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The Effects of Declining Aspen Forest Health on Rocky Mountain Birds

Abstract:

Aspen trees are a vital part of ecosystems in North America, including Southwestern Colorado. With climate change occurring at a rapid rate over recent years (Worrall et. al. 2008), sudden aspen decline (SAD) has taken place, likely impacting many species utilizing aspens. Bird species that require aspen for nesting or foraging are likely to be impacted. This study therefore assesses the effect that declining aspen forests is having on avian conservation and species composition. Sound recorders were used to record bird species' presence/absence at a total of 11 sites in the East River Valley in Colorado. Data was collected from 5-9 AM during the month of July. Forest health data was also collected, including recording the health of the 10 closest trees to the central tree (where recorders were placed) by a visual assessment, along with capturing an image of the canopy above the central tree, which was visually analyzed and classified as low, medium, or high density canopy. These data were analyzed in R using linear mixed models to determine the effect of canopy status and number of dead trees on Total Avian Conservation Value (mean Conservation Concern Score for present species) (Partners in Flight 2017), and nonmetric multidimensional scaling to visualize species compositions by site. The results showed that there is no effect of canopy status and number of dead trees on Total Avian Conservation Value. Also, results showed that species composition is affected by forest health. Specifically, cavity nesters favor low/medium density canopies. Thus, bird conservation is not immediately being affected by SAD due to the varying species' nesting preferences favoring a gradient of forest health, and no one variant of forest health being more prevalent than the other. This is evidenced by an insignificant change in TACV among sites with varying health. It is possible, however, that with sudden aspen decline taking place, bird composition will change based on my results, favoring cavity nesters who prefer more unhealthy, dead stands. Further, long-term studies should be conducted to determine how bird conservation and composition are being affected by SAD over time.

1.0 Introduction:

Climate change has been changing ecosystems and affecting species globally in recent decades (Munson). One driver of this change is drought, which comes from higher temperatures and the changing atmosphere. In Colorado, drought is being seen firsthand this year with snow melting faster than in previous years (Munson) and species changing their behaviors. Drought has had impact on aspen trees (*Populus tremuloides*) in Southwestern Colorado with mortality increasing from 7–9% in 2002/2003 to 31–60% in 2006, evidence of sudden aspen decline (SAD) (Worrall et. al. 2008).

Aspen are an ecologically important species that occurs at high abundance throughout western North America (Worrall et. al. 2008). Aspen forests produce an abundance of forage, as much as many grasslands and more than 10 times the forage produced in conifer forests (Aspen Ecology). With sudden aspen decline taking place, many species throughout Western North America from Mexico to Canada are likely to be impacted (Bombaci and Korb). Climate-driven shifts in aspen forest health may lead to indirect effects on the many species that rely on them.

In Eastern Canada, boreal forests are being affected by another cause of worldwide deforestation: forestry. In this study by Imbeau et. al. (2001), because of the effects of forestry on boreal forests, bird populations are being threatened habitat loss. The mechanisms for forest loss via forestry do differ from the mechanisms taking place via climate change, but this study depicts how the loss of habitat can lead to avian decline, especially when entire habitats are cleared. With aspen declining at such a rapid rate, the effects on birds over time are likely to be profound.

Some bird species are very reliant on aspens, especially for canopy and cavity nesters. Aspen trees provide habitats for around one hundred bird species in the East River Valley alone, with each species utilizing the aspens differently (All About Birds) (DeByle 1980). The East River Valley is a watershed located near Crested Butte, CO, that is defined by the presence of the East River and is surrounded by mountain ranges on all sides. This watershed provides representation of an area with features characteristic of the Rocky Mountains, along with an abundance of aspens.

Canopy and ground species prefer healthy aspen stands, while shrub, cavity, and opening species generally will favor less dense aspen forest stands with more decay. Canopy nesters utilize dense healthy aspen canopies for nesting, protection, and for stealthily stalking prey (DeByle 1980). Ground nesters prefer healthy aspen forests for feeding and understory protection (DeByle 1980). Shrub nesters prefer more dead aspens, since healthy aspen stands have herbaceous understories with few or no shrubs (DeByle 1980). Clearcutting of aspens has been shown to increase understory plant production to the benefit of shrub nesters (DeByle 1980). Cavity nesters benefit from aspen tree decay, as this allows for excavation of cavities (Hollenbeck and Ripple 2008). Bird species that utilize open spaces naturally prefer an unhealthy aspen forest, as they still have trees to nest and look for prey but have open spaces available for foraging (DeByle 1980).

Due to the effects of climate change on aspen stands, many bird species' habitats are changing. This may have major implications for the conservation of birds in the East River Valley. Specifically, there may be changes in the bird Total Avian Conservation Value (TACV) of bird species in these landscapes. TACV is measured using the Partners in Flight (PIF) approach, which prioritizes bird species in North America using global and regional assessment scores along with area importance factors (Panjabi et al. 2012). The value is calculated by multiplying species abundance by PIF rankings (Conover et al. 2009). There are also likely to be impacts on the richness of bird species and the composition in bird species, with both richness and composition changing based on varying habitat preferences among species.

The specific aim of this study was to examine the effect of aspen forest health on bird community composition and mean conservation value. The focal area was the East River Valley in the Gunnison National Forest of Colorado due to the familiarity of the bird species and the high aspen cover throughout the area.

