Appendix E

Biodiversity-Wildlife Populations

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CHAPTER 1.0 METHODOLOGY FOR FOREST BIRD POPULATION CHANGE ANALYSIS

1.1 INTRODUCTION

The GEIS identified that changes in forest composition, both in terms of cover type and age class distribution, can result in significant impacts to forest bird populations. The DEIS assessed how statewide timber harvest could affect forest birds for the No-Build and Build Alternatives. The DEIS also assessed how timber harvest in two northern Minnesota ecosections, where the majority of harvest will occur could change species populations relative their historic range of natural variation populations.

1.1.1 ANALYSIS AREA

Potential changes in forest bird populations were assessed statewide and for two northern Minnesota ecosections (Drift and Lakes Plains and Northern Superior Uplands).

1.1.2 MODELS

Two different models were used to calculate current and to predict future breeding bird populations in the State. The models were used to: 1) complete a statewide population assessment, and 2) interpret model results in northern Minnesota in the context of individual species range of natural variation (RNV) populations. For the latter, RNV models were used for two ecosections in northern Minnesota, specifically the Minnesota Drift and Lakes Plains and Northern Superior Uplands (the DLP and NSU), while forest inventory and analysis (FIA) models were applied to all forestland outside of these two ecosections. The statewide assessment is accomplished by adding the RNV model outputs to the FIA model outputs (e.g. DLP population + NSU population + FIA population) for both the Build and No-Build Alternatives[1].

1.1.2.1 RNV Model

The DEIS analysis used an RNV bird/habitat model to interpret predicted change in breeding bird populations relative to their RNV midpoint population at different harvest levels in two northern Minnesota ecosections. RNV midpoint population can be interpreted as equivalent to the average number of individuals of a species that occurred on the landscape over the RNV timeframe based on midpoint acreage values of the vegetation growth stages (VGSs) where each species occurs.

Several pieces of information were required to quantify RNV of breeding bird populations for each ecosection. These included: (1) a base map of the native plant communities (NPCs) for each ecosection;

[1] Modeling was conducted for all of the derivative Build and No-Build scenarios noted in DEIS Appendix C. The results of the comparison of the No-Build (A) and Build Alternatives (A&P) are reported in the DEIS consistent with the Final Scoping Decision. The results of the derivative scenarios are reported when further insights can be gained.

(2) estimates of percentage ranges for each successional stage within each ecosystem type; (3) current numbers of acres for each successional stage and ecosystem type; (4) modeled future numbers of acres for each successional stage and ecosystem type; and (5) bird species-specific habitat relationships and abundances.

RNV Model – Data Sources

Forest bird monitoring data collected within each of the National Forests over 13 years (1991 through 2003) provided the bird/habitat information for the models (Hanowski et al. 2003). These data met the needs of this analysis because: 1) they are linked directly to forest cover type and age; 2) they represent standardized counts conducted by qualified and trained observers; 3) relative abundance and probability of occurrence of over 90 species are available; and 4) it is the largest data base available for breeding birds in the upper Midwest (Hanowski et al. 2003; Lind et al. 2003). Because populations for individual species have fluctuated over the time period of the surveys, the mean abundance value from all survey years was used in calculating both current and historic midpoint of each species population. Bird data were collected in forest stands classified by the United States Forest Service to major tree species and age class. Current stand identification information was cross-referenced to the native ecosystem types and successional stages within each type. One assumption of this model is that current habitat associations and relative abundance of individual bird species in those habitats are the same today as they were historically. Because historical abundance values are not known, it is impossible to determine whether this assumption is valid. However, models developed here utilized the best available information and therefore are useful for the objectives of this analysis.

RNV vegetation model based results for individual breeding birds were used as benchmarks or thresholds to assess current population status and predicted population trends of breeding birds. The RNV usage assumes that individual species populations will be sustainable over time if they occur across the landscape at a level in which they have existed historically. In this instance, historically refers to the previous 100s to 1000s of years. Individual species current populations were calculated in the same manner, but for this calculation current forest cover type and age composition was used. This value was compared to a species midpoint RNV population[2].

1.1.2.2 FIA Model

Forest bird population assessment outside the NSU and DLP was accomplished by using a FIA-based model. The underlying algorithm multiplied estimates of bird density per acre of forest by the total acres of each forest cover type in Minnesota, and then sum across all cover types in all ecoregions statewide. Each forest cover type has an estimate of the amount of acres in each ecoregion; similarly, each bird species has a separate density estimate for each forest cover type in each ecoregion. This is the same model that was used for the GEIS and the GEIS Report Card Study.

[2] This differs from the minimum or maximum threshold that was used in the Report Card Study.

FIA Model – Data Sources

Updated (from 1994) bird density estimates were used. The original bird density values for the 1994 GEIS were from three sources: 1) calculated from NRRI monitoring program point counts, 2) estimated from expert opinion, and 3) estimated from the literature. To reflect density changes in current bird populations from 1990, bird density estimates were updated using the following criteria. Density estimates (1999-2001) from NRRI's forest bird monitoring program for forest cover types in ecoregions 2, 3, 4, and 6. When NRRI data were unavailable, USGS Breeding Bird Survey (BBS) trends (percent annual change from 1991-2001) were used from Minnesota BBS routes to adjust original density values (Sauer et al. 2004). United States Fish and Wildlife Mourning Dove survey data (1994-2003) were used to calculate new density values for the Mourning Dove (Dolton and Rau 2004). When data were not available from either of these sources, densities in the original bird/habitat matrix were not revised. Therefore, a species can have a combination of NRRI-updated density values, BBS-adjusted values, and original values.

NRRI bird data were not used for calculating density values in the updated matrix in the following cases. Specifically, when:

- point counts are an inappropriate sampling method for a given species (e.g. waterfowl, herons, raptors, etc.); or
- NRRI sampled three or fewer points in a given ecoregion/forest cover type (small sample size).

USGS BBS trends (i.e. percent annual changes) were not used for calculating density values in the updated matrix in the following cases. Specifically, when:

- appropriate updated density values were available from NRRI survey points;
- point counts are an inappropriate sampling method for a given species (e.g. waterfowl, herons, raptors, etc.); or
- less than 14 BBS routes were sampled from 1991–2000 (small sample size). Exceptions were made to this criterion for 10 passerine species that were represented by 9-13 BBS routes, and had a Minnesota trend similar in direction and magnitude to their continent-wide BBS trend. This exception was made because the trend used was based on a larger sample that was representative of the trend on Minnesota BBS routes.

The area of all forestland (acres) was computed by stand-size class by forest type using FIA data from 1999-2003 with pre-determined queries from the FIA instruction manual. Fuzzed coordinates intersected with a digital map of ecoregion boundaries were used to compute acres per ecoregion. Although FIA provides information for a larger number of forest types, types were aggregated into ten classes. Many bird species reach their range limits in Minnesota, so distributions were delineated along ecoregion

boundaries. Within ecoregions 4 and 9, the two largest ecoregions, county boundaries were used to delineate range limits and calculate forest type acreages.

1.1.2.3 Reporting Criteria

The RNV- and FIA-based models project how available habitat changes for each bird species over the 40-year study period. Projections are provided for both the Build and No-Build Alternatives. Population change worthy of concern, or significance, is reported in two basic ways:

- Projected Reduction from Current Population Level. For threatened, endangered or special concern species, or ETS species, a reduction in population of > 5 percent from current population at any decade. For all other non-ETS species, results are reported at a ≥ 10 percent reduction in population statewide for all forestland at any decade, with a 25 percent change level to determine significance (consistent with the GEIS). A 10 percent change is used as the reporting criterion because the level of increased harvest modeled is relatively small, or approximately a 5 percent increase in statewide harvest.
- Projected Populations Below Midpoint RNV Population. For model results for either the NSU or DLP sections, or those sections combined, the number of species that were projected to fall or stay below their midpoint RNV population is reported.

Although both criteria are useful, for the DEIS analyses more emphasis will be placed on the RNV results. RNV is the ecological benchmark for assessing impacts due to an increase in harvest and most harvest will likely occur in the region of Minnesota where we have RNV models. In contrast, changes in statewide bird populations can only be compared to current populations and alone cannot be used to determine if individual species populations are moving away or toward sustainability.

1.1.2.4 Reliability of DEIS Model Outputs – Static Population Densities

It is important to note that discrepancies exist between the GEIS-predicted and current condition of Minnesota breeding bird populations. Detailed discussion of the issue is offered in the next section, "Reasons for Difference in Current and GEIS Projected Populations." One reason for these differences is changes in breeding bird densities between 1990 and 2000; see Kilgore et al. 2005. The GEIS and the DEIS's RNV and FIA models keep bird density static over their respective study periods. Although bird densities are not static, no information is or was available that would allow prediction changes (magnitude or direction (e.g., increase or decrease)) in species densities over the next 40 years. Given this practical restriction, interpretation of population trajectories are less reliable beyond 15 years[3].

[3] As an example, from the report card, it was found that even small annual changes in a species population density resulted in substantial changes in a species population over ten years; see Kilgore et al. 2005.

1.1.2.5 Bird/Habitat Models – Summary of Strengths and Limitations

The models used to project future bird populations have the following general strengths and limitations.

Model Strengths

The RNV-based model provides insights into landscape-scale changes in habitat suitability and related species abundances. Both the FIA- and RNV-based models rely on the best available population data for bird species, which has improved substantially since the completion of the GEIS.

Model Limitations

Modeling and projecting population trajectories for 136 species of forest birds has some limitations for all species, but some groups of species are more problematic than others. Results are presented for all species but greater uncertainty exists for species that 1) have large home ranges, 2) are associated with riparian forest habitat, or 3) have low population sizes. Neither forest model used here is spatial, therefore the outputs do not adequately capture landscape habitat needs of large-bodied birds like raptors. In addition, forest models did not explicitly treat riparian forests as a "wildlife habitat" and impacts for these species (e.g., ducks, Bald Eagle) were not specific to changes in riparian forest area. Another limit is that species with low populations can show negative population trajectories due to harvest of a small number of FIA plots with suitable habitat. There is less uncertainty in bird/habitat models for passerine (perching bird) species that are easily monitored with point counts.

1.1.3 EXISTING CONDITION – FOREST BREEDING BIRD POPULATIONS

Information from several sources, which was summarized for the GEIS Report Card Study (Kilgore et al. 2005), was used to assess existing conditions or populations of forest birds in Minnesota. This approach incorporated data/information from all bird monitoring and conservation efforts that are on-going in the State today, including: 1) species breeding population trends from Breeding Bird Survey (BBS) data collected in the State since the mid 1960's (Sauer et al. 2004); 2) population trends from long-term breeding bird monitoring (e.g., Lind et al. 2005); 3) Partner's in Flight (PIF) bird conservation scores for the Boreal Hardwood Transition (Bird Conservation Region 12 (BCR)) (Rich et al. 2004); and 4) species of conservation concern list developed by Minnesota's Comprehensive Conservation Wildlife Strategy team.

For the report card, current populations of 136 forest dependent bird species for timberland (based on FIA data) in Minnesota were calculated and compared to populations projected for the GEIS Base Harvest Scenario (4 million cords/year of harvest) of the GEIS for Decade 1. The assessment of the "current status" of forest bird populations in the State of Minnesota is based on a significant change in species populations from 1990 to 2000 (for this analysis significance was defined by a $\pm$ >25 percent change in population from 1990 to 2000) and/or a significant deviation from the species historic population range (RNV) in National Forests in northern Minnesota.

1.1.3.1 Current versus 1990 Forest Bird Populations

Populations of 75 of 136 bird species significantly increased or decreased from 1990 to 2000; see Table E-1. Thirty-three species had significant increases and 42 species populations declined significantly. The Evening Grosbeak had the largest decrease in population (68.7 percent) and the Blue-gray Gnatcatcher increased by over 100 percent. Species that showed increases in populations > 90 percent from 1990 to 2000 were primarily those species whose densities were estimated in 1990 and where more accurate values from point count data were available for the 2000 estimates. Most of these species occur in the southern portion of the State and point count data collected in the early to late 1990's indicated that the population densities were underestimated; see Table E-1. Other species that had large population increases have relatively low (Bay-breasted Warbler) or irruptive populations (Red and White-winged Crossbills) and small changes in numbers represent a large percent population change. In contrast, most species that decreased significantly from 1990 to 2000 have higher populations in the State (except Loggerhead Shrike, Yellow-breasted Chat, American Three-toed Woodpecker, Rusty Blackbird, Black-backed Woodpecker and Bell's Vireo).

