; Carr, Susan C. 2011. A Review of the Potential Effects of Climate Change on Quaking Aspen (*Populus tremuloides*) in The Western United States and a New Tool for Surveying Sudden Aspen Decline. Gen. Tech. Rep. PSW-GTR-235. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 31 p. http://www.fs.fed.us/psw/publications/documents/psw_gtr235/psw_gtr235.pdf

Panjabi, A. O., P. J. Blancher, R. Dettmers, and K. V. Rosenberg, Version 2012. Partners in Flight Technical Series No. 3. Rocky Mountain Bird Observatory website: http://www.rmbo.org/pubs/downloads/Handbook2012.pdf

Partners in Flight Science Committee 2013. Population Estimates Database, version 2013. Available at http://rmbo.org/pifpopestimates . Accessed on 03/17/2014.

Partners in Flight Science Committee 2012. Species Assessment Database, version 2012. Available at http://rmbo.org/pifassessment . Accessed on 03.17/2014.

Rocky Mountain Bird Observatory 2014. http://rmbo.org/v3/OurWork/Science_/BirdPopulationMonitoring/StatePrograms/Colorado.aspx

Rocky Mountain Bird Observatory, 2014a. Rocky Mountain Bird Observatory Data Center. http://rmbo.org/v3/avian/Home.aspx Accessed 01/14/2014 and 03/12-17/2014.

Sadoti, G. and K.T. Vierling. Nonideal Habitat Selection by a North American Cavity Excavator: Pecking up the Wrong Tree? Canadian Journal of Zoology, 2010, 88(6): 527-535. http://www.nrcresearchpress.com/doi/full/10.1139/Z10-025

Sauer, J. R., J. E. Hines, J. E. Fallon, K. L. Pardieck, D. J. Ziolkowski, Jr., and W. A. Link. 2014. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2012. Version 02.19.2014 USGS Patuxent Wildlife Research Center, Laurel, MD.* Accessed 01/14, 03/14 and 03/17/2014.

Smith, A.E. and F.W. Smith. 2005. Twenty-Year Change in Aspen Dominance in Pure Aspen and Mixed Aspen-Conifer Stands on the Uncompahgre Plateau, Colorado, USA. Forest Ecology and Management 213 (2005) 338-348. http://www.sciencedirect.com/science/article/pii/S037811270500215X

Strand, E.K., L.A. Verling, S.C. Bunting, and P.E. Gessler. 2009. Quantifying Successional Rates in Western Aspen Woodlands: Current Conditions, Future Predictions. Forest Ecology and Management 257 (2009) 1705-1715. http://www.sciencedirect.com/science/article/pii/S037811270900053X

Vasquez, M. 2005. Red-Naped Sapsucker (*Sphyrapicus nuchalis*) Species Assessment Draft. Grand Mesa, Uncompahgre, and Gunnison National Forest. Delta, Colorado. http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5199831.pdf

Wiebe, K. L., W. D. Koenig, and K. Martin. 2007. Costs and Benefits of Nest Reuse versus Excavation in Cavity-Nesting Birds. Annales Zoologici Fennici, v. 44, no. 3, p. 209-217. http://www.annzool.net/PDF/anzf44/anzf44-209.pdf

Witt, C. 2010. Characteristics of Aspen Infected with Heartrot: Implications for Cavity-Nesting Birds. Forest Ecology and Management 260 (2010) 1010-1016. http://www.sciencedirect.com/science/article/pii/S0378112710003567

Worrall, J. J., L. Egeland, T. Eager, R.A. Mask, E.W. Johnson, P.A. Kemp, and W.D. Shepperd. 2008. Rapid Mortality of Populus Tremuloides in Southwestern Colorado, USA. Forest Ecology and Management 255 (2008) 686-696. http://www.fs.fed.us/rm/pubs_other/rmrs_2008_worrall_j001.pdf

Worral, J.J., S. Marchetti, L. Egeland, R.A. Mask, T. Eager, and B. Howell. 2010. Effects and Etiology of Sudden Aspen Decline in Southwestern Colorado, USA. Forest Ecology and Management 260 (2010) 638-648. http://www.sciencedirect.com/science/article/pii/S037811271000277X