As aspen forest health declines, bird community composition was expected to be arranged by each species' habitat preference and to change depending on the forest health at each site, while bird conservation value was expected to be unchanged no matter the extent of aspen decline.

2.0 Methods:

2.1 Preliminary Analysis

Before conducting data analysis, a preliminary analysis was conducted to develop a hypothesis and to attempt to gather preliminary data to be used for future analyses.

The five categories used for analyses of bird preferred habitats within aspen stands are: canopy, shrub, ground, cavity, openings, with some species utilizing a mixture. Canopy and ground species are defined as "prefer healthy aspens" (PHA) and shrub, cavity, and openings species are "prefer unhealthy aspens" (PUA) species (Table 1).

Based on this data, TACV for PHA and PUA species were calculated, along with richness of PHA and PUA species.

Table 1. Bird species to be measured, preferred habitats, PIF rankings, and scores based on habitat preferences in combination with PIF rankings.

Bird	Preferred Habitat	PIF Rank (CCS)	PHA, PUA, or No Preference (NP)
1. American Crow	Openings	7	PUA
2. American Kestrel	Cavity	11	PUA
3. American Robin	Canopy	5	PHA
4. Black-Capped Chickadee	Cavity	7	PUA
5. Brewer's Blackbird	Varies	10	NP
6. Brewer's Sparrow	Shrub	11	PUA

7. Broad-Tailed Hummingbird	Canopy/Shrub	12	NP
8. Brown-Headed Cowbird	Avoid forests (no canopy)	7	PUA
9. Cassins Finch	Canopy	13	PHA
10. Cliff Swallow	Avoid forests (no canopy)	6	PUA
11. Common Merganser	Cavities of large trees (mature forests)	7	PHA
12. Common Nighthawk	Ground	11	PHA
13. Common Raven	Canopy	6	PHA
14. Cooper's Hawk	Canopy	7	PHA
15. Cordilleran Flycatcher	Shrub	11	PUA
16. Dark-Eyed Junco	Ground	8	PHA
17. Downy Woodpecker	Cavity	7	PUA
18. Dusky Flycatcher	Shrub	11	PUA
19. Dusky Grouse	Openings	11	PUA
20. Evening Grosbeak	Canopy	13	PHA
21. Fox Sparrow	Ground	8	PHA
22. Golden Eagle	Open area in vicinity	10	NP
23. Gray Jay	Canopy	9	PHA
24. Great Horned Owl	Canopy	8	PHA
25. Green-Tailed Towhee	Shrub	12	PUA
26. Hairy Woodpecker	Cavity	6	PUA
27. Hammond's Flycatcher	Shrub	10	PUA
28. Hermit Thrush	Ground	7	PHA
29. House Wren	Cavity	5	PUA
30. Lazuli Bunting	Shrub	9	PUA
31. Lincoln's Sparrow	Ground	9	PHA
32. MacGillivray's Warbler	Shrub	12	PUA
33. Mountain Bluebird	Cavity	11	PUA
34. Mountain Chickadee	Cavity	10	PUA
35. Mourning Dove	Tall shrubs/trees – open areas	6	NP
36. Northern Flicker	Cavity	9	PUA
37. Northern Goshawk	Canopy	11	PHA
38. Northern Pygmy Owl	Cavity	11	PUA
39. Olive-Sided Flycatcher	Canopy (tall trees/snags)	13	NP
40. Orange-Crowned Warbler	Ground	9	PHA
41. Pine Grosbeak	Canopy	10	PHA
42. Pine Siskin	Canopy	10	PHA

43. Red Breasted Nuthatch	Cavity	6	PUA
44. Red Crossbill	Canopy	8	PHA
45. Red-Naped Sapsucker	Cavity	9	PUA
46. Ruby Crowned Kinglet	Canopy	6	PHA
47. Rufous Hummingbird	Canopy/Shrub	14	NP
48. Sharp-Shinned Hawk	Canopy	7	PHA
49. Song Sparrow	Shrub	8	PUA
50. Stellar's Jay	Canopy	9	PHA
51. Swainson's Hawk	Solitary trees (Openings)	12	PUA
52. Swainson's Thrush	Shrub	10	PUA
53. Three-Toed Woodpecker	Cavity	10	PUA
54. Townsend's Solitaire	Ground	11	PHA
55. Tree Swallow	Cavity	10	PUA
56. Vesper Sparrow	Ground	11	PHA
57. Violet-Green Swallow	Cavity	10	PUA
58. Virginia's Warbler	Ground	14	PHA
59. Warbling Vireo	Canopy	8	PHA
60. Western Tanager	Canopy	9	PHA
61. Western-Wood Pewee	Canopy	11	PHA
62. White-Crowned Sparrow	Ground	8	PHA
63. Willow Flycatcher	Shrub	11	PUA
64. Wilson's Warbler	Shrub	10	PUA
65. Yellow Warbler	Shrub	8	PUA
66. Yellow-Rumped Warbler	Canopy	6	PHA

Results: Average for Prefer Healthy Aspens = 9.1, $S_x = 2.3$

(Debyle 1980)

Average for Prefer Unhealthy Aspens = 9.3, $S_x = 2.0$

(All About Birds)

T-Test Results: $t = .397$, $p\text{-value} = .6921696291$, $df = 59$

2.2 Bird data:

Data was collected within a total of 11 sample sites in the East River Valley under aspen forest cover and in non-wilderness parts of the Gunnison National Forest (Figure 1) (sites selected by my mentor using image analysis methods and USFS inventory maps). Selected sites were at least 200m apart to avoid overlap between site recordings, avoided edges to reduce edge effects. Sites were selected on a gradient of forest health based on previously collected forest health data.