Table E-1
Changes in Forest Bird Species Populations for
Timberland in Minnesota from 1990 to 2000

Common Name	Percent RNV midpoint in 2000	1990 to 2000 Population change	Population change due to habitat	Population change due to density change	Status
Wood Duck	70	-9.2	-9.2	0	
American Black Duck	NM	4.8	4.8	0	
Bufflehead	NM	5.7	5.7	0	
Common Goldeneye	NM	-18.8	-18.8	0	
Hooded Merganser	242	-7.9	-7.9	0	
Common Merganser	186	-11.3	-11.3	0	
Double-crested Cormorant	NM	-15.1	-15.1	0	
Great Blue Heron	224	-8.8	-8.8	0	Mod. concern; BCR11 Waterbird
Great Egret	NM	-8.8	-8.8	0	
Green Heron	NM	-5.2	-5.2	0	
Black-crowned Night-Heron	NM	-7.3	-7.3	0	Mod-high priority; BCR11 Waterbird
Yellow-crowned Night-Heron	NM	-7.9	-7.9	0	
Turkey Vulture	152	-5.2	-5.2	0	
Osprey	148	-11.6	-11.6	0	
Bald Eagle	195	-16.1	-16.1	0	Fed. Threat. MN Special Concern
Sharp-shinned Hawk	100	-5	-5	0	
Cooper's Hawk	103	-5.2	-5.2	0	
Northern Goshawk	242	-9.1	-9.1	0	
Red-shouldered Hawk	89	-7.2	-7.2	0	MN Special Concern
Broad-winged Hawk	111	-10.7	-10.7	0	
Red-tailed Hawk	136	-1.4	-1.4	0	

Common Name	Percent RNV midpoint in 2000	1990 to 2000 Population change	Population change due to habitat	Population change due to density change	Status
American Kestrel	186	11.5	11.5	0	
Merlin	186	-7.4	-7.4	0	
Ruffed Grouse	NM	NM	NM	NM	PIF 2A in BCR 12
Mourning Dove	197	25.1	4.6	20.5	
Black-billed Cuckoo	115	-24.6	-2.6	-22	PIF in several BCRs
Yellow-billed Cuckoo	119	7.4	-7.8	15.2	
Eastern Screech-Owl	NM	-9.6	-9.6	0	
Great Horned Owl	194	-4.7	-4.7	0	
Barred Owl	50	-9.1	-9.1	0	
Great Gray Owl	282	-19.3	-19.3	0	
Long-eared Owl	NM	-6	-6	0	
Boreal Owl	282	-10.5	-10.5	0	
Northern Saw-whet Owl	57	-16.3	-16.3	0	
Whip-poor-will	103	-11.3	-11.3	0	
Chimney Swift	151	-26.6	0.6	-27.2	
Ruby-throated Hummingbird	102	19.6	0	19.6	
Red-headed Woodpecker	192	-53.7	-5.1	-48.6	PIF Continental Watch
Red-bellied Woodpecker	224	>100	-3.7	>100	
Yellow-bellied Sapsucker	116	>100	-6	>100	PIF 2A in BCR 12
Downy Woodpecker	144	-30.6	-4	-26.6	
Hairy Woodpecker	99	2.6	0	2.6	
American Three-toed Woodpecker	NM	-31.5	-31.5	0	
Black-backed Woodpecker	99	-26.1	-26.1	0	PIF 2C in BCR 12
Northern Flicker	104	-21.2	5.7	-26.9	
Pileated Woodpecker	113	-28.7	-6.1	-22.6	
Olive-sided Flycatcher	67	-54.2	11.6	-65.8	PIF Continental Watch
Eastern Wood-Pewee	107	-43.5	-13.8	-29.7	PIF 2A in BCR 12
Yellow-bellied Flycatcher	86	25.8	0.7	25.1	
Acadian Flycatcher	NM	>100	-1.1	>100	MN Special Concern
Least Flycatcher	108	-12.7	-4.1	-8.6	PIF 2A in BCR 12
Eastern Phoebe	141	25.7	-2.3	28	
Great Crested Flycatcher	118	-35.2	-1.4	-33.8	
Loggerhead Shrike	NM	-38.9	-38.9	0	MN Threatened
Bell's Vireo	NM	-28.6	-28.6	0	PIF Continental Watch
Yellow-throated Vireo	138	-1.6	-2.9	1.3	
Blue-headed Vireo	74	-32	-31	-1	
Warbling Vireo	137	2.5	-3.6	6.1	
Philadelphia Vireo	77	14.9	14.9	0	
Red-eyed Vireo	109	28.5	-4.9	33.4	
Gray Jay	92	-40.9	-15.2	-25.7	
Blue Jay	102	-25.9	-11.8	-14.1	
Black-billed Magpie	NM	40	12.9	27.1	
American Crow	100	30	-13	43	
Common Raven	84	-10.5	-26.5	16	

Common Name	Percent RNV midpoint in 2000	1990 to 2000 Population change	Population change due to habitat	Population change due to density change	Status
Tree Swallow	96	82.7	-1.6	84.3	PIF 2A in BCR 12
Black-capped Chickadee	105	44.9	-10.8	55.7	
Boreal Chickadee	98	-28.6	-19.1	-9.5	
Tufted Titmouse	NM	>100	-3.6	>100	
Red-breasted Nuthatch	83	18.7	-21.1	39.8	
White-breasted Nuthatch	126	88.4	-6.2	94.6	
Brown Creeper	93	-44.4	-13.6	-30.8	
House Wren	159	25.1	-3.5	28.6	
Winter Wren	82	-36.5	-6.9	-29.6	
Golden-crowned Kinglet	87	-68.5	-20.1	-48.4	
Ruby-crowned Kinglet	84	-47.7	-15.4	-32.3	
Blue-gray Gnatcatcher	NM	>100	-4.4	>100	
Eastern Bluebird	122	31.8	13.9	17.9	
Veery	125	5.4	4.5	0.9	PIF 1 in BCR 12
Swainson's Thrush	79	-28.1	-16.7	-11.4	
Hermit Thrush	90	-16.3	-11.9	-4.4	
Wood Thrush	78	72.6	-6.9	79.5	PIF Continental Watch
American Robin	89	7.5	3.7	3.8	
Gray Catbird	185	63	7.4	55.6	
Brown Thrasher	100	-48.6	10.5	-59.1	PIF 2A in several BCRs
Cedar Waxwing	98	67.3	-3.5	70.8	
Blue-winged Warbler	NM	>100	-8.1	>100	PIF Continental Watch
Golden-winged Warbler	114	17.2	-1.5	18.7	PIF Continental Watch
Tennessee Warbler	79	-34.6	-11.6	-23	
Nashville Warbler	89	-5.9	2.4	-8.3	
Northern Parula	73	-4.4	-18	13.6	
Yellow Warbler	127	8	-2.2	10.2	
Chestnut-sided Warbler	127	-1.1	-4.5	3.4	
Magnolia Warbler	86	-33.1	-16.2	-16.9	
Cape May Warbler	98	-32.1	-28.3	-3.8	PIF 1 in BCR 12
Black-throated Blue Warbler	83	72.5	-3.6	76.1	PIF 1 in BCR 12
Yellow-rumped Warbler	80	51.4	-22.9	74.3	
Black-throated Green Warbler	82	-26.7	-12.3	-14.4	
Blackburnian Warbler	94	-53.8	-17.9	-35.9	
Pine Warbler	85	-54.3	-38.5	-15.8	
Palm Warbler	62	11.7	3.1	8.6	
Bay-breasted Warbler	78	>100	-33.9	>100	PIF Continental Watch
Cerulean Warbler	NM	30.8	-3.5	34.3	MN Special Concern
Black-and-white Warbler	95	-62.1	1.1	-63.2	
American Redstart	120	42	1.3	40.7	
Prothonotary Warbler	NM	91.8	-9.9	>100	PIF Continental Watch
Ovenbird	104	-14.4	-10.1	-4.3	
Northern Waterthrush	88	-36.9	-9.8	-27.1	
Louisiana Waterthrush	NM	>100	-8.2	>100	MN Special Concern
Connecticut Warbler	75	-48.4	1.4	-49.8	PIF 1 in BCR 12

Common Name	Percent RNV midpoint in 2000	1990 to 2000 Population change	Population change due to habitat	Population change due to density change	Status
Mourning Warbler	125	-29.8	4	-33.8	
Common Yellowthroat	87	30	18.2	11.8	
Hooded Warbler	NM	-4.7	-4.7	0	MN Special Concern
Wilson's Warbler	107	42.6	42.6	0	
Canada Warbler	87	-54.2	2.5	-56.7	PIF Continental Watch
Yellow-breasted Chat	NM	-33.3	-33.3	0	
Scarlet Tanager	124	-11	-13.7	2.7	
Eastern Towhee	134	-30.2	40.6	-70.8	
Chipping Sparrow	97	-26.9	-11	-15.9	
Song Sparrow	159	0.9	9.1	-8.2	
Lincoln's Sparrow	105	53.2	28.6	24.6	
White-throated Sparrow	84	-38.6	-3.4	-35.2	
Dark-eyed Junco	82	-4.3	0.9	-5.2	
Northern Cardinal	NM	35.6	-9.4	45	
Rose-breasted Grosbeak	116	-11.4	2.9	-14.3	PIF 2A in BCR 12
Indigo Bunting	145	-24.5	3.8	-28.3	
Rusty Blackbird	NM	-31.5	-31.5	0	PIF Continental Watch
Common Grackle	126	9.2	16.4	-7.2	
Brown-headed Cowbird	133	-25.1	4.9	-30	
Orchard Oriole	NM	-10	-10.1	0.1	
Baltimore Oriole	145	-28.9	-4.4	-24.5	
Purple Finch	101	-43	-14.9	-28.1	PIF 2A in BCR 12
Red Crossbill	74	>100	-18.5	>100	
White-winged Crossbill	98	>100	-20.9	>100	
Pine Siskin	76	-57	-32.8	-24.2	
American Goldfinch	135	16.4	9.3	7.1	
Evening Grosbeak	85	-68.7	-33.9	-34.8	

NM=no RNV model, PIF=Partners in Flight, BCR=Bird Conservation Region, percent RNV midpoint is percent of a species current population relative to its historic RNV midpoint population for the Drift and Lake Plains and Northern Superior Uplands sections in northern Minnesota. Species in bold are those below midpoint RNV and with population declines >25 percent over the past decade.

As Table E-1 notes, over 100 (101) species had a negative change in their population from 1990 to 2000 due to changes in habitat availability based on FIA data. Thirteen of these species had a significant decrease in population attributed to a decrease in habitat. Eight species with significant population decreases are primarily affiliated with mature conifer habitat (e.g., Evening Grosbeak, Pine Siskin, Pine Warbler). Three species that had significant increases in population attributed to habitat availability are primarily associated with early-successional forests (Eastern Towhee, Lincoln's Sparrow and Wilson's Warbler). Changes in species populations attributed to changes in habitat availability reflected differences in amounts of habitat types and ages in Minnesota timberland from the 1990 to 2000 FIA data (see Kilgore et al. 2005).

Almost 100 (97) species had changes in overall population from 1990 to 2000 that were attributed to a change in population density. Almost an equal number of species increased in population due to an increase in density (49 species) or to a decrease in density (48). Twenty-nine species had significant increases in population from 1990 to 2000 due to density increases and 13 species had a significant overall decline in population because their densities decreased from 1990 to 2000.

Species trend information was summarized for predicted 2000 and current 2000 populations for 95 species that had good density estimates in either or both 1990 and 2000 (see Kilgore et al. 2005) by major habitat guilds. Thirteen of 20 species that prefer upland conifer forest habitats decreased and four increased in abundance from 1990 to 2000. The decrease in abundance of seven species was due primarily to a decrease in habitat, but no species that increased did so in response to an increase in habitat. Almost an equal number of species increased (five) or decreased (seven) in abundance from 1990 to 2000 because their densities changed. Seven of thirteen lowland conifer bird species declined and two species increased in population from 1990 to 2000. Only one species increased in abundance because of a change in available habitat and four species declined in abundance because their densities were lower in 2000 than in 1990. It was found that 25 of 35 species in the deciduous forest habitat guild either increased (15) or decreased (10) in population from 1990 to 2000. The reason for the difference between 1990 and 2000 populations was due to changes in bird densities. All of the species that increased had significant increases in abundance from 1990 to 2000. Eleven of 27 early-successional bird species increased and six species decreased. One of the species' populations increased because of an increase in available habitat, but most of the changes in population were due to changes in bird density from 1990 to 2000. Eight species decreases were attributed to a decline in density and eight species densities increased from 1990 to 2000 leading to a significant population increase.

1.1.3.2 Comparison of GEIS Predictions versus Current Conditions

Only 43 percent of all 2000 predicted populations and current 2000 populations were in agreement. The Mourning Dove was the only species where the GEIS predicted a significant increase in population and a significant increase was observed (Kilgore et al. 2005). Two species, the Lincoln's Sparrow and Eastern Towhee showed the opposite significant difference from what the GEIS predicted (Towhee now declining and Sparrow now increasing). For three species (American Black Duck, American Kestrel and Golden-winged Warbler), the GEIS predicted significant increases in population whereas a non-significant change was found. More species (41 total) have current populations that are $\geq$25 percent lower than they were in 1990 and were predicted to have non-significant changes. In addition, 31 species increased in population by $\geq$25 percent from 1990 to 2000 and were projected to have non-significant population trends.

1.1.3.3 Reasons for Differences Between Current and GEIS Projected Populations

Because bird population estimates are arithmetic products of bird density in each habitat where it occurs and amount of each habitat, disagreements between predictions and observations in year 2000 can be attributed to either a change in the amount of habitat or to bird density values. Changes in FIA data in addition to changes made in bird density affected population calculations of individual bird species differently. For some species the majority of the difference in population can be attributed to changes in

their densities between 1990 and 2000. For other species, the reason for their significant increase or decrease was due primarily to the difference in 2000 FIA data (suitable habitat change). In addition, there were species that had decreases in amount of habitat and increases in densities (or vice versa) and their populations in 2000 were affected by both factors.

As predicted, changes in habitat availability from 1990 to 2000 impacted groups of species differently depending on direction and relative amount of change in acres among habitat types. On average, 65 of 95 species populations (good data criteria; see Kilgore et al. 2005) decreased in abundance by 11.6 percent due to a change in available habitat. In contrast, 30 species populations increased an average of 7.6 percent because their preferred habitat increased. Although amount of early-successional habitat increased by 13 percent from 1990 to 2000, only one of 17 early-successional species showing a significant population increase or decrease could be attributed to change in amount of early-successional habitat. Amount of suitable habitat for the Eastern Towhee increased significantly from 1990 to 2000, but a much larger decrease in its density resulted in an overall significant decrease for this species.