# Appendix 1. Red-Naped Sapsucker Habitat Suitability Model 2014

Below is the table from the 2005 assessment (Vasquez, 2005) showing how habitat was delineated in that document. This table was the basis for the 2014 habitat model described below.

| Habitat Parameter | Primary Habitat | Secondary Habitat | |
|---|---|---|---|
| | High Quality | Marginal Quality | Low Quality |
| Summer Cover and Nesting | • Aspen<br>➢ 4a, 4b, 4c<br><br>• Cottonwood<br>➢ 4a, 4b, 4c<br><br>• Willow Cover type if mature aspen or cottonwood is adjacent to willow dominated areas | • Aspen<br>➢ 3a, 3b, 3c<br><br>▪ Cottonwood<br>➢ 3a, 3b, 3c<br><br>• Douglas-fir w/aspen in the species mix<br>➢ 4a, 4b, 4c<br><br>• Lodgepole Pine w/aspen in the species mix<br>➢ 4a, 4b, 4c<br><br>• Ponderosa Pine w/aspen in the species mix<br>➢ 4b, 4c<br><br>• Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas | • Douglas-fir w/aspen in the species mix<br>➢ 3a, 3b, 3c<br><br>• Lodgepole Pine w/aspen in the species mix<br>➢ 3a, 3b, 3c<br><br>• Ponderosa Pine w/aspen in the species mix<br>➢ 3a, 3b, 3c, 4a |
| Summer Feeding | • Aspen<br>➢ 3a, 3b, 3c, 4a, 4b, 4c<br><br>• Cottonwood<br>➢ 3a, 3b, 3c, 4a, 4b, 4c<br><br>• Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas | • Douglas-fir<br>➢ 3a, 3b, 3c, 4a, 4b, 4c<br><br>• Lodgepole Pine<br>➢ 3a, 3b, 3c, 4a, 4b, 4c<br><br>• Ponderosa Pine<br>➢ 3a, 3b, 3c, 4a, 4b, 4c<br><br>• Willow cover type if any of the above cover types and structural stages are adjacent to willow dominated areas | |

The FSVEG_Spatial GIS layer as of February 12, 2104, was used as the base layer upon which the model was run. A copy of that layer from that date will be included in the electronic file for this project, along with this document. The exact syntax for the GIS queries will not be used here. The entire query was not done as one, in order to more easily pick components from the above table and attribute them, which also allowed tracking of amounts of individual types through the process to help determine changes from 2005 values.

Two additional fields were added to the GIS layer, one for summer cover and nesting habitat, and one for summer feeding habitat, and attributed appropriately based on the queries below.

## Primary Habitat (High)

The vegetation layer was queried for Cover Type = TAA or TCW, and Habitat Structural Stage = 4a, 4b, or 4c. The resulting selected polygons were attributed as “High” for summer cover and nesting, and “High” for summer feeding.

The vegetation layer was queried for all Cover Type = SWI polygons which were adjacent to the above polygons of TAA and TCW size 4. Adjacent in this case means that the polygons were actually touching the TAA or TCW polygons. The resulting selected polygons were attributed as “High” for summer cover and nesting, and “High” for summer feeding.

## Secondary Habitat (Medium)

The vegetation layer was queried for all Cover Type = TAA or TCW and Habitat Structural Stage = 3a, 3b, or 3c. The resulting selected polygons were attributed as “Moderate” for summer cover and nesting, and “High” for summer feeding.

The vegetation layer was queried for all Cover Type = SWI polygons which were adjacent to any of the above polygons of TAA or TCW size class 3. The resulting selected polygons were attributed as “Moderate” for summer cover and nesting, and “High” for summer feeding.

The vegetation layer was queried for all Cover Type = TDF or TLP, of Habitat Structural Stage = 4a, 4b, or 4c, and for aspen percentage (AA_pct) greater than zero. The resulting selected polygons were attributed as “Moderate” for summer cover and nesting and “Moderate” for summer feeding.

The vegetation layer was queried for all Cover Type = TPP, of Habitat Structural Stages 4b and 4c, with AA_pct greater than zero. The resulting selected polygons were attributed as “Moderate” for summer cover and nesting and “Moderate” for summer feeding.