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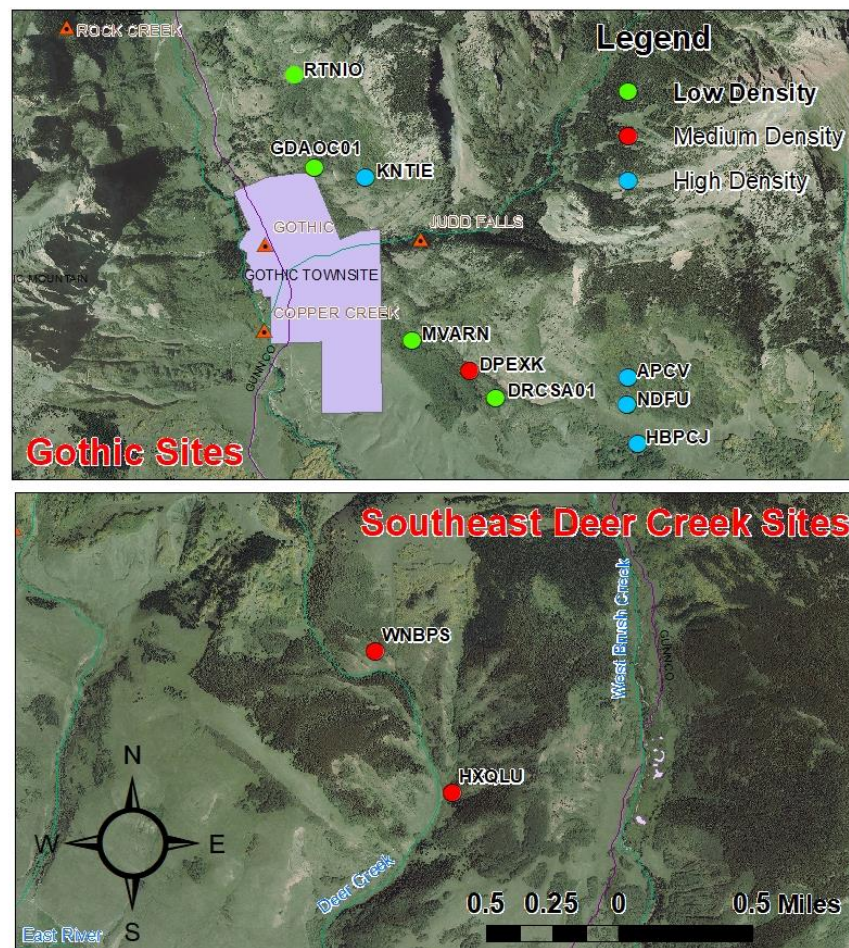


Figure 1. These 11 sites are in aspen forests in the East River Valley. These sites were used for collecting data on how bird species composition and conservation is affected by declining aspen forests.

In each site, an acoustic sound recorder (Song Meter SM4 by Wildlife Acoustics and Song Meter SM1 by Wildlife Acoustics) was placed from 5-9 AM to record 10 minutes of an hour in order to capture the dawn chorus along with additional data to enhance the results prior to collecting the unit (Wimmer et. al. 2013). The SM1 unit was set to record at a sampling rate of 44100 Hz with the left and right gain set at 42 db. The SM4 unit was set to record at a sampling rate of 24000 Hz with the left and right gain set at 16 db (this is a newer unit). Recorders were placed

in late afternoon the day prior to sound recording and were collected either the following afternoon or on a subsequent day after data was collected. Each recorder was placed at a central tree where forest health data was collected at 1.3 m above the ground (Figure 2).

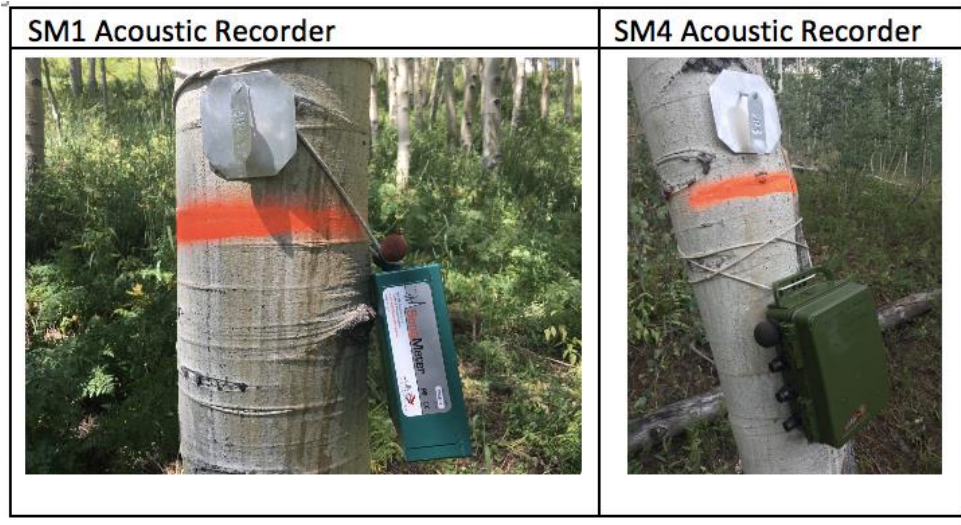


Figure 2. Placement of Wildlife Acoustics sound recorders at sites RTNIO and GDAOC01 respectively for sound data collection.