Similar results were found for birds within the lowland conifer and upland deciduous forest habitat guilds. A slight increase in acres of lowland conifer forest (6 percent) was observed from 1990 to 2000 and one species, the Lincoln's Sparrow increased in abundance because of an increase in lowland conifer habitat. The amount of upland deciduous habitat in 2000 increased by 3 percent over the GEIS first decade predicted acres and was slightly lower (3 percent) than it was in 1990. No birds that prefer upland deciduous forest had significant changes in abundance attributed to a change in habitat availability.

Acres of upland conifer forest decreased by 41 percent in 2000 compared to 1990 and by 39 percent over the GEIS first decade predicted amount. This habitat type had the biggest change in acres and as a result, several differences were observed in species changes (predicted versus observed) in birds associated with upland conifer habitat. Of the 13 upland conifer associated species that decreased from 1990 to 2000, seven were due primarily to changes in habitat availability.

Changes made in species densities in the bird/habitat model from 1990 to 2000 also contributed to differences between 1990 and first decade GEIS predictions and 1990 and 2000 observed population trends. Because density change was not modeled in the original GEIS projections, it is not surprising that differences between predicted and observed population trends were observed. What is surprising is the magnitude of population change that has occurred in the past decade that is due to decreasing or increasing densities. When species that had population changes greater than 500 percent are excluded, 47 species decreased on average by 27 percent and 44 species had increases that averaged 48 percent. Large changes in densities from 1990 and 2000 accounted for many differences between the GEIS predicted 2000 and current 2000 bird species populations. These species have either significant increasing or decreasing trends from NRRI's monitoring program or from BBS (Lind et al. 2005; Sauer et al. 2004).

1.1.3.4 Species Trends in the Context of RNV

The degree to which forest cover types in the DLP and NSU ecosections deviate from their range of natural variation midpoint population also varies by forest ecosystem type. In general, current forests are younger in age, have a smaller amount of conifer tree basal area, and there are fewer acres of conifer forest today then what was present on the landscape 100s to 1000s of years ago (see Brown et al. 2005). It is not surprising that many bird species that have current populations below their RNV midpoint are associated with upland conifer forest types. Comparison of FIA data between 1990 and 2000 indicate that the trend of decreasing conifers in Minnesota continues at an alarming rate. Acres of upland conifer forest decreased by 41 percent in 2000 compared to 1990. More than half (11 of 24 species) of bird species with populations below their midpoint RNV and that declined in population from 1990 to 2000 are associated with upland conifer forests (Table E-1). In the Drift and Lake Plains (DLP) 47 species have populations that are currently below their midpoint RNV population (Exhibit E-2). Forty-six species in the Northern Superior Uplands (NSU) have populations that are currently below their midpoint (Exhibit E-3) and for both sections, 49 species current populations are below their midpoint RNV population (Exhibit E-4); note that these results are different than those in the Report Card Study because a different forest base was used to calculate RNV here).

1.1.3.5 Species of Concern Based on Population Change and RNV Population

Population projections made for forest birds by the GEIS are problematic and unreliable for assessing current and future population conditions. Twenty-four species were projected to decline more than 25 percent in population from 1990 to 2000 and have populations below their midpoint RNV population (for those with RNV estimates). The response of these 24 species should be considered carefully when assessing forest harvest impacts into the future. See Table E-1 for identification of species of concern.

In summary, populations of 75 of 136 bird species significantly (>25 percent) increased or decreased from 1990 to 2000. Thirty-three species had significant increases and 42 species populations declined significantly. Forest management activities projected into the future should consider habitat needs of 24 bird species that were projected to decline more than 25 percent from 1990 to 2000 and have populations below their midpoint RNV population (for those with RNV estimates). Three special concern, threatened and endangered species, the Bald Eagle, Red-shouldered Hawk and Loggerhead Shrike were projected to decrease by >5 percent from 1990 to 2000.

1.1.4 RESULTS: PROJECTED POPULATION CHANGE UNDER NO-BUILD ALTERNATIVE

1.1.4.1 Statewide Change[4]

Six bird species (4.4 percent) were projected to decrease by $\geq$ 10 percent in Decade 1 under the No-Build Alternative (Exhibit E-1). The number of species projected to decline substantially increased in Decade 2

[4] Statewide change combines outputs from both the FIA-based and RNV-based models.

to 7 species (5.2 percent), 12 species (8.8 percent) were projected to decrease by ≥10 percent in Decade 3, and in Decade 4, 14 species (10.3 percent) were projected to decline under the No-Build Alternative. The potentially affected species are listed below in Table E-2.

Individual species projected to decline were similar for under both derivative private ownership scenarios (e.g., high availability versus lower availability) over the four decades (Exhibit E-1). The Great Gray Owl and Boreal Owl were projected to decrease by ≥10 percent in all decades for both scenarios. The Bald Eagle and Tree Swallow were projected to decline in Decades 2, 3 and 4 for both scenarios. The Black Duck, Cooper's Hawk, Tree Swallow, Yellow Warbler and Song Sparrow were projected to decline for more than two decades under both scenarios. Other species were projected to decline for either one or two decades for either scenario with most impacts evident in either Decade 3 or 4.

Two special concern, threatened and endangered species, the Bald Eagle and Red-shouldered Hawk were projected to decline by ≥5 percent for the No-Build Alternative at all decades except Decade 1 for Bald Eagle (Exhibit E-1).

Table E-2
Listing of Species Projected with ≥10 Percent Population Declines per Decade
Under No-Build Alternative

Decade 1	Decade 2	Decade 3	Decade 4
American black duck Cooper's hawk Great gray owl Boreal owl Bell's vireo Yellow-breasted chat	American black duck Sharp-shinned hawk Cooper's hawk Great gray owl Boreal owl Tree swallow Song sparrow	American black duck Bald eagle Sharp-shinned hawk Cooper's hawk Great gray owl Boreal owl Tree swallow Gray catbird Blue-winged warbler Yellow warbler Song sparrow American goldfinch	American black duck Bald eagle Sharp-shinned hawk Great gray owl Boreal owl Tree swallow Gray catbird Blue-winged warbler Yellow warbler Song sparrow Indigo bunting Common grackle American goldfinch

On a habitat guild level, a smaller proportion of species associated with deciduous, coniferous and mixed upland forests were projected to decline (note that decline in the guild context refers to individual species declines from current population) from their current population. The opposite pattern was observed for lowland conifer and early-successional bird species. The proportion of species projected to decline for these two habitat guilds increased from Decade 1 to Decade 4; see Table E-3.

Table E-3

Percentage of Bird Species with Negative Statewide Population Changes for Four Habitat Guilds by Decade Under No-Build Alternative (compared to current condition)

	Number of species	Decade	Percentage
Upland Conifer	22	1	32
	22	2	18
	22	3	18
	22	4	18
Upland Deciduous	38	1	63
	38	2	53
	38	3	55
	38	4	58
Early Successional	12	1	42
	12	2	58
	12	3	75
	12	4	75
Lowland Conifer	13	1	15
	13	2	31
	13	3	23
	13	4	15
Upland Mixed	10	1	70
	10	2	50
	10	3	50
	10	4	40

For example, in Decade 1 some 32 percent of upland conifer associated bird species populations decreased from their current population (all species declines are noted, not just declines at the ≥10 percent reporting criteria).

1.1.4.2 RNV Change[5]

Each species of forest bird's population can be viewed as moving "toward" or "away" from its midpoint RNV population over the 40-year study period relative to the current condition. This movement can be expressed as a ratio between the number of species moving toward the midpoint RNV population versus the number of species moving away; see Table E-4. In the DLP, the ratio of species that had populations that moved toward midpoint RNV was higher than moved away for all decades under the No-Build Alternative. The same results apply to the NSU ecosection. Private land availability had little or no effect across both the NSU and DLP.

[5] RNV projections are for forest bird populations in the Drift and Lakes Plains and Northern Superior Highlands ecosections only.

Table E-4
Ratio of Species Moving Away or Toward RNV Midpoint Value
Compared to Current Condition

Region	Decade	Ratio
DLP	1	2.2
DLP	2	2.2
DLP	3	3.2
DLP	4	4.9
DLP+NSU	1	2.5
DLP+NSU	2	2.8
DLP+NSU	3	3.6
DLP+NSU	4	3.8
NSU	1	1.8
NSU	2	2.2
NSU	3	2.4
NSU	4	2.2

Values in cells equal the ratio of [number of species closer to the RNV midpoint at decade x at current conditions]: [number of species further from RNV at decade x compared to current conditions]. So, a value > 1.0 means that more species were closer to RNV after the time step than they are currently. Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) alone and together for four decades.

For the DLP section, a higher proportion of species moved into the below midpoint RNV category compared to the current condition in all decades. In the NSU, the No-Build Alternative resulted in a small proportion of species moving below their midpoint RNV population compared to the current condition. For the two sections combined, a higher proportion of species were projected to fall below their midpoint RNV under the No-Build Alternative for the next four decades under the current harvest level (compared to current condition).

Results for the 24 species of concern in both the DLP and NSU indicated that the No-Build Alternative reduced the number of species that had populations below their midpoint RNV population (see Table E-5). In Decade 4, three fewer of these 24 concern species were projected to be below their RNV midpoint; see Table E-6 for the number of species by decade remaining below the midpoint RNV value.

In summary, under the No-Build Alternative six bird species were projected to decrease statewide by $\geq$ 10 percent in Decade 1. In Decade 4, 14 species were projected to decline under the No-Build Alternative. One special concern, threatened and endangered species was projected to have statewide population changes exceeding 5 percent (Bald Eagle), while the Red-shouldered Hawk was projected to remain below its RNV midpoint population in northern Minnesota. Harvest under current conditions would result in no substantial improvement in species RNV status in northern Minnesota. Approximately 35 percent of species will remain below their midpoint RNV value at Decade 4, and 21 of 24 species of concern were projected to have populations below their RNV midpoint into Decade 4.

Table E-5
Percentage of Species Remaining Below Midpoint RNV Value
Currently and for Four Decades under No-Build Alternative

Region	Decade	Percentage
DLP	0	34.6
DLP	1	36.0
DLP	2	33.8
DLP	3	34.6
DLP	4	33.8
DLP+NSU	0	36.0
DLP+NSU	1	37.5
DLP+NSU	2	36.0
DLP+NSU	3	36.0
DLP+NSU	4	35.3
NSU	0	33.9
NSU	1	34.6
NSU	2	30.1
NSU	3	31.6
NSU	4	30.9

Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) alone and together for four decades.

Table E-6
Number of 24 Species of Concern Remaining Below Midpoint RNV Value
Currently and for Four Decades under No-Build Alternative

Region	Decade	Number of Species
DLP+NSU	0	24
DLP+NSU	1	23
DLP+NSU	2	24
DLP+NSU	3	22
DLP+NSU	4	21

Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) together for four decades.

1.1.5 RESULTS: PROJECTED POPULATION CHANGE UNDER BUILD ALTERNATIVE

1.1.5.1 Statewide Change

Six bird species were projected to decrease by $\geq$ 10 percent in Decade 1 under the Build Alternative (Exhibit E-1). The number of species projected to decline at the reporting criteria decreased in Decade 2 to five species, but increases to nine species in Decade 3. Fourteen forest bird populations are projected to decrease by $\geq$ 10 percent in Decade 4 of the study period. Species projected to decline were similar under both sets of private ownership assumptions. The percent of species projected to decline increased

over the four decades for both the Build and No-Build Alternatives; see Table E-7. See Table E- 8 for the listing of potentially affected species.

Table E-7
Percentage of Species with ≥10 Percent Population Declines per Decade
For Build and No-Build Alternatives

Alternative	Decade			
	1	2	3	4
No-Build	4.4	5.2	8.1	9.6
Build	4.4	3.7	6.6	10.3

Table E- 8
Listing of Species Projected with ≥10 Percent Population Declines per Decade under Build Alternative

Decade 1	Decade 2	Decade 3	Decade 4
American black duck Cooper's hawk Great gray owl Boreal owl Bell's vireo Yellow-breasted chat	American black duck Sharp-shinned hawk Cooper's hawk Great gray owl Boreal owl	American black duck Bald eagle Sharp-shinned hawk Cooper's hawk Great gray owl Boreal owl Tree swallow Blue-winged warbler Song sparrow	American black duck Bald eagle Sharp-shinned hawk Great gray owl Boreal owl Bell's vireo Tree swallow Gray catbird Blue-winged warbler Yellow warbler Yellow-breasted chat Song sparrow Indigo bunting American goldfinch

On a species level, a comparison of impacts between No-Build Alternative and Build Alternative model projections indicated few differences in reported declines. More species/decade declines were observed with the No-Build Alternative for Decade 1, primarily for early-successional species like the Tree Swallow, Gray Catbird and Song Sparrow. For example, the Song Sparrow was projected to decline significantly under the No-Build Alternative at Decade 2 but not at the Build Alternative harvest level at the same decade. In contrast, the No-Build Alternative model predicted that more early-successional species like Yellow Warbler, Song Sparrow, Rose-breasted Grosbeak and Common Grackle would decline in later decades.

Build Alternative bird habitat guild responses (relative to the No-Build Alternative) were similar regardless of ownership constraints; see Table E-9. Proportion of upland conifer, early successional and mixed forest bird species projected to decline decreased from Decade 1 to 4. Proportion of upland deciduous forest species projected to decline was higher for the Build Alternative in all decades but the fourth. In contrast, proportion of lowland conifer species projected to decline was lower in Decades 1 and 2, but higher in Decade 4 for the Build Alternative.