The vegetation layer was queried for all Cover Type = SWI polygons which were adjacent to the above polygons of TDF, TLP, and TPP. Adjacent in this case means that the polygons were actually touching the TAA or TCW polygons. The resulting selected polygons were attributed as “Moderate” for summer cover and nesting and “Moderate” for summer feeding.

## Secondary habitat (Low)

The vegetation layer was queried for Cover Type = TDF and TLP where Habitat Structural Stage = 3a, 3b, or 3c. The resulting selected polygons were attributed as “Low” for summer cover and nesting, and “Moderate” for summer feeding.

The vegetation layer was queried for Cover Type = TPP where Habitat Structural Stage = 3a, 3b, 3c, and 4a. The resulting selected polygons were attributed as “Low” for summer cover and nesting, and “Moderate” for summer feeding.

The vegetation layer was queried for all Cover Type = SWI polygons which were adjacent to the above polygons of TDF, TLP, and TPP. Adjacent in this case means that the polygons were actually touching the attributed polygons. The resulting selected polygons were attributed as “Moderate” for summer feeding.

## Comparison with 2005 data

The 2005 data included a shapefile of the vegetation layer attributed with the 2005 sapsucker habitat values for each polygon. However, the 2005 layer lacked the original basic vegetation data itself, such as cover type, habitat structural stage, and so on. In order to compare the two data sets to determine changes, the two layers were combined, so that spatially, any polygon would then have the 2014 value in an attribute field, as well as the 2005 value. Where polygon boundaries had changed, the combining split polygons as necessary so that each layer’s attributes were applied spatially to the areas represented in each layer. Data comparisons (Appendix 2) were then done from this combined layer. This combined layer is stored in the electronic files for this project.

# Appendix 2.  Description of Habitat Changes in Vegetation Data, 2005 to 2014

This data is based upon the attributes of the combined vegetation layer as described in Appendix 1 and present in the project file.  These tables were developed in Excel, and the source tables are also present in the electronic file for this project.  Values are rounded to the nearest whole acre.

## Changes to High Quality Habitat

| | | | |
|---|---|---|---|
| High summer cover changes | | to moderate habitat type | |
| Cover type | Habitat structural stages | acres | explanation |
| SWI | 2S | 9593 | 2014 model defines adjacency as a connecting polygon.  2005 model parameter not found. |
| TAA | 3ABC | 4199 | All currently typed as size class 3 TDF |
| TDF | 4ABC | 267 | Currently typed as TDF size class 4 with TAA in species mix |
| TLP | 4ABC | 394 | Currently typed as TLP size class 4 with TAA in species mix |
| TPP | 4BC | 2330 | Currently typed as 4B or 4C with TAA in species mix |
| | | | |
| total | | 16783 | |
| | | | |
| | | | |
| | | to low habitat types | |
| Cover type | Habitat structural stages | acres | explanation |
| TDF | 3ABC | 3 | Currently typed as TDF size class 3 with TAA in species mix |
| TLP | 3ABC | 414 | Currently typed as TLP size class 3 with TAA in species mix |
| TPP | 3ABC or 4A | 88 | Currently typed as TPP size class 3 or HSS 4A with TAA in species mix |
| | | | |
| total | | 505 | |
| | | | |
| | | | |
| | | to nonhabitat types | |
| Cover type | Habitat structural stages | acres | explanation |
| Grass/Forbs | 1 | 1298 | Currently typed as grass or forb types.  May contain scattered aspen or willow. |
| NBA | 0 | 46 | Currently typed as bare ground. |

| | | | |
|---|---|---|---|
| Shrubs | 2S | 1388 | non-willow shrub types including oak, snowberry, sage, etc. May or may not have willow present. |
| SWI | 2S | 4 | Willow type. May no longer be adjacent to high quality TAA or TCW polygon due to changes in those polygons. |
| TAA | 2T | 4605 | Aspen regen from harvest or other disturbance. |
| TBC | | 57 | Bristlecone pine. Not included as habitat in model. |
| TBS | | 316 | Blue spruce, which may include a willow understory along stream courses but does not have willow in the attributes of the vegetation layer. |
| TDF | | 13 | Does not show TAA as a component |
| TGO | | 1 | Not habitat |
| TLP | | 47 | Does not show TAA as a component |
| TPP | | 131 | Does not show TAA as a component |
| TSF | | 2577 | Spruce-fir, not typed as suitable. See text. |
| | | | 65 acres with 0 TAA |
| | | | 175 acres with 1-10% TAA |
| | | | 879 acres with 11-20% TAA |
| | | | 1436 acres with 21-30% TAA |
| | | | 22 acres with 30-40% TAA |
| WAT | | 10 | |
| | | | |
| total | | 10493 | |