Bird sounds were identified using the program Raven Lite, where audible vocalizations were separated into separate files. Only the bird species featured in Table 1 were recorded. Only common and uncommon birds were featured from the East River Valley and Gothic Area Bird Checklist, and these species were only included if they utilize aspens (Debyle 1980) (All About Birds). Species' presence/absence was then recorded based on analysis of these bird calls conducted by expert listeners (Dr. Ross Conover and Savannah Troy).

2.3 Forest Health Data:

For the sites where audio data was collected, data on the health of the 10 closest trees and the central tree being sampled at each site was collected. Health was measured as mortality (# dead trees per m² ground area) and canopy openness (low, medium, or high density). The tree death data was collected using DBH tape or a Range Finder (LaserTech, TruPulse 360R) to determine the health status of the 10 closest trees by a visual analysis, and the canopy data was collected by taking an aerial photo on the north-facing side of the site. Canopy density was determined by a visual analysis.

2.4 Analyses:

TACV was compared across forest health statuses using linear mixed models. Mixed models treated individual bird observations as replicates, and included a random intercept of site, reflecting the hierarchical structure of the data (i.e. bird presences within sites). The model also included fixed effects of two forest health metrics (canopy status and # of dead trees per plot).

TACV was determined using the Conservation Concern Scores (CCS) of all present species for each site. CCS was taken from the 2017 Partners in Flight Avian Conservation Assessment Database (Table 1) (Partners in Flight 2017).

To test for shifts in bird community composition, nonmetric multidimensional scaling (NMDS) was used to model species compositions among sites of the same type and between healthy and unhealthy aspen stands, based on canopy density. The stress for the NMDS was 0.1380322, which is deemed appropriate by (Non-metric multidimensional scaling) as approximately “fair.” The NMDS was visualized by displaying species by their habitat preference and sites by their canopy status. In the visualizations of the NMDS, the darkest circle signifies high density canopy, while lighter circles mean less canopy density. Circles that are closer together mean that the sites are more similar based on species composition (Figure 5).

All data were compiled in Excel using separate data sheets for each site. These data were then combined in R for analyses. Mixed models were built using the *lme4* package. The NMDS was created using the *vegan* package in R and data was reshaped for the NMDS using the *reshape* package. Visualization of data was completed via boxplots with the *ggplot2* package.

3.0 Results:

3.1 Preliminary Results

Based on the rough calculations, the number of species that favor dense healthy aspen forests (30) is approximately the same as the number of species preferring unhealthy aspen forests (31). The Partners in Flight Conservation Concern Scores (CCS) were averaged, which show the importance of different bird species based on several variables on a scale of 4 to 20, and a mean score of 9.1, s.d. = 2.3 for PHA species and a score of 9.3, s.d. = 2.0 for PUA species was determined (Table 1) (Partners in Flight 2017). Thus, this analysis suggests modest changes in TACV (a function of CCS) across declines in aspen mortality, though overall species composition may have large changes in aspen landscapes with differing levels of mortality.

3.2 Shifts in Bird Conservation Score Across Forest Health Types

The results from the linear mixed model and box plots were largely not statistically significant. The t-values for each fixed effect in the linear mixed model were very small (absolute value < 0.1), indicating that there was no significant difference between CCS across canopy density or tree mortality.

These results are supported by the box plots for mean CCS and canopy density and mean CCS and number of dead trees. As expected, CCS for each group hovers between 8 and 10 (Figure 3) (Figure 4).