Table E-9

Percentage of Bird Species with Negative Statewide Population Changes for Four Habitat Guilds by Decade and Alternative (compared to current condition)

	Number of species	Decade	No-Build	Build
Upland Conifer	22	1	32	27
	22	2	18	18
	22	3	18	18
	22	4	18	18
Upland Deciduous	38	1	63	66
	38	2	53	58
	38	3	55	61
	38	4	58	58
Early Successional	12	1	42	42
	12	2	58	58
	12	3	75	58
	12	4	75	75
Lowland Conifer	13	1	15	8
	13	2	31	23
	13	3	23	23
	13	4	15	23
Upland Mixed	10	1	70	70
	10	2	50	50
	10	3	50	50
	10	4	40	40

For example, in Decade 1 for the No-Build Alternative, 32 percent of upland conifer associated bird species populations decreased from their current population (all species declines are noted, not just reported declines e.g. ≥10 percent).

Two special concerns, threatened and endangered species, the Bald Eagle and Red-shouldered Hawk were projected to decline by ≥ 5 percent for the Build Alternative. Results were the same for the No-Build and Build Alternatives.

1.1.5.2 RNV Change

In the DLP, the Build Alternative was slightly better at moving species toward RNV than the No-Build Alternative in Decade 1. For the NSU, the No-Build Alternative was better (i.e., moving toward RNV) than the Build Alternative in Decades 1 and 2, but the reverse was true for Decades 3 and 4. For the DLP and NSU combined the Build Alternative was better than the No-Build Alternative for Decades 1, 2 and 3, but the RNV outcomes were similar at Decade 4; see Table E-10 and Table E-11 and Exhibits E-2 through E-4.

Table E-10
Ratio of Species Moving Away or Toward RNV Midpoint Value
No-Build and Build Alternatives Compared to Current Condition

Region	Decade	No-Build	Build
DLP	1	2.2	1.9
DLP	2	2.2	2.2
DLP	3	3.2	3.2
DLP	4	4.9	4.9
DLP+NSU	1	2.5	2.1
DLP+NSU	2	2.8	2.7
DLP+NSU	3	3.6	3.4
DLP+NSU	4	3.8	3.8
NSU	1	1.8	2.0
NSU	2	2.2	2.3
NSU	3	2.4	2.3
NSU	4	2.2	2.1

Values in cells equal the ratio of [number of species closer to the RNV midpoint at decade x at current conditions]: [number of species further from RNV at decade x compared to current conditions]. So, a value > 1.0 means that more species were closer to RNV after the time step than they are currently. Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) alone and together for four decades.

Results for the DLP and NSU for RNV species impacts were almost identical in the Build and No-Build Alternatives regardless of private land availability. Neither alternative significantly reduced the proportion of species that have current populations below their midpoint RNV in any decade.

Table E-11
Percentage of Species Remaining Below Midpoint RNV Value
Currently and for Four Decades

Region	Decade	No-Build	Build
DLP	0	34.6	34.6
DLP	1	36.0	36.0
DLP	2	33.8	33.8
DLP	3	34.6	34.6
DLP	4	33.8	33.8
DLP+NSU	0	36.0	36.0
DLP+NSU	1	37.5	37.5
DLP+NSU	2	36.0	36.8
DLP+NSU	3	36.0	36.8
DLP+NSU	4	35.3	35.3
NSU	0	33.9	33.9
NSU	1	34.6	34.6
NSU	2	30.1	31.2
NSU	3	31.6	30.9
NSU	4	30.9	30.0

Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) alone and together for four decades.

For the 24 species of concern in the DLP and NSU, the No-Build Alternatives resulted in better condition for a small number of these species in Decades 3 and 4 compared to the Build Alternative (Table E-12).

Table E-12
Number of 24 Species of Concern Remaining Below Midpoint RNV Value Currently and for Four Decades

Region	Decade	No-Build	Build
DLP+NSU	0	24	24
DLP+NSU	1	23	23
DLP+NSU	2	24	23
DLP+NSU	3	22	23
DLP+NSU	4	21	22

Results are reported for Northern Superior Uplands (NSU) and Drift and Lake Plains (DLP) together for four decades.

In summary, for the Build Alternative model projections, six bird species were projected to decrease by > 10 percent in Decade 1. The number of species projected to decline increased over the four decades to 14 species. One special concern, threatened and endangered species was projected to have statewide population changes exceeding 5 percent (Bald Eagle) and the Red-shouldered Hawk was projected to remain below its RNV midpoint population in northern Minnesota. Harvest under this Build Alternative would result in no substantial improvement in species RNV status in northern Minnesota. Approximately 35 percent of species will remain below their midpoint RNV value at Decade 4, and 22 of 24 species of concern were projected to have populations below their RNV midpoint into Decade 4.

1.1.6 RESULTS: ADDITIONAL INSIGHTS FROM FOREST BIRD POPULATION MODELING

The Final Scoping Decision required the DEIS to evaluate the environmental consequences of a No-Build and Build Alternative. As noted in DEIS Appendix C, modeling of forest conditions included several derivative Build and No-Build scenarios; these outputs were examined in the forest bird population models. Although not required by the Final Scoping Decision, this section provides insights from this additional modeling.

1.1.6.1 Species Substitution

Statewide Change

Regardless of private land availability, the proportion of bird species that were projected to decline over four decades within habitat guilds were almost identical for the Build and No-Build Alternatives.

RNV Change

Under the Build Alternative with species substitution, seven bird species were projected to decrease by ≥ 10 percent in Decade 1 regardless of private land availability. The number of species projected to decline increased over the four decades. One special concern, threatened and endangered species was projected

to have statewide population changes exceeding 5 percent (Bald Eagle) and the Red-shouldered Hawk was projected to remain below its RNV midpoint population in northern Minnesota. Harvest under the Build Alternative would result in no substantial improvement in species RNV status in northern Minnesota. Approximately 35 percent of species will remain below their midpoint RNV value (under both private land availability assumptions) at Decade 4, and 22 of 24 species of concern were projected to have populations below their RNV midpoint into Decade 4.

1.1.6.2 Spruce-fir Substitution

Statewide Change

All modeling under the derivative spruce-fir substitution occurred under the low availability of private lands assumption. Six bird species were projected to decrease by > 10 percent in Decade 1. The number of species projected to decline significantly increased in Decades 2 and 3 to 11 species. In Decade 4, 18 species were projected to decline (Exhibit E-1).

The pattern of response within bird habitat guilds between the No-Build and Build Alternatives indicated that more conifer-associated species were projected to decline for Decades 1 and 2 in the Build Alternative compared to the No-Build Alternative. In contrast, proportion of deciduous associated species projected to decline was lower in the Build than the No-Build Alternative for all decades. In addition, the proportion of early-successional species projected to decrease was higher in Decade 3 for lowland conifer species and higher in Decade 1 for species associated with mixed forests for the Build Alternative versus No-Build Alternative.

RNV Change

Results for this model for the DLP indicated that the Build Alternative was better at moving species toward their RNV midpoint population than the No-Build Alternative at all decades. In the NSU, the same result was found except for Decade 4, where the No-Build Alternative was better than the Build Alternative. When the NSU and DLP were combined, the results were the same as for the NSU alone; more species moved toward their RNV benchmark in the Build Alternative than the No-Build Alternative for Decades 1, 2 and 3(Exhibit E-2 and Exhibit E-4).

Under the Build Alternative with higher use of spruce-fir, six bird species were projected to decrease by > 10 percent in Decade 1. The number of species projected to decline increased over the four decades to 18 species. One special concern, threatened and endangered species was projected to have statewide population changes exceeding 5 percent (Bald Eagle) and the Red-shouldered Hawk was projected to remain below its RNV midpoint population in northern Minnesota. Harvest under this Build Alternative would result in no substantial improvement in species RNV status in northern Minnesota. Approximately 35 percent of species will remain below their midpoint RNV value (regardless of high or low availability of private lands at Decade 4), and 22 of 24 species of concern were projected to have populations below their RNV midpoint into Decade 4.

1.1.6.3 Methods for Mammals, Reptiles and Amphibians

The habitat matrix from the GEIS Wildlife Technical Paper was used for reptiles and amphibians (Jaakko Pöyry 1992, Table 3.8). This matrix specifies reptiles and amphibians habitat suitability indexes based on acreage of forest that is at least 20 years old for the appropriate forest types statewide. For small and medium mammals, the GEIS used three matrices, one for recent clearcuts, and one each for productive and unproductive forestlands. In these matrices, each forest type and size class (sapling, pole, sawtimber) was assigned a weighting factor reflecting habitat value for each wildlife species. These weightings were 0, absent; 2, low; 5, medium; and 10, high. Some forest type and size class categories had two weightings depending on whether a site was moist, near agricultural fields, or had mast trees present (oak tree or white spruce). These weightings were multiplied by the appropriate acreages for a statewide habitat suitability index.

For this analysis the three matrices were incorporated into a single matrix in which the weightings were adjusted to reflect the proportion of acreage in each forest type that was unproductive or moist, and the recent clearcuts were included as a separate category within each cover type (i.e. less than 10 years old). The spatial constraints related to agricultural fields and presence of oak and spruce trees were dropped in this analysis due to the absence of spatial data and lack of ability to match up FIA plots with the analyses of forest change that had been used for the GEIS. In addition, Lee Frelich and Peter Jordan (the latter devised the original deer, moose and bear analyses for the GEIS) devised a new habitat weighting matrix for a statewide analysis of white-tailed deer, moose, and black bear. The previous analyses for the GEIS used detailed spatial analyses on a township basis, and that was not possible here. The final habitat matrix for small mammals and deer, moose and bear, and the table that allowed conversion of age class data from the forest change analysis to size class (Table E-13). Note that the assumptions are made that moist stands, unproductive stands, age classes, and interspersion of conifers and deciduous stands in northern Minnesota are random and occur throughout the landscape. No statewide analyses in the absence of spatially explicit harvesting scenarios are possible without this assumption.

1.1.6.4 Mammal, Reptiles and Amphibians Habitat Model Strengths and Limitations

The model used to conduct the analysis of potential changes in habitat suitability for forest-dwelling mammals, reptiles, and amphibians from timber harvest has both strengths and limitations.

Strengths

- It can be applied on a statewide basis using the 2001 FIA dataset and forest change model outputs (e.g., forest cover type and tree size class).
- The model construct relates directly to comparison with the GEIS's significance criterion, where an impact is considered significant if the available habitat of a species is projected to change by 25 or more percent.
- The model also is a logical way to make use of limited knowledge of mammal and reptile and amphibian use of habitats on a statewide basis; the model makes a minimal number of assumptions compared to more complex models.

Limitations

- Retention of data uncertainties imbedded in the FIA data and forest projection model outputs.
- The spatial complexity of animal habitats, which is important to a number of species, is poorly addressed. The model is limited in that it only provides information on how much poor, good, and very good habitat is available for a given species, not the degree to which that habitat is actually used by a given species, or the number of individuals that are present in the state.

Each of these factors is considered in the impact assessment.