## Changes to Moderate Quality Habitat

| Moderate summer cover changes | | to high habitat type | |
|---|---|---|---|
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| SWI | 2S | 24 | Presumably adjacent to TAA or TCW polygons that increased from moderate to high value |
| TAA | 4ABC | 4921 | TAA size class 4, presumably increased from 3 in previous model |
| TCW | 4A | 30 | TCW size class 4, presumably increased from 3 in previous model |
| | | | |
| total | | 4975 | |
| | | | |
| | | | |

| Moderate summer cover changes | | to low habitat type | |
|---|---|---|---|
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| TDF | 3AB | 32 | Shows no TAA as a component of stand |
| TLP | 3ABC | 841 | Shows no TAA as a component of stand |
| TPP | 3ABC, 4A | 766 | Shows no TAA as a component of stand |
| | | | |
| total | | 1639 | |
| | | | |
| | | | |
| Moderate summer cover changes | | to non habitat type | |
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| grass/forbs | 1 | 917 | |
| NBA | | 1 | bare ground |
| NRK | | 3 | rock |
| nonwillow shrubs | 2s | 581 | |
| willow | 2s | 5942 | presumably adjacent to other polygons that decreased to low or nonhabitat values |
| TAA | 2T | 102 | TAA regen, presumably harvested or burned |
| TBC | | 226 | Bristlecone pine, not in the model as suitable habitat |
| TBS | | 177 | Blue spruce, not in the model. May contain aspen, willow not indicated in attributes. |
| TDF | 3,4 | 14641 | Shows no TAA as a component of stand |
| TGO | | <1 | Not suitable habitat |
| TLP | 2,3,4 | 58432 | Shows no TAA as a component of stand |
| TPJ | | 29 | Not suitable habitat |
| TPP | 2,3,4 | 1681 | shows no TAA as a component of stand except in 2T stands (regen) which are too small to be suitable |
| TSF | 2,3,4 | 3842 | Spruce-fir, not typed as suitable. See text. |
| | | | 923 acres 0% TAA |
| | | | 1454 acres 1-10% TAA |
| | | | 1174 acres 11-20% TAA |
| | | | 282 acres 21-30% TAA |
| | | | 9 acres 31-40% TAA |
| WAT | | <1 | |
| Total | | 86574 | |

## Changes to Low Quality Habitat

| | | | |
|---|---|---|---|
| Low summer cover changes | | to high habitat type | |
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| SWI | 2S | <1 | likely a sliver polygon from redrawing |
| TAA | 4ABC | 293 | TAA size class 4 in current layer |
| | | | |
| total | | 293 | |
| | | | |
| | | | |
| | | | |
| Low summer cover changes | | to moderate habitat type | |
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| TAA | 3ABC | 1491 | TAA size class 3 in current vegetation layer |
| TDF | 4AB | 54 | Showing TAA component in stands |
| TLP | 4ABC | 274 | Showing TAA component in stands |
| TPP | 4BC | 384 | Showing TAA component in stands |
| | | | |
| total | | 2203 | |
| | | | |
| | | | |
| Low summer cover changes | | to non habitat type | |
| Cover type | Habitat structural stages | acres | explanation |
| | | | |
| grass/forbs | 1 | 158 | |
| NRK | | 2 | rock |
| shrubs except for willow | 2S | 11 | |
| SWI | | <1 | |
| TBC | | 239 | Bristlecone pine, not in model as suitable habitat |
| TBS | | 215 | Blue spruce, may contain aspen, no willow in attributes |
| TDF | 3,4 | 339 | no TAA in species mix |
| TLP | 2,3,4 | 2884 | no TAA in species mix except in 2T regen stands |
| TPJ | | 3 | not suitable habitat |
| TPP | 3,4 | 424 | no TAA in species mix |
| TSF | 3,4 | 602 | Not in model as suitable habitat |
| | | | |

| | | | |
|---|---|---|---|
| Total | | 4877 | |