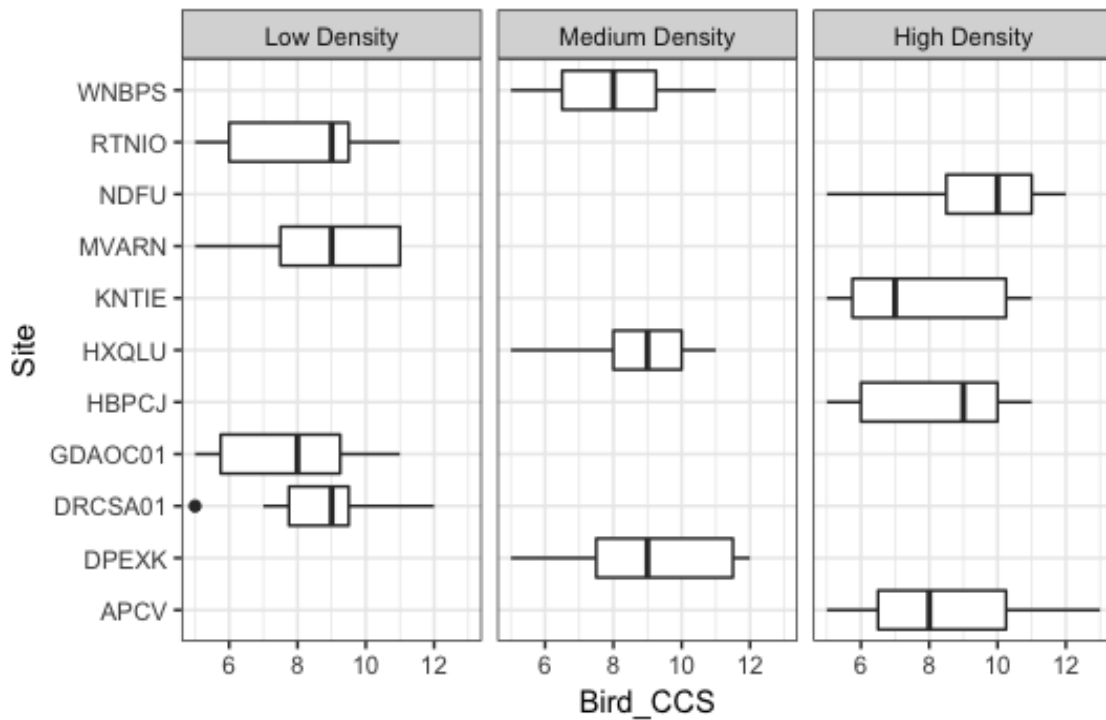


Figure 3. Bird mean Conservation Concern Scores for present species at each site, grouped by the canopy status of each site.

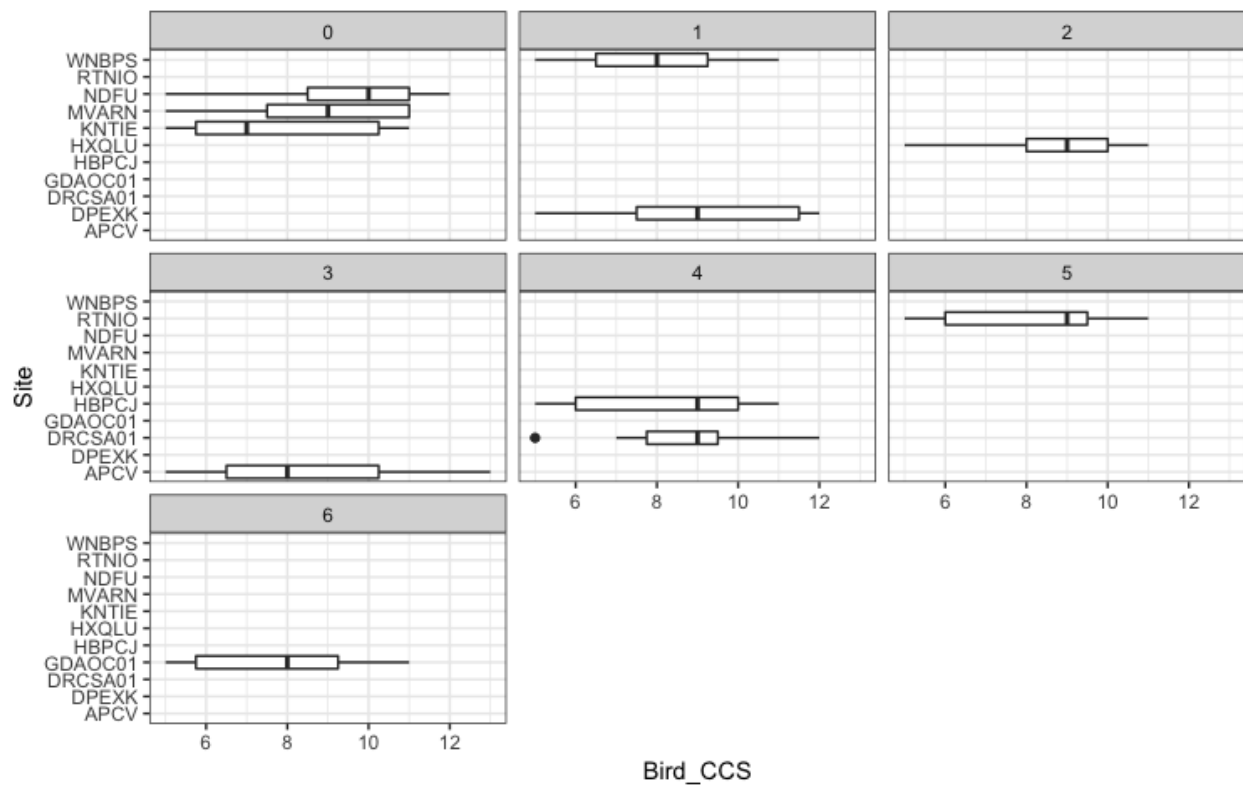


Figure 4. Bird mean Conservation Concern Scores for present species at each site, grouped by the number of dead trees of each site.

3.3 Shifts in Bird Composition

The NMDS showed results that supported the preliminary analyses. In terms of species composition, it can be seen that the lighter-colored low density sites all have similar species compositions. The other sites are more scattered, but there is a clear distinction between low density, medium density, and high density sites in terms of species compositions (Figure 5).

Canopy species in green were found across all types of sites (Figure 5).