Table E-13

Wildlife Habitat Matrix

Forest type	Size class	Snowshoe hare	Eastern chipmunk	Least chipmunk	Red squirrel	Gray squirrel	Fox squirrel	S. flying squirrel	N. flying squirrel	Beaver	Woodland deer mouse	White-footed mouse	S. red-backed vole	Meadow vole	Meadow jumping mouse	Woodland jumping mouse	Porcupine	Red fox	Gray fox	Marten	Fisher	Lynx	Bobcat	White-tailed deer	Moose	Black bear
Jp	cc	2	5	10	0	0	0	0	0	0	5	0	2	2	0	0	0	2	0	0	0	0	0	0	0	2
Jp	sap	2	5	2	0	0	0	0	0	0	2	2	2	0	0	0	0	2	0	0	2	2	2	0	0	0
Jp	pole	0	5	2	2	2	2	0	5	0	2	2	2	0	0	2	2	2	0	1	1	2	2	0	2	0
Jp	saw	0	10	0	5	2	2	0	10	0	2	2	2	0	0	2	2	2	2	9	4	2	2	2	2	2
Rp	cc	2	5	10	0	0	0	0	0	0	5	0	2	2	2	0	0	2	0	0	0	0	0	2	0	5
Rp	sap	2	5	2	0	0	0	0	0	0	5	2	2	0	2	0	0	2	0	0	2	2	2	0	0	0
Rp	pole	0	5	2	5	2	2	0	5	0	10	2	2	0	0	2	2	2	0	1	3.5	2	2	0	2	0
Rp	saw	0	10	0	10	2	2	0	5	0	10	2	2	0	0	2	2	2	2	7.5	3.5	2	2	2	2	2
Wp	cc	2	5	10	0	0	0	0	0	0	5	0	2	2	2	0	0	2	0	0	0	0	0	5	0	5
Wp	sap	2	5	2	0	0	0	0	0	0	5	2	2	0	2	0	2	2	0	0	0	2	2	0	2	2
wp	pole	0	5	2	5	2	2	2	5	0	10	2	2	0	0	2	10	2	0	2	2	2	2	0	2	2
wp	saw	0	10	0	10	2	2	2	5	0	10	2	2	0	0	2	10	2	2	10	10	2	2	5	5	10
sf	cc	5	10	10	0	0	0	0	0	0	2.5	0	4.5	4.5	2	0	0	2	0	0	0	2	2	2	5	2
sf	sap	9	4	0.5	0	0	0	0	0	0.3	4.5	2	2	0.3	2.5	0.3	0	2	0	0	0.6	9	9	0	2	2
sf	pole	9	0.5	0.5	3	0	0	0	5	0.3	5.5	2	3	1.5	0.3	2.5	2	2	0	2	2	9	9	0	2	2
sf	saw	9	0	0	4	0	0	0	9	0.3	9.25	2	3	1.5	0.3	2.5	2	2	0	9.8	9.8	9	9	2	5	2
oak	cc	2	0	0	0	0	0	0	0	0	2	2	2	0	0	0	0	5	2	0	0	0	0	10	0	2
oak	sap	2	10	2	0	2	2	5	2	0	2	10	2	0	2	0	2	5	5	0	0	2	2	5	0	2
oak	pole	2	10	2	2	10	10	10	5	0	2	10	2	0	0	2	5	5	10	0	0	2	2	5	0	5
oak	saw	2	10	0	5	10	10	10	5	0	5	10	2	0	0	2	5	2	10	0	0	2	2	10	0	10
nhwd	cc	2	2	2	0	0	0	0	0	0	2	2	2	2	2	0	0	5	2	0	0	0	0	10	2	2
nhwd	sap	2	2	2	0	0	0	0	0	0	5	5	2	0	2	2	5	5	2	0	2	0	0	2	0	2
nhwd	pole	2	2	0	2	5	5	5	2	0	5	5	2	0	0	2	10	5	5	0	2	0	0	2	0	2
nhwd	saw	2	5	0	2	5	5	10	2	0	5	10	2	0	0	2	10	2	10	2	5	0	0	5	2	5
asp	cc	2	2	4.5	0	0	0	0	0	0	2	2	2	0	0	4	0	0	4.5	2	0	0	0	1.5	10	5	2
asp	sap	2.5	4.5	5	0	0	0	0	0	10	2	5	5	0	5	2	1.8	5	4.5	0	2	0	2	2	2	2
asp	pole	2.5	9	0	2	1	1	4.5	2	5	4.5	10	5	0	2	2	4.5	5	4.5	2	2	0	2	2	2	2
asp	saw	2.5	9	0	2	1	1	4.5	2	2	9	10	5	0	0	2	4.5	2	9	5	5	0	2	5	2	5
pbirch	cc	2	5	5	0	0	0	0	0	2	2	2	0	0	2	0	0	5	2	0	0	0	0	10	5	2
pbirch	sap	2	5	5	0	0	0	0	0	5	2	2	5	0	2	2	0	5	2	0	2	0	2	2	2	2
pbirch	pole	2	10	0	2	1	1	5	2	5	5	10	5	0	0	0	2	5	2	2	2	0	2	2	2	2
pbirch	saw	2	10	0	2	1	1	5	2	2	10	10	5	2	0	0	2	2	5	5	5	0	2	5	2	5
lowspruce	cc	5	10	10	0	0	0	0	0	0	3.8	0	5	5	4	1	0	2	0	0	0	4	4	0	0	2
lowspruce	sap	7.75	0	0.55	0	0	0	0	0	1.1	3.35	2	3.7	3.35	3.35	0.55	0	2	0	0	3.7	10	10	0	2	2
lowspruce	pole	7.75	0	0	5	0	0	0	3.35	1.1	3.35	2	3.7	2	2	3.7	0	2	0	1.1	5	10	10	0	5	2
lowspruce	saw	7.75	0	0	10	0	0	0	7.25	1.1	3.35	2	3.7	1.1	1.1	3.7	0	2	0	3.35	7.75	10	10	0	5	2
tam	cc	2	2	2	0	0	0	0	0	0	2	0	5	10	5	2	0	0	0	0	0	2	2	0	0	2
tam	sap	5	0	0.9	0	0	0	0	0	1.1	3.35	2	10	1.1	5	2	0	0	0	0	2	2	2	0	2	0
tam	pole	3.7	0	0.9	3.7	0	0	0	2	1.1	3.35	2	10	2	5	2	0	0	0	0	10	2	2	0	2	0
tam	saw	3.7	0	0	3.7	0	0	0	5	1.1	3.35	3.35	10	2	2	2	0	0	0	2	10	2	2	0	2	2
lowhard	cc	2	0	0	0	0	0	0	0	0	2	2	2	5	5.5	2	0	2.3	2	0	0	0	0	10	0	2
lowhard	sap	2	2	2	0	0	0	0	0	2	2	10	2.3	0	5.5	2	0	2	5	0	2	2	2	2	0	2
lowhard	pole	2	2	2	2	0	0	5	2	2	2	10	2.3	0	2.3	5	5	2	10	2	2	2	2	2	0	2
lowhard	saw	2	5	0	2	0	0	5	2	0	2	10	2.3	0	2.3	5	5	2	10	5	2	2	2	5	0	5
cedar	cc	5	5	5	0	0	0	0	0	0	3	0	5	5	4	1.2	0	4	0	0	0	4	4	5	2	5
cedar	sap	10	0	2	0	0	0	0	0	1.2	3.2	2	5	1.2	3.8	1.2	0	2	0	0	2	10	10	2	2	2
cedar	pole	10	0	2	2	0	0	0	5	1.2	3.2	2	10	0	1.2	3.8	2	2	0	2	10	10	10	0	2	2
cedar	saw	10	0	0	10	0	0	0	10	1.2	3.2	2	10	0	1.2	3.8	2	2	0	10	10	10	10	5	5	5

EXHIBITS TO APPENDIX E: RESULTS OF FOREST BIRD MODELING

Four tables detailing bird population changes are provided:

Exhibit E-1 Projected changes in populations for 136 bird species across four decades for seven forest harvest models

Exhibit E-2 Range of natural variation values for bird species in the Drift and Lake Plains, comparison of scenarios and decades

Exhibit E-3 Range of natural variation values for bird species in the Northern Superior Uplands, comparison of scenarios and decades

Exhibit E-4 Range of natural variation values for bird species in the Drift and Lake Plains and Northern Superior Uplands, combined

Exhibit E-5 Endangered, Threatened, and Special Concern Plant Species List

Exhibit E-1: Projected changes in populations for 136 bird species across four decades for seven forest harvest models for Scenario A and B. This table displays Decades 1 and 2.

Common Name	Decade 1							Decade 2						
	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Double-crested Cormorant	-7	-4	-6	-4	-4	-4	-4	-2	-5	-2	-3	-5	-4	-4
Great Blue Heron	-2	-1	-2	-1	0	-1	-1	1	1	1	1	1	1	1
Great Egret	1	1	1	1	1	1	1	3	3	3	3	3	3	3
Green Heron	-6	-4	-6	-3	-2	-3	-3	-1	-3	-1	-3	-4	-2	-3
Black-crowned Night-Heron	-4	-2	-4	-2	-1	-2	-2	0	-3	0	-1	-3	-1	-2
Yellow-crowned Night-Heron	-5	-3	-5	-2	-2	-2	-2	0	-2	0	-1	-3	-1	-2
Turkey Vulture	-3	-3	-3	-3	-2	-3	-3	-2	-2	-2	-2	-3	-2	-2
Wood Duck	-1	0	-1	0	0	0	0	1	1	1	1	1	1	1
American Black Duck	-13	-10	-13	-8	-8	-10	-9	-21	-21	-23	-18	-19	-20	-19
Bufflehead	-8	-4	-8	-4	-3	-4	-4	-2	-6	-2	-4	-7	-4	-5
Common Goldeneye	3	3	4	4	4	4	4	2	1	1	2	3	2	1
Hooded Merganser	-5	-3	-5	-3	-2	-3	-3	-4	-5	-4	-5	-6	-5	-5
Common Merganser	-2	0	-1	0	0	0	0	-3	-4	-3	-3	-3	-3	-3
Osprey	-1	0	-1	1	2	0	1	2	2	2	2	1	2	1
Bald Eagle	-3	-1	-2	-3	-5	-1	-3	-15	-15	-14	-14	-12	-13	-13
Sharp-shinned Hawk	-8	-8	-8	-9	-9	-9	-9	-8	-9	-8	-9	-10	-10	-9
Cooper's Hawk	-10	-10	-11	-9	-7	-10	-9	-13	-13	-14	-12	-12	-14	-13
Northern Goshawk	-2	-1	-2	0	1	-1	0	5	5	6	2	1	5	3
Red-shouldered Hawk	-6	-5	-6	-4	-4	-5	-4	-6	-6	-6	-6	-6	-6	-6
Broad-winged Hawk	0	0	0	0	1	0	0	3	3	3	3	2	3	2
Red-tailed Hawk	0	0	0	-2	-4	-1	-2	-7	-7	-6	-7	-6	-6	-6
American Kestrel	37	23	36	19	16	21	20	6	21	10	14	21	15	18
Merlin	-3	-3	-3	-3	-3	-3	-4	-5	-2	-1	-4	-3	-4	-1
Mourning Dove	38	30	42	19	15	27	21	12	16	13	17	17	13	16
Black-billed Cuckoo	3	2	3	1	0	2	1	0	0	0	0	1	0	0
Yellow-billed Cuckoo	6	5	7	3	3	4	3	5	7	6	7	5	6	7
Eastern Screech-Owl	1	1	1	1	1	1	1	3	3	3	3	3	3	3
Great Horned Owl	-3	-2	-4	-2	-1	-2	-2	0	0	0	0	-1	0	0
Barred Owl	2	2	2	3	3	3	3	6	6	6	6	6	6	6
Great Gray Owl	-25	-25	-25	-24	-23	-25	-24	-37	-37	-37	-36	-36	-38	-36
Long-eared Owl	-4	-2	-4	-2	-1	-3	-2	0	-1	0	-1	-2	-2	-1
Boreal Owl	-14	-12	-13	-12	-12	-13	-12	-18	-19	-19	-18	-18	-20	-18
Northern Saw-whet Owl	0	1	0	1	-1	0	0	2	1	2	1	1	1	1
Whip-poor-will	1	0	1	0	0	0	0	-1	-1	-2	-2	-1	-1	-1
Chimney Swift	-1	0	-1	1	2	0	1	4	4	4	3	2	4	3
Ruby-throated Hummingbird	0	0	0	1	0	0	0	-1	-1	-1	-1	0	-1	-1
Red-headed Woodpecker	2	3	2	3	3	3	3	7	8	8	6	6	7	7
Red-bellied Woodpecker	-2	-2	-3	-1	-1	-2	-1	-2	-2	-2	-2	-2	-2	-2
Yellow-bellied Sapsucker	-5	-4	-5	-4	-3	-4	-4	-5	-5	-5	-5	-5	-5	-5
Downy Woodpecker	-2	-1	-2	-1	-1	-1	-1	-2	-2	-2	-2	-2	-2	-1

Exhibit E-1: Projected changes in populations for 136 bird species across four decades for seven forest harvest models for Scenario A and B. This table displays Decades 1 and 2.

Common Name	Decade 1							Decade 2						
	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Hairy Woodpecker	3	3	3	3	3	3	3	7	7	7	6	6	6	6
Three-toed Woodpecker*	8	8	8	8	8	8	8	4	4	4	4	8	4	4
Black-backed Woodpecker	2	3	2	3	2	3	2	1	2	2	1	0	0	1
Northern Flicker (Yellow-shafted)	4	4	4	3	1	3	3	2	2	2	2	2	2	2
Pileated Woodpecker	-3	-4	-3	-4	-3	-4	-3	1	-1	-1	-1	0	1	0
Olive-sided Flycatcher	7	6	7	6	7	7	6	4	5	4	6	5	6	6
Eastern Wood-Pewee	-3	-2	-3	-1	-1	-2	-1	-1	-1	-1	0	-1	-1	-1
Yellow-bellied Flycatcher	4	5	4	5	5	4	5	7	8	7	8	7	6	7
Acadian Flycatcher	3	3	3	3	3	3	3	8	8	8	8	8	8	8
Least Flycatcher	-4	-3	-4	-2	-1	-3	-2	-2	-2	-2	-2	-2	-2	-2
Eastern Phoebe	-1	-1	-1	-1	-1	-1	-1	-3	-3	-3	-3	-2	-2	-2
Great Crested Flycatcher	-4	-4	-4	-4	-4	-4	-4	-5	-5	-5	-5	-6	-5	-5
Loggerhead Shrike*	125	101	134	76	63	96	74	98	84	86	83	98	80	83
Bell's Vireo*	-58	-58	-58	-58	-48	-58	-58					-98		
Yellow-throated Vireo	-5	-4	-5	-3	-2	-4	-3	-3	-3	-3	-3	-3	-3	-3
Blue-headed Vireo	6	6	5	6	6	5	6	11	11	10	12	11	10	11
Warbling Vireo	-2	-1	-2	0	0	-1	0	2	1	2	2	1	2	1
Philadelphia Vireo	3	1	2	2	4	2	2	5	4	4	6	6	4	5
Red-eyed Vireo	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
Gray Jay	0	-1	0	-1	0	-1	-1	3	2	2	3	3	2	3
Blue Jay	-2	-1	-2	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1
Black-billed Magpie*	23	3	21	3	8	2	7	7	24	23	14	11	29	15
American Crow	-2	-2	-3	-1	-1	-2	-1	0	0	1	-1	-1	0	-1
Common Raven	6	7	6	7	7	6	7	11	11	10	12	11	10	11
Tree Swallow	30	19	33	14	10	17	13	-13	-6	-15	-17	-13	-13	-14
Black-capped Chickadee	-4	-4	-4	-3	-3	-4	-3	-4	-4	-4	-4	-4	-4	-4
Boreal Chickadee	2	2	2	1	1	1	1	0	0	1	0	0	-2	0
Tufted Titmouse (Eastern)	-2	-1	-2	-1	-1	-1	-1	-2	-2	-2	-2	-2	-2	-2
Red-breasted Nuthatch	1	1	1	2	2	1	2	5	4	5	5	5	4	4
White-breasted Nuthatch	-5	-4	-5	-3	-3	-4	-3	-4	-4	-3	-4	-5	-4	-4
Brown Creeper	1	1	0	1	1	1	1	4	3	3	3	3	3	3
House Wren	1	1	0	1	1	1	1	1	2	2	1	1	2	2
Winter Wren	2	2	2	3	3	2	3	5	5	5	5	5	4	5
Golden-crowned Kinglet	2	2	2	2	2	2	2	4	4	3	4	3	2	3
Ruby-crowned Kinglet	6	6	6	6	5	5	5	7	8	7	8	7	5	7
Blue-gray Gnatcatcher	1	1	1	1	1	1	1	2	2	2	2	2	2	2
Eastern Bluebird	17	14	19	8	6	13	9	6	7	7	7	8	8	7
Veery	-1	-1	-1	-2	-2	-1	-2	-3	-3	-3	-4	-4	-3	-3
Swainson's Thrush	3	3	3	3	3	2	3	4	5	4	5	5	4	4
Hermit Thrush	1	1	1	1	2	1	1	3	3	3	3	3	2	3

Exhibit E-1: Projected changes in populations for 136 bird species across four decades for seven forest harvest models for Scenario A and B. This table displays Decades 1 and 2.

Common Name	Decade 1							Decade 2						
	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Wood Thrush	-2	-2	-2	-2	-2	-2	-2	3	2	4	-1	-1	1	0
American Robin	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Catbird	14	12	16	5	-1	11	5	-6	-5	-4	-7	-4	-4	-5
Brown Thrasher	15	11	15	8	8	12	9	9	11	10	10	13	13	11
Cedar Waxwing	1	1	2	1	1	1	1	4	3	4	3	2	3	3
Blue-winged Warbler	-1	-1	-1	-1	-1	-1	-1	-3	-3	-3	-3	-3	-3	-3
Golden-winged Warbler	7	7	8	3	0	6	4	-3	-2	-1	-3	-1	-1	-1
Tennessee Warbler	3	4	3	4	4	4	4	6	6	6	6	6	5	6
Nashville Warbler	2	2	2	3	2	2	2	4	4	3	4	4	3	4
Northern Parula	4	4	3	4	4	3	4	9	9	9	8	8	8	8
Yellow Warbler	1	0	2	-3	-5	0	-2	-9	-9	-8	-10	-7	-7	-8
Chestnut-sided Warbler	-1	-1	0	-2	-3	-1	-2	-4	-4	-3	-4	-4	-3	-4
Magnolia Warbler	1	2	2	2	2	2	2	3	3	3	3	3	3	2
Cape May Warbler	2	2	2	2	2	2	2	0	1	0	1	1	0	0
Black-throated Blue Warbler	1	1	1	1	2	1	1	0	0	0	1	1	0	0
Yellow-rumped Warbler (Myrtle)	5	5	5	5	5	4	5	9	8	8	9	8	7	8
Black-throated Green Warbler	-3	-2	-3	-1	0	-2	-1	1	0	0	0	0	0	-1
Blackburnian Warbler	-1	-1	-1	-1	0	-1	-1	2	2	2	2	2	1	2
Pine Warbler	2	1	1	1	2	1	1	5	4	3	5	5	4	4
Palm Warbler (Western)	5	4	5	2	2	3	2	7	6	6	6	5	4	6
Bay-breasted Warbler	0	0	0	1	1	0	1	0	0	-1	0	1	0	0
Cerulean Warbler	-3	-3	-4	-2	-2	-2	-2	-2	-1	-1	-1	-2	-1	-1
Black-and-white Warbler	0	1	0	0	0	1	1	2	2	2	2	2	2	2
American Redstart	-3	-3	-3	-3	-3	-3	-3	-5	-4	-4	-5	-4	-4	-4
Prothonotary Warbler	6	6	6	6	6	6	6	10	10	10	10	10	10	10
Ovenbird	-2	-2	-2	-1	-1	-2	-1	-1	-1	-1	-1	-1	-1	-1
Northern Waterthrush	0	0	0	0	0	0	0	0	-1	-1	0	0	-1	-1
Louisiana Waterthrush	2	2	2	3	2	2	2	5	5	5	5	4	5	5
Connecticut Warbler	5	6	5	6	6	5	6	9	9	9	10	9	8	9
Mourning Warbler	-1	-1	0	-1	-2	-1	-1	-4	-3	-3	-4	-3	-3	-3
Common Yellowthroat	7	6	7	5	3	6	5	5	5	5	5	5	5	5
Hooded Warbler	-2	-2	-2	-1	-1	-2	-1	1	0	1	1	1	1	2
Wilson's Warbler	3	4	3	4	3	4	4	3	4	4	3	2	3	3
Canada Warbler	-1	0	0	0	0	0	0	0	0	0	-1	-1	0	-1
Yellow-breasted Chat*	-58	-58	-58	-58	-48	-58	-58					-98		
Scarlet Tanager	-2	-2	-2	-2	-2	-2	-2	-1	-2	-1	-2	-2	-1	-2
Eastern Towhee	26	21	28	12	6	20	13	4	6	6	5	6	6	5
Chipping Sparrow	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Song Sparrow	1	0	2	-3	-5	0	-3	-11	-9	-8	-10	-8	-7	-8
Lincoln's Sparrow	1	1	1	1	0	3	0	-5	-4	-4	-5	-5	-2	-5

Exhibit E-1: Projected changes in populations for 136 bird species across four decades for seven forest harvest models for Scenario A and B. This table displays Decades 1 and 2.

Common Name	Decade 1							Decade 2						
	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
White-throated Sparrow	1	1	1	1	2	1	1	2	3	3	3	4	3	3
Dark-eyed Junco (Slate-colored)	3	3	3	3	3	4	3	0	0	0	-2	-2	1	-1
Northern Cardinal	2	2	2	2	2	2	2	5	5	5	5	5	5	5
Rose-breasted Grosbeak	-1	-1	0	-2	-4	-1	-2	-7	-6	-5	-7	-6	-6	-6
Indigo Bunting	-1	-1	0	-2	-3	-1	-2	-4	-5	-4	-5	-4	-3	-4
Rusty Blackbird*	8	8	8	8	8	8	8	4	4	4	4	8	4	4
Common Grackle	27	19	30	13	9	18	12	8	9	6	5	9	9	6
Brown-headed Cowbird	-4	-3	-4	-3	-3	-3	-3	-5	-5	-4	-5	-5	-4	-5
Orchard Oriole	-3	-3	-4	-2	-2	-3	-2	-3	-2	-2	-2	-3	-2	-2
Baltimore Oriole	0	1	0	1	0	1	1	8	6	9	4	3	6	5
Purple Finch	-3	-3	-3	-3	-3	-3	-3	-2	-3	-2	-3	-4	-3	-3
Red Crossbill	5	4	4	4	6	4	4	13	11	11	13	12	11	12
White-winged Crossbill	3	3	3	2	2	1	2	5	4	5	4	3	2	4
Pine Siskin	2	2	2	2	3	2	2	7	6	6	7	6	6	6
American Goldfinch	4	3	5	-1	-3	2	0	-8	-7	-6	-7	-5	-5	-6
Evening Grosbeak	13	13	13	12	12	12	12	18	17	17	17	17	15	17

**Species with low populations, models are less accurate.*

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-1 (CONT): PROJECTED CHANGES IN POPULATIONS FOR 136 BIRD SPECIES ACROSS FOUR DECADES FOR SEVEN FOREST HARVEST MODELS FOR SCENARIO A AND B. This table displays Decades 3 and 4

Common Name	Decade 3							Decade 4						
	A	A&P	A&P& SS	B	B&P	B&P& SF	B&P& SS	A	A&P	A&P& SS	B	B&P	B&P& SF	B&P& SS
Double-crested Cormorant	0	1	0	1	1	1	2	-1	-1	-1	0	0	0	-1
Great Blue Heron	1	1	1	1	0	1	0	1	1	1	1	1	1	1
Great Egret	3	3	3	3	2	3	2	3	3	3	3	3	3	3
Green Heron	0	0	0	0	0	0	0	-1	-1	-1	-1	0	0	0
Black-crowned Night-Heron	1	1	1	2	1	2	2	0	-1	0	0	0	0	0
Yellow-crowned Night-Heron	1	1	1	1	1	1	1	0	-1	0	0	0	0	0
Turkey Vulture	-1	0	0	-1	-1	0	-1	-2	-2	-1	-2	-2	-1	-2
Wood Duck	2	1	2	1	0	2	1	2	2	2	2	2	2	2
American Black Duck	-25	-29	-29	-24	-24	-25	-26	-26	-29	-29	-24	-23	-23	-24
Bufflehead	-1	0	-1	1	0	1	1	-2	-4	-3	-2	-2	-2	-2
Common Goldeneye	-1	-1	-1	1	3	-2	0	5	5	5	5	4	7	6
Hooded Merganser	-6	-5	-6	-5	-5	-5	-4	-7	-7	-8	-6	-6	-6	-6
Common Merganser	-5	-4	-5	-3	-3	-4	-3	-2	-2	-2	-1	-2	0	-1
Osprey	-2	-3	-2	-3	-4	-1	-3	-5	-5	-4	-4	-3	-3	-2
Bald Eagle	-19	-17	-18	-16	-16	-16	-15	-22	-22	-23	-21	-20	-22	-21
Sharp-shinned Hawk	-11	-12	-10	-12	-13	-12	-12	-12	-12	-12	-12	-12	-12	-11
Cooper's Hawk	-11	-12	-12	-11	-11	-12	-12	-7	-8	-8	-7	-8	-7	-8
Northern Goshawk	-2	-2	0	-5	-6	-1	-4	-8	-6	-5	-7	-6	-4	-4
Red-shouldered Hawk	-7	-8	-7	-8	-8	-7	-8	-5	-6	-5	-5	-6	-5	-5
Broad-winged Hawk	4	3	4	3	2	3	3	3	3	3	3	3	3	3
Red-tailed Hawk	-6	-5	-6	-6	-5	-5	-4	-8	-7	-8	-8	-7	-9	-8
American Kestrel	-6	-4	-2	-9	-5	-4	-7	-3	1	1	-5	-8	-4	-4
Merlin	-9	-7	-6	-11	-12	-3	-9	-3	-2	-1	-6	-5	-1	-1
Mourning Dove	5	16	7	11	16	6	16	0	2	2	-1	-4	-1	-4
Black-billed Cuckoo	0	2	1	1	0	1	1	-2	-2	-3	-3	-3	-3	-3
Yellow-billed Cuckoo	0	1	1	0	2	1	1	-1	0	1	-1	-2	0	-1
Eastern Screech-Owl	3	3	3	3	2	3	2	3	2	3	3	3	3	3
Great Horned Owl	-1	-2	-1	-2	-3	-1	-2	-2	-2	-1	-2	-2	-1	-1
Barred Owl	8	7	7	8	7	8	7	9	8	9	9	9	9	9
Great Gray Owl	-42	-41	-42	-40	-40	-43	-41	-47	-47	-47	-45	-46	-47	-46
Long-eared Owl	1	1	1	1	1	1	1	2	1	1	2	2	1	2
Boreal Owl	-20	-21	-21	-19	-19	-22	-20	-23	-24	-24	-22	-23	-23	-23
Northern Saw-whet Owl	4	3	4	2	2	3	3	0	0	1	-1	-2	-1	0
Whip-poor-will	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0	0
Chimney Swift	-1	-1	0	-3	-3	0	-2	-4	-3	-3	-4	-3	-2	-2
Ruby-throated Hummingbird	-1	-1	-1	-1	-1	-1	-1	-2	-2	-1	-2	-2	-1	-2
Red-headed Woodpecker	7	7	8	6	5	7	6	6	6	7	6	6	7	7
Red-bellied Woodpecker	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Yellow-bellied Sapsucker	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-5	-6
Downy Woodpecker	-2	-2	-2	-2	-2	-2	-2	-3	-2	-2	-2	-3	-2	-2
Hairy Woodpecker	9	8	9	8	8	8	8	9	9	9	9	8	8	9
Three-toed Woodpecker*	12	14	12	14	14	12	14	14	12	14	11	7	14	12
Black-backed Woodpecker	2	2	2	2	1	0	2	7	7	7	7	5	5	7
Northern Flicker (Yellow-shafted)	2	3	3	3	2	3	3	2	2	2	2	1	1	1
Pileated Woodpecker	-1	-1	-1	-3	-1	1	-2	-9	-9	-9	-10	-6	-6	-8

EXHIBIT E-1 (CONT): PROJECTED CHANGES IN POPULATIONS FOR 136 BIRD SPECIES ACROSS FOUR DECADES FOR SEVEN FOREST HARVEST MODELS FOR SCENARIO A AND B. This table displays Decades 3 and 4