The ground nesting species and the one “other” species in red and purple were only observed on 3 separate occasions and are seen scattered evenly between sites of different types (Figure 5).

However, cavity nesters in yellow were observed utilizing unhealthy aspen sites, specifically, the more medium/low canopy sites much more regularly than the high density sites (Figure 5).

As with shrub nesting species in blue, they were found to prefer the healthy aspen stands more than any other species, with 3 of the 4 shrub species compositions being farthest removed from the low and medium density sites, meaning shrub nesters favor high density canopies (Figure 5).

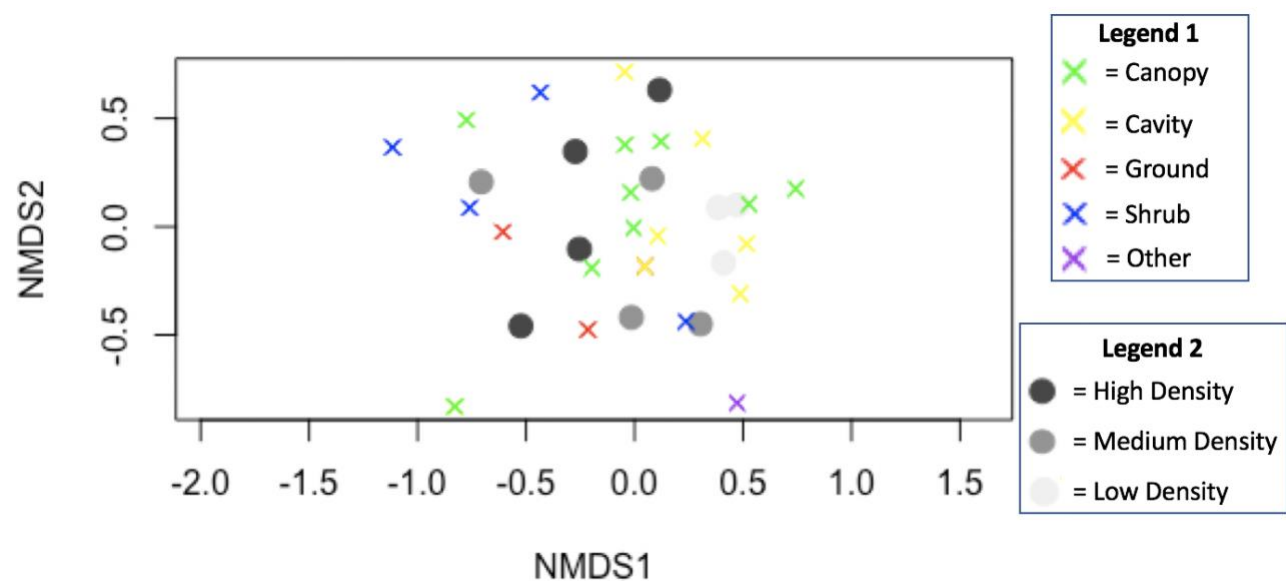


Figure 5. Nonmetric Multidimensional Scaling of high, medium, and low density sites, arranged by bird species composition at each site.

4.0 Discussion:

4.1 Bird Conservation

These results indicate that both healthy and unhealthy aspens have important values for bird conservation. Since TACV does not shift between forest types, this likely means that, despite species composition varying between sites, each site has a similar distribution of birds with low,

medium, and higher conservation values. This also likely means that no one group of species based on habitat preference has higher CCS. If cavity nesters had consistently higher CCS, then low density sites likely would have had higher conservation score.

Sudden aspen decline is likely not affecting avian conservation, because at this point, it is likely that no one species variety is directly facing decline due to loss of resources. In areas where aspens are being lost in complete stands, birds are able to migrate to other stands. Species compositions are likely changing, but all the birds in the East River Valley are still present. Also, there is still an abundance of healthy and unhealthy stands, with no one forest health being observed far more than the other, so species of each nesting preferences have available habitat.

It is also possible that the abundance of aspens in the East River Valley allow for movement to new sites when previous habitats are lost. Based on my observations of the area, aspens are both abundant and widespread, and due to the focus of the state of Colorado and the Rocky Mountain Biological Laboratory, the area may serve as a habitat corridor for bird species to migrate to new habitats easily without extensive fragmentation.

The biggest risk I can see in SAD is the potential for entire aspen stands to be lost and for bird species to not have new habitats to migrate to. It is difficult to know whether aspen decline will continue at its current rate and when/if this will start to impact avian conservation, but as of now, avian conservation is not actively being lost as a result of sudden aspen decline.

4.2 Bird Composition

The study's results demonstrate clear shifts in bird species composition across forest types, with greater effects for cavity-nesting birds who can be predicted to increase in population size as a function of increased sudden aspen decline. This is likely due to aspen forest decline increasing overall biodiversity of the area, providing more resources for birds (Bombaci and Korb). This likely also benefits "openings" species who thrive in less dense aspen stands. Similarly, Bombacia and Korb found that avian biodiversity and richness were significantly greater in areas with high sudden aspen decline, with cavity nesters seen benefitting the most from SAD.