Common Name	Decade 3							Decade 4						
	A	A&P	A&P& SS	B	B&P	B&P& SF	B&P& SS	A	A&P	A&P& SS	B	B&P	B&P& SF	B&P& SS
Olive-sided Flycatcher	7	8	7	9	8	9	8	7	7	6	8	8	7	6
Eastern Wood-Pewee	0	-1	-1	0	0	0	0	0	0	0	1	1	1	1
Yellow-bellied Flycatcher	10	10	10	11	10	8	10	13	12	12	13	11	11	12
Acadian Flycatcher	9	9	9	9	6	9	7	11	10	11	10	9	10	9
Least Flycatcher	-2	-3	-2	-2	-2	-2	-3	-2	-2	-2	-2	-1	-1	-1
Eastern Phoebe	-5	-5	-5	-5	-4	-4	-4	-6	-6	-6	-5	-5	-5	-5
Great Crested Flycatcher	-6	-7	-6	-7	-7	-6	-7	-8	-8	-7	-8	-7	-7	-7
Loggerhead Shrike*	102	141	115	131	123	107	133	42	53	34	44	62	41	50
Bell's Vireo*					-72		-78		-89		-89	-98	-89	-98
Yellow-throated Vireo	-4	-5	-4	-5	-5	-4	-5	-6	-6	-6	-6	-5	-5	-4
Blue-headed Vireo	15	14	14	15	15	14	14	16	14	15	16	15	14	14
Warbling Vireo	2	2	2	2	2	3	2	3	2	2	2	2	3	2
Philadelphia Vireo	10	8	7	10	10	8	8	15	13	13	15	14	13	14
Red-eyed Vireo	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Gray Jay	4	4	4	4	4	4	4	0	0	0	0	1	1	0
Blue Jay	-1	-1	0	-1	-1	-1	-1	0	0	0	0	0	0	0
Black-billed Magpie*	-9	11	-2	-5	-7	-7	-1	-8	-9	-9	-5	-7	-13	-12
American Crow	1	-1	0	-1	-1	0	-1	2	2	2	2	2	2	2
Common Raven	13	13	13	14	14	13	13	13	12	13	13	12	12	12
Tree Swallow	-27	-27	-26	-27	-18	-29	-24	-27	-18	-23	-20	-21	-24	-20
Black-capped Chickadee	-4	-4	-4	-4	-4	-4	-4	-3	-3	-3	-3	-3	-3	-3
Boreal Chickadee	-1	0	-1	0	-2	-3	-1	3	2	2	3	1	0	2
Tufted Titmouse (Eastern)	-7	-7	-7	-7	-7	-7	-7	-8	-9	-8	-9	-9	-9	-9
Red-breasted Nuthatch	9	8	8	9	9	7	8	10	10	9	11	10	9	10
White-breasted Nuthatch	-5	-6	-5	-6	-6	-5	-6	-5	-5	-4	-5	-4	-4	-4
Brown Creeper	6	5	5	6	6	5	5	7	7	7	8	8	7	8
House Wren	2	1	2	1	1	2	1	2	2	2	2	2	2	2
Winter Wren	7	7	7	7	7	6	6	8	8	8	8	7	7	7
Golden-crowned Kinglet	5	5	4	5	5	3	5	7	7	7	7	6	6	7
Ruby-crowned Kinglet	10	10	10	11	9	7	10	15	14	14	15	13	12	14
Blue-gray Gnatcatcher	1	1	1	1	1	1	1	1	1	1	1	2	1	1
Eastern Bluebird	2	7	3	4	6	4	7	-1	0	-1	-2	-1	-1	-2
Veery	-5	-4	-4	-5	-5	-4	-4	-5	-5	-5	-6	-5	-5	-5
Swainson's Thrush	7	7	7	7	7	5	7	9	9	9	9	9	8	9
Hermit Thrush	4	4	4	5	4	4	4	5	5	5	6	5	5	5
Wood Thrush	8	6	8	5	3	6	4	10	10	9	8	9	7	9
American Robin	2	2	2	2	2	2	2	3	3	3	3	3	3	3
Gray Catbird	-11	-5	-8	-7	-6	-7	-4	-17	-14	-16	-17	-14	-18	-17
Brown Thrasher	6	10	8	8	9	11	9	2	4	3	2	3	4	3
Cedar Waxwing	6	6	6	5	5	5	5	7	7	7	6	6	6	6
Blue-winged Warbler	-10	-10	-10	-10	-10	-10	-10	-12	-12	-12	-12	-12	-12	-12
Golden-winged Warbler	-4	-1	-2	-1	-2	-1	0	-6	-4	-5	-6	-5	-6	-6
Tennessee Warbler	9	9	9	9	9	7	9	13	12	13	12	12	11	12
Nashville Warbler	5	5	5	5	5	5	5	6	5	5	6	5	5	5
Northern Parula	12	11	11	11	11	10	11	13	13	13	13	12	12	13
Yellow Warbler	-12	-9	-11	-11	-9	-9	-8	-16	-14	-15	-16	-15	-15	-16
Chestnut-sided Warbler	-5	-5	-5	-6	-5	-4	-5	-7	-6	-6	-7	-7	-6	-7
Magnolia Warbler	4	3	3	4	4	3	4	5	5	5	6	5	5	5
Cape May Warbler	1	2	1	2	1	0	2	4	3	4	3	2	2	3

EXHIBIT E-1 (CONT): PROJECTED CHANGES IN POPULATIONS FOR 136 BIRD SPECIES ACROSS FOUR DECADES FOR SEVEN FOREST HARVEST MODELS FOR SCENARIO A AND B. This table displays Decades 3 and 4

Common Name	Decade 3							Decade 4						
	A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS	A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS
Black-throated Blue Warbler	0	-1	-1	0	1	-1	0	-1	-1	-1	0	0	-1	-1
Yellow-rumped Warbler (Myrtle)	12	11	11	12	12	10	12	14	13	13	14	13	12	13
Black-throated Green Warbler	1	0	1	1	0	1	0	1	1	1	2	2	1	2
Blackburnian Warbler	4	4	4	4	4	3	4	5	4	4	5	5	4	4
Pine Warbler	9	7	6	8	9	7	7	12	11	10	12	11	11	11
Palm Warbler (Western)	6	7	5	9	8	4	8	5	6	5	6	6	5	5
Bay-breasted Warbler	1	1	0	2	2	0	1	4	4	3	5	4	3	4
Cerulean Warbler	-2	-2	-2	-2	-2	-2	-2	0	-1	0	0	-1	0	0
Black-and-white Warbler	3	3	3	3	3	3	3	3	3	4	3	2	3	2
American Redstart	-6	-6	-6	-6	-6	-5	-5	-6	-6	-6	-6	-5	-5	-5
Prothonotary Warbler	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Ovenbird	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0
Northern Waterthrush	1	0	1	0	1	0	0	1	1	1	1	0	1	1
Louisiana Waterthrush	0	0	0	0	-3	0	-2	0	-1	0	0	-3	0	-1
Connecticut Warbler	12	11	11	13	11	10	11	15	14	14	15	13	13	14
Mourning Warbler	-5	-4	-4	-5	-5	-4	-4	-5	-5	-4	-5	-5	-5	-5
Common Yellowthroat	4	5	5	6	5	5	6	4	4	4	4	4	3	3
Hooded Warbler	1	2	2	1	1	2	2	2	1	2	1	1	2	1
Wilson's Warbler	3	4	4	4	2	2	4	9	10	10	9	6	8	9
Canada Warbler	0	-1	0	-1	-1	-1	-1	0	0	-1	0	0	-1	-1
Yellow-breasted Chat*					-72		-78		-89		-89	-98	-89	-98
Scarlet Tanager	-2	-2	-2	-3	-3	-2	-3	-4	-3	-3	-4	-3	-3	-3
Eastern Towhee	-2	2	-2	-1	3	-3	2	-7	-5	-6	-6	-4	-8	-6
Chipping Sparrow	1	1	1	1	2	0	1	3	2	2	3	2	2	2
Song Sparrow	-16	-13	-13	-15	-14	-10	-13	-19	-16	-17	-19	-17	-17	-18
Lincoln's Sparrow	-8	-7	-7	-7	-7	-4	-7	-4	-1	-3	-2	-3	-2	-2
White-throated Sparrow	4	5	5	5	5	5	5	5	5	6	5	4	5	5
Dark-eyed Junco (Slate-colored)	-3	-4	-4	-3	-2	-2	-3	-3	-2	-4	-2	-3	-2	-2
Northern Cardinal	7	7	7	7	7	7	7	9	8	9	9	9	9	9
Rose-breasted Grosbeak	-8	-7	-8	-8	-8	-7	-7	-9	-9	-9	-10	-9	-9	-9
Indigo Bunting	-6	-5	-5	-6	-5	-4	-5	-11	-10	-11	-11	-9	-10	-11
Rusty Blackbird*	12	14	12	14	14	12	14	14	12	14	11	7	14	12
Common Grackle	-2	6	1	2	3	2	4	-13	-8	-12	-11	-6	-12	-10
Brown-headed Cowbird	-5	-4	-4	-5	-4	-3	-4	-5	-5	-4	-5	-5	-4	-5
Orchard Oriole	-3	-5	-4	-4	-4	-3	-5	-1	-1	-1	-1	-1	-1	-1
Baltimore Oriole	11	10	12	8	7	10	8	11	12	12	10	10	10	11
Purple Finch	-2	-3	-3	-3	-3	-3	-3	-1	-1	-2	-1	-1	-1	-1
Red Crossbill	19	16	15	18	19	15	16	24	21	21	24	23	21	22
White-winged Crossbill	4	5	4	6	4	1	6	9	8	9	8	8	6	8
Pine Siskin	9	8	8	9	9	7	8	11	10	10	11	11	9	10
American Goldfinch	-11	-8	-9	-9	-8	-7	-7	-13	-11	-12	-13	-12	-13	-13
Evening Grosbeak	25	25	24	25	24	21	25	31	29	30	29	28	26	29

**Species with low populations, models are less accurate.*

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-2: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Great Blue Heron	226	223	224	223	226	228	224	226	236	238	239	231	226	236	232
Turkey Vulture	152	129	127	129	129	132	127	127	135	138	133	134	126	137	136
Hooded Merganser	242	240	242	240	244	246	242	244	256	258	259	250	245	257	251
Osprey	148	148	148	148	150	152	149	150	157	157	157	154	152	156	155
Bald Eagle	195	203	206	208	188	173	203	190	155	156	165	154	163	164	161
Sharp-shinned Hawk	98	76	76	76	75	75	76	75	70	71	71	70	70	71	71
Cooper's Hawk	103	91	91	91	93	94	91	93	86	86	86	88	89	86	87
Northern Goshawk	242	240	242	240	244	246	242	244	256	258	259	250	245	257	251
Red-shouldered Hawk	89	76	77	76	79	80	77	79	73	73	73	71	72	73	71
Broad-winged Hawk	117	115	115	114	116	117	115	116	119	119	119	118	117	118	118
Red-tailed Hawk	136	136	137	138	130	125	136	131	119	119	122	118	121	122	121
Mourning Dove	198	194	195	195	193	192	195	194	190	190	193	186	186	191	188
Black-billed Cuckoo	132	116	117	117	114	113	116	115	102	102	103	102	105	103	104
Yellow-billed Cuckoo	117	118	118	118	119	120	118	119	125	127	126	125	123	126	125
Great Horned Owl	194	204	205	204	205	207	205	206	225	230	228	225	217	228	225
Barred Owl	53	53	53	53	53	54	53	53	54	54	54	55	55	54	54
Whip-poor-will	82	82	81	82	82	83	81	81	85	84	84	85	85	84	85
Chimney Swift	151	148	149	148	150	152	149	150	156	157	157	153	151	156	153
Ruby-throated Hummingbird	98	99	100	99	100	99	99	100	99	99	99	100	100	99	99
Red-headed Woodpecker	242	240	242	240	244	246	242	244	256	258	259	250	245	257	251
Yellow-bellied Sapsucker	119	113	113	113	114	115	113	114	113	113	113	112	112	113	112
Downy Woodpecker	135	128	128	128	129	129	128	129	125	125	126	124	125	126	125
Hairy Woodpecker	95	99	100	99	100	99	99	100	103	103	102	103	102	102	102
Black-backed Woodpecker	85	81	81	81	81	82	81	81	80	80	80	80	80	80	80
Northern Flicker (Yellow-shafted)	88	93	94	94	93	91	93	93	91	91	92	92	93	92	92
Pileated Woodpecker	146	143	143	143	144	145	143	144	145	146	146	143	143	146	144
Olive-sided Flycatcher	61	69	69	69	69	68	69	68	72	71	71	72	72	71	72
Eastern Wood-Pewee	106	105	104	104	105	106	104	105	106	106	106	106	106	106	106
Yellow-bellied Flycatcher	64	70	70	69	70	70	69	70	74	74	73	75	74	73	74
Least Flycatcher	108	104	104	104	105	106	104	105	105	105	105	105	105	105	105
Eastern Phoebe	143	136	137	136	137	136	137	137	137	137	138	135	134	137	136

EXHIBIT E-2: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Great Crested Flycatcher	120	114	114	114	113	113	114	114	110	111	111	110	110	111	110
Yellow-throated Vireo	138	133	134	133	135	135	134	135	135	135	135	134	133	135	134
Blue-headed Vireo	66	73	73	72	74	74	72	73	78	78	77	79	78	77	78
Warbling Vireo	137	122	123	122	123	123	123	123	110	110	110	110	112	111	112
Philadelphia Vireo	76	78	77	77	78	79	77	78	81	80	79	81	81	80	80
Red-eyed Vireo	111	108	108	108	109	109	108	109	108	108	108	108	108	108	108
Gray Jay	71	75	75	75	76	76	75	76	79	79	78	80	79	78	79
Blue Jay	105	104	105	104	104	104	104	105	105	105	105	104	104	105	105
American Crow	101	100	100	100	100	100	100	100	101	101	101	101	100	101	101
Common Raven	70	77	78	77	78	78	77	78	83	83	82	84	83	82	83
Tree Swallow	95	89	89	89	89	90	89	89	91	92	91	92	91	91	91
Black-capped Chickadee	106	104	104	104	104	104	104	104	103	103	103	103	103	103	103
Boreal Chickadee	78	77	76	77	75	76	77	76	75	75	76	75	75	76	76
Red-breasted Nuthatch	86	88	87	87	88	89	87	88	90	90	89	90	90	89	90
White-breasted Nuthatch	129	124	124	124	124	125	124	124	123	124	124	123	122	124	123
Brown Creeper	93	93	92	92	93	94	93	93	95	95	95	95	95	95	95
House Wren	176	172	173	173	170	167	173	171	160	160	163	157	160	162	160
Winter Wren	79	83	83	83	84	84	83	84	87	87	86	87	86	86	86
Golden-crowned Kinglet	80	81	80	81	81	82	81	81	83	82	82	83	83	82	83
Ruby-crowned Kinglet	75	77	75	76	75	76	76	75	77	77	77	77	77	77	77
Eastern Bluebird	121	122	122	122	121	120	122	121	119	118	120	117	118	119	118
Veery	142	137	138	138	136	135	137	137	131	132	133	131	131	133	132
Swainson's Thrush	100	105	104	105	104	105	104	104	109	109	109	108	107	109	108
Hermit Thrush	78	80	80	79	80	81	80	80	82	82	81	83	82	81	82
Wood Thrush	89	87	87	87	86	85	87	86	81	81	82	82	83	82	82
American Robin	89	90	89	89	89	89	89	89	90	89	89	90	90	89	90
Gray Catbird	185	186	188	189	178	169	186	180	156	157	162	154	160	161	159
Brown Thrasher	142	149	149	149	147	146	148	147	152	153	154	152	150	153	152
Cedar Waxwing	103	103	103	103	102	102	103	102	102	102	102	102	102	102	102
Golden-winged Warbler	113	118	119	119	116	111	118	116	109	109	111	109	111	111	110
Tennessee Warbler	82	85	84	85	83	84	84	84	85	85	85	84	84	85	85
Nashville Warbler	73	77	77	77	77	77	77	77	79	79	79	80	80	79	80
Northern Parula	79	82	82	82	83	83	82	83	86	86	85	86	86	85	86