Should aspen forests throughout Southwestern Colorado become mostly unhealthy, cavity nesting and opening nesting species will increase in abundance. It is possible that this increase will eventually lead to decline in canopy and shrub nesting species who not only are lacking abundant habitats, but who are being outcompeted by the abundant cavity and ground nesters. This will likely have cascading effects through the ecosystem, with the insects preferred by cavity nesters possibly being threatened, or with the prey of certain abundant canopy nesters experiencing overabundance because their predators are declining.

While not all species are benefitted by aspen decline, in terms of avian conservation, forest management should focus on allowing aspen stands to decay and keeping aspen snags available to species like the Northern Flicker. For bird species, maintaining forest diversity is key

(Bombaci and Korb). Sudden aspen decline is likely increasing forest diversity but may eventually affect aspens to the point of devastation, where too much habitat is lost without regeneration. It is difficult to know when or if SAD will reach this point, but this would be the greatest risk for avian conservation for species that utilize aspens in my opinion.

For the species with other nesting habits such as canopy, ground, shrub, and openings nesters, more data could be collected to see more clearly where they prefer to nest based on the conditions found at each site. This also would require some more extensive forest health data to get a full picture of the types of aspen forests that different nesters utilize.

A long-term version of study could provide some very important results to see how aspen forest health is changing each year in the East River Valley, along with providing data for how bird species compositions change each year as a function of aspen forest decline. If this study could also span various aspen-dense regions in Southwestern Colorado, this study could provide even more extensive and profound results. These results may better show a gradient of forest health, especially if different areas are more affected by SAD. Also, a more diverse set of bird species could be considered, which may lead to more significant results for how TACV is affected by changing aspen forest health.

4.3 Limitations

The study methodology could be extended to obtain more robust results. With more time, more data would have been collected to further classify the forest health of the areas where recorders were placed. Canopy status seems to be the most effective way to determine health of a forest, especially for bird species. Therefore, in a future study, a 200m grid around the central tree would be recommended, where in that grid, 20 canopy photos would be taken evenly spaced apart 10m. The photos could be analyzed for total % cover for each site.

It is difficult to quantify how far the acoustic recorders can “hear,” especially with certain species able to be heard a mile away, with other species only a few meters away. A 200m grid would be recommended in a future study, as this would encompass vocalizations for most birds, with some birds likely being heard from further distances, but overlap would be relatively minimized. This depicts an aspect of acoustic recorder technology that is less desirable than use of point counts or transects. More research on the use of acoustic recorders for identifying birds in specific habitats without including vocalizations from other distinct habitats should be conducted.

Also, to further enhance the results, the study could be conducted at the very start of mating season to capture the largest variety of vocalizations, and point counts could be used in conjunction with sound recordings to capture both abundance and presence/absence. More data could also be collected during the summer to try and observe the rarer species who could most strongly impact the Total Avian Conservation Value.

The biggest hurdle in conducting this kind of study is analyzing sound data, especially with many overlapping songs heard and many calls that could be any number of species. Having point

counts included could have provided more ease in analysis, as well as some different data that also shows abundance of bird species. With including abundances in the calculation of TACV, the results could be different.

5.0 Conclusion:

My study revealed changes in bird species compositions between sites of varying aspen forest health. In applying this data to sudden aspen decline, I have concluded that as aspen forest health declines, overall species composition and richness will be favored, especially for cavity nesting species, due to the availability of more resources and snags for nesting and foraging. However, based on my results for how bird conservation scores change based on canopy density, I concluded that as aspen forest health declines, avian conservation will be unchanged. The key to these analyses is the extent of sudden aspen decline. With initial decline taking place affecting the understory and killing adult aspens while aspens still are abundant, overall avian biodiversity is improved and conservation value is unaffected. However, as aspen forest decline progresses, the impacts are likely to permanently destroy aspen stands and completely alter forest landscapes, which will lead to overall bird species biodiversity loss and bird conservation loss as well.

Therefore, in the short term, for avian conservation purposes, sudden aspen decline does not need to be mitigated. However, as aspens continue to be lost in the long term, it is possible that the effects on bird species will eventually favor mitigation, depending on the rate SAD increases over time. In order to accomplish this, the effects of climate change have to be targeted. Climate change has been persistent, and efforts have been slow, but without continued research into climate change reduction, or potentially looking into genetic variation in aspens to determine if certain aspen genotypes are more drought tolerant, many bird species and species in all taxonomic levels may be threatened by either loss of habitat (Pimm and Askins 1995), or by a shift in forest type, potentially to a conifer forest favoring a different composition of species (Bombaci and Korb).

When considering forest health, there are many effects that directly impact bird species, along with many indirect linkages between species that utilize the forest for survival. These linkages are complex and difficult to model, but these linkages are very important in determining how a species is affected when forest health changes. It is not only important to focus on climate change reduction, but to further understand the complex interconnectivity of species in aspen forests to determine the mechanisms by which bird species conservation could be threatened.

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Appendix:

Table 1. Present Bird Species at each site, along with date of data collection and Wildlife Acoustics sound recorder used.

2018-07-13	KNTIE	SM4	American Robin
2018-07-13	KNTIE	SM4	Cordilleron Flycatcher
2018-07-13	KNTIE	SM4	House Wren
2018-07-13	KNTIE	SM4	Pine Siskin
2018-07-13	KNTIE	SM4	Red-Breasted Nuthatch
2018-07-13	KNTIE	SM4	Ruby Crowned Kinglet
2018-07-13	KNTIE	SM4	Warbling Vireo
2018-07-13	KNTIE	SM4	Western-Wood Pewee
2018-07-17	APCV	SM4	Dark-Eyed Junco
2018-07-17	APCV	SM4	Hairy Woodpecker
2018-07-17	APCV	SM4	House Wren
2018-07-17	APCV	SM4	Olive-Sided Flycatcher
2018-07-17	APCV	SM4	Warbling Vireo
2018-07-17	APCV	SM4	Western-Wood Pewee
2018-07-17	NDFU	SM1	Dusky Flycatcher
2018-07-17	NDFU	SM1	Green-Tailed Towhee
2018-07-17	NDFU	SM1	House Wren
2018-07-17	NDFU	SM1	Lincoln's Sparrow
2018-07-17	NDFU	SM1	Pine Siskin
2018-07-17	NDFU	SM1	Warbling Vireo
2018-07-17	NDFU	SM1	Western-Wood Pewee
2018-07-20	DPEXK	SM1	Black-Capped Chickadee
2018-07-20	DPEXK	SM1	Broad-Tailed Hummingbird
2018-07-20	DPEXK	SM1	Green-Tailed Towhee
2018-07-20	DPEXK	SM1	House Wren
2018-07-20	DPEXK	SM1	Northern Flicker
2018-07-20	DPEXK	SM1	Warbling Vireo
2018-07-20	DPEXK	SM1	Western-Wood Pewee
2018-07-20	MVARN	SM4	American Robin
2018-07-20	MVARN	SM4	Dark-Eyed Junco
2018-07-20	MVARN	SM4	Dusky Flycatcher
2018-07-20	MVARN	SM4	Pine Siskin
2018-07-20	MVARN	SM4	Ruby Crowned Kinglet
2018-07-20	MVARN	SM4	Warbling Vireo
2018-07-20	MVARN	SM4	Western-Wood Pewee
2018-07-20	MVARN	SM4	Willow Flycatcher

2018-07-25	HXQLU	SM4	American Robin
2018-07-25	HXQLU	SM4	Dark-Eyed Junco
2018-07-25	HXQLU	SM4	Fox Sparrow
2018-07-25	HXQLU	SM4	House Wren
2018-07-25	HXQLU	SM4	Mountain Chickadee
2018-07-25	HXQLU	SM4	Northern Flicker
2018-07-25	HXQLU	SM4	Northern Goshawk
2018-07-25	HXQLU	SM4	Pine Siskin
2018-07-25	HXQLU	SM4	Red-Breasted Nuthatch
2018-07-25	HXQLU	SM4	Red-Naped Sapsucker
2018-07-25	HXQLU	SM4	Stellar's Jay
2018-07-25	HXQLU	SM4	Warbling Vireo
2018-07-25	HXQLU	SM4	Western-Wood Pewee
2018-07-25	WNBPS	SM1	American Robin
2018-07-25	WNBPS	SM1	Black-Capped Chickadee
2018-07-25	WNBPS	SM1	Fox Sparrow
2018-07-25	WNBPS	SM1	House Wren
2018-07-25	WNBPS	SM1	Lincoln's Sparrow
2018-07-25	WNBPS	SM1	Mountain Chickadee
2018-07-25	WNBPS	SM1	Warbling Vireo
2018-07-25	WNBPS	SM1	Western-Wood Pewee
2018-07-29	DRCSA01	SM4	Black-Capped Chickadee
2018-07-29	DRCSA01	SM4	Green-Tailed Towhee
2018-07-29	DRCSA01	SM4	House Wren
2018-07-29	DRCSA01	SM4	Northern Flicker
2018-07-29	DRCSA01	SM4	Red-Naped Sapsucker
2018-07-29	DRCSA01	SM4	Stellar's Jay
2018-07-29	DRCSA01	SM4	Warbling Vireo
2018-07-29	DRCSA01	SM4	Western-Wood Pewee
2018-07-29	HBPCJ	SM1	House Wren
2018-07-29	HBPCJ	SM1	Pine Siskin
2018-07-29	HBPCJ	SM1	Red-Breasted Nuthatch
2018-07-29	HBPCJ	SM1	Red-Naped Sapsucker
2018-07-29	HBPCJ	SM1	Western-Wood Pewee
2018-07-30	GDAOC01	SM4	American Robin
2018-07-30	GDAOC01	SM4	Black-Capped Chickadee
2018-07-30	GDAOC01	SM4	Common Raven
2018-07-30	GDAOC01	SM4	House Wren
2018-07-30	GDAOC01	SM4	Northern Flicker

2018-07-30	GDAOC01	SM4	Pine Siskin
2018-07-30	GDAOC01	SM4	Stellar's Jay
2018-07-30	GDAOC01	SM4	Western-Wood Pewee
2018-07-31	RTNIO	SM1	American Robin
2018-07-31	RTNIO	SM1	Black-Capped Chickadee
2018-07-31	RTNIO	SM1	House Wren
2018-07-31	RTNIO	SM1	Northern Flicker
2018-07-31	RTNIO	SM1	Pine Siskin
2018-07-31	RTNIO	SM1	Stellar's Jay
2018-07-31	RTNIO	SM1	Western-Wood Pewee