EXHIBIT E-2: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Yellow Warbler	135	134	135	136	131	126	135	131	120	120	123	119	122	122	121
Chestnut-sided Warbler	133	131	131	132	129	127	131	129	123	124	125	123	124	125	124
Magnolia Warbler	106	107	106	107	106	107	106	106	108	108	108	108	108	108	108
Cape May Warbler	119	120	119	120	119	118	119	119	120	120	121	119	119	120	119
Black-throated Blue Warbler	74	77	76	77	77	78	77	77	77	76	76	77	77	76	77
Yellow-rumped Warbler (Myrtle)	72	76	76	76	76	76	76	76	79	79	78	80	79	79	79
Black-throated Green Warbler	93	93	92	92	93	94	93	93	95	94	94	94	94	94	94
Blackburnian Warbler	98	96	96	96	96	98	96	96	98	98	97	98	98	97	98
Pine Warbler	85	86	85	85	85	87	85	85	88	87	87	88	88	87	88
Palm Warbler (Western)	60	67	66	67	64	64	66	64	67	66	66	67	67	67	67
Bay-breasted Warbler	75	78	77	77	77	78	77	77	80	80	79	81	81	79	80
Black-and-white Warbler	93	96	96	96	96	95	96	96	97	97	97	97	97	97	97
American Redstart	130	124	125	125	124	124	125	125	121	121	122	121	121	122	121
Ovenbird	105	103	103	103	104	105	103	104	105	105	104	105	104	104	104
Northern Waterthrush	91	87	87	87	88	88	87	88	87	87	87	87	87	87	87
Connecticut Warbler	66	70	70	69	71	70	70	71	74	74	73	75	74	73	74
Mourning Warbler	128	127	127	127	125	123	127	125	119	119	121	119	120	120	120
Common Yellowthroat	85	89	89	89	88	87	89	88	89	89	89	89	89	89	89
Canada Warbler	100	102	102	102	103	103	102	103	105	105	105	104	104	104	104
Scarlet Tanager	129	127	127	127	127	127	127	127	126	127	127	126	125	127	126
Eastern Towhee	134	136	137	138	132	127	136	132	122	122	125	121	124	125	123
Chipping Sparrow	97	96	96	96	95	96	96	95	95	95	95	95	96	95	95
Song Sparrow	163	161	162	163	156	150	161	157	143	144	148	142	145	147	145
Lincoln's Sparrow	97	96	96	97	91	88	95	91	84	84	87	83	85	87	86
White-throated Sparrow	66	72	73	72	73	73	72	73	76	76	76	77	77	76	76
Dark-eyed Junco (Slate-colored)	82	82	80	83	79	80	82	79	79	79	80	79	79	80	80
Rose-breasted Grosbeak	152	149	150	151	145	141	149	146	133	133	136	132	135	136	134
Indigo Bunting	156	154	155	156	150	145	154	151	138	139	142	137	140	141	140

EXHIBIT E-2: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P& SS
Common Grackle	144	137	138	137	139	141	138	139	140	141	141	140	138	140	140
Brown-headed Cowbird	133	130	130	130	129	128	130	129	125	125	126	124	125	126	125
Baltimore Oriole	186	184	185	185	181	178	184	182	175	177	179	173	174	178	176
Purple Finch	99	94	93	94	93	94	94	93	93	93	93	93	93	93	93
Red Crossbill	76	78	77	77	77	79	77	77	80	79	79	81	81	79	80
White-winged Crossbill	89	82	82	82	81	82	82	82	78	78	78	78	78	78	78
Pine Siskin	99	99	98	99	99	100	99	99	104	104	103	104	103	103	104
American Goldfinch	130	129	130	130	126	123	129	126	119	119	122	118	120	121	120
Evening Grosbeak	90	88	87	88	87	88	87	87	86	86	86	87	87	86	87

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-2 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Cur. Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Great Blue Heron	226	217	218	224	210	208	221	214	203	208	209	204	207	212	212
Turkey Vulture	152	144	153	151	147	145	151	145	138	140	141	134	136	141	137
Hooded Merganser	242	235	236	243	227	225	239	232	221	225	227	221	225	230	230
Osprey	148	150	149	152	146	146	151	148	146	147	148	146	147	149	149
Bald Eagle	195	153	163	158	160	162	162	170	140	147	143	139	146	135	139
Sharp-shinned Hawk	98	65	64	66	61	63	66	63	62	62	63	61	63	64	63
Cooper's Hawk	103	89	88	87	89	90	87	88	94	93	93	94	92	94	93
Northern Goshawk	242	235	236	243	227	225	239	232	221	225	227	221	225	230	230
Red-shouldered Hawk	89	68	68	70	66	66	69	67	68	68	68	68	68	70	69
Broad-winged Hawk	117	115	115	116	113	113	115	114	114	114	115	114	114	115	115
Red-tailed Hawk	136	121	125	123	124	124	124	127	116	118	117	115	118	114	115
Mourning Dove	198	178	181	183	175	175	182	180	170	174	174	170	173	174	175
Black-billed Cuckoo	132	99	99	100	98	99	100	99	98	98	98	97	98	98	97
Yellow-billed Cuckoo	117	120	120	121	118	118	120	119	114	116	117	115	115	117	117
Great Horned Owl	194	203	205	209	198	196	207	203	179	186	191	182	183	189	189
Barred Owl	53	58	57	56	58	59	57	57	60	59	58	60	60	59	59
Whip-poor-will	82	89	88	88	89	90	88	88	92	91	91	92	92	91	91
Chimney Swift	151	147	147	150	143	143	149	145	142	144	145	143	144	146	146
Ruby-throated Hummingbird	98	100	101	100	101	100	100	101	100	100	100	100	100	100	100
Red-headed Woodpecker	242	235	236	243	227	225	239	232	221	225	227	221	225	230	230
Yellow-bellied Sapsucker	119	111	110	111	110	110	111	110	111	111	111	110	110	112	111
Downy Woodpecker	135	121	122	123	120	121	122	122	120	121	121	120	120	121	121
Hairy Woodpecker	95	102	103	103	103	102	103	102	101	101	102	102	101	101	101
Black-backed Woodpecker	85	81	81	81	80	81	80	80	82	82	82	82	82	82	82
Northern Flicker (Yellow-shafted)	88	94	94	94	95	95	94	95	93	93	93	94	94	92	93
Pileated Woodpecker	146	139	139	141	136	136	140	138	135	136	137	135	136	138	138
Olive-sided Flycatcher	61	74	75	74	77	76	74	75	75	75	74	76	75	74	74
Eastern Wood-Pewee	106	107	106	106	106	106	106	105	107	107	107	107	107	108	108
Yellow-bellied Flycatcher	64	77	77	77	78	77	77	77	78	77	77	78	77	77	77
Least Flycatcher	108	105	104	104	104	104	104	103	106	105	106	105	105	106	106
Eastern Phoebe	143	129	129	132	126	126	131	128	124	125	126	124	125	127	126
Great Crested Flycatcher	120	107	107	108	106	106	108	107	105	106	106	105	106	106	106
Yellow-throated Vireo	138	130	130	132	129	128	131	130	127	128	129	127	127	129	129
Blue-headed Vireo	66	82	81	81	83	82	81	81	83	82	82	84	82	82	82
Warbling Vireo	137	112	114	114	114	114	114	114	117	116	117	115	114	116	115
Philadelphia Vireo	76	85	83	82	84	85	82	83	88	87	86	88	88	87	87
Red-eyed Vireo	111	107	107	107	107	107	107	107	107	107	107	107	107	108	108
Gray Jay	71	81	81	81	82	81	81	81	82	81	81	82	81	81	81

EXHIBIT E-2 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Cur. Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Blue Jay	105	104	104	105	104	104	104	104	104	104	104	104	104	104	104
American Crow	101	99	99	99	98	98	99	99	97	97	98	97	98	98	98
Common Raven	70	86	85	85	86	86	85	85	86	85	85	86	85	85	85
Tree Swallow	95	89	88	89	87	87	89	87	87	87	88	87	87	88	88
Black-capped Chickadee	106	102	102	102	102	102	102	102	102	102	102	102	102	102	102
Boreal Chickadee	78	76	75	75	75	77	75	76	77	77	76	76	77	76	77
Red-breasted Nuthatch	86	92	91	91	92	92	91	91	95	94	94	95	94	94	94
White-breasted Nuthatch	129	120	120	121	118	119	120	119	118	119	119	118	118	120	119
Brown Creeper	93	96	96	96	96	96	96	95	98	97	97	98	98	98	98
House Wren	176	155	157	158	154	154	157	157	152	154	153	151	154	152	153
Winter Wren	79	88	88	88	88	88	88	88	89	88	88	89	88	88	88
Golden-crowned Kinglet	80	85	84	84	84	85	84	84	87	86	86	87	86	86	86
Ruby-crowned Kinglet	75	79	78	78	79	80	78	79	81	81	80	81	81	80	81
Eastern Bluebird	121	117	118	118	117	117	118	118	117	118	117	117	118	117	118
Veery	142	128	129	129	127	127	129	129	124	126	126	124	125	125	126
Swainson's Thrush	100	106	106	107	104	104	107	105	102	103	104	102	103	104	104
Hermit Thrush	78	84	84	84	85	85	84	84	86	85	85	86	85	85	85
Wood Thrush	89	84	84	83	84	85	83	84	85	85	84	85	85	84	84
American Robin	89	91	91	90	91	91	90	91	92	92	92	92	92	92	92
Gray Catbird	185	152	159	157	156	156	158	162	145	149	147	143	148	143	144
Brown Thrasher	142	144	145	146	143	143	146	145	134	137	138	135	136	137	137
Cedar Waxwing	103	102	102	102	102	102	102	102	102	102	102	102	102	102	102
Golden-winged Warbler	113	109	112	111	112	112	112	113	106	108	107	106	107	105	106
Tennessee Warbler	82	84	84	85	83	82	84	83	84	84	84	83	83	84	84
Nashville Warbler	73	82	81	81	83	82	81	82	83	82	82	83	82	82	82
Northern Parula	79	88	87	87	88	87	87	87	88	88	88	89	88	88	88
Yellow Warbler	135	117	120	119	119	120	120	122	113	116	115	113	115	113	113
Chestnut-sided Warbler	133	122	123	123	122	122	123	124	119	121	120	119	120	119	120
Magnolia Warbler	106	108	107	108	107	107	108	107	108	108	108	108	108	108	108
Cape May Warbler	119	118	118	118	116	116	118	117	115	116	116	115	116	116	117
Black-throated Blue Warbler	74	77	76	76	77	77	76	76	79	78	78	79	79	79	78
Yellow-rumped Warbler (Myrtle)	72	82	81	81	83	82	81	81	83	83	82	83	83	82	82
Black-throated Green Warbler	93	95	94	95	94	95	94	94	97	96	96	97	97	97	97
Blackburnian Warbler	98	99	98	99	99	99	98	98	101	100	100	101	101	101	101
Pine Warbler	85	91	90	89	91	91	89	90	94	93	92	94	94	93	93
Palm Warbler (Western)	60	68	68	66	70	70	67	70	68	68	68	68	68	67	67
Bay-breasted Warbler	75	84	83	82	84	84	82	83	88	86	86	88	87	86	87
Black-and-white Warbler	93	97	97	97	97	97	97	97	96	96	97	97	96	96	96

EXHIBIT E-2 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Cur. Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
American Redstart	130	119	119	119	118	119	119	119	118	118	119	117	118	119	118
Ovenbird	105	104	104	104	103	104	104	103	105	105	105	105	105	105	105
Northern Waterthrush	91	86	85	86	84	85	86	85	85	85	85	85	86	86	86
Connecticut Warbler	66	76	76	76	77	76	76	76	77	76	77	78	77	76	76
Mourning Warbler	128	118	120	119	119	119	119	120	117	118	117	116	117	116	116
Common Yellowthroat	85	89	90	89	91	90	90	91	88	89	88	89	89	88	88
Canada Warbler	100	105	104	105	104	104	104	104	105	105	105	105	105	105	105
Scarlet Tanager	129	123	124	125	122	122	124	124	121	122	122	121	122	122	122
Eastern Towhee	134	123	125	124	124	125	125	127	121	122	120	120	123	119	120
Chipping Sparrow	97	97	96	96	97	97	96	96	98	98	97	98	98	97	98
Song Sparrow	163	137	141	141	138	139	141	143	129	133	132	129	132	130	130
Lincoln's Sparrow	97	82	84	82	82	85	83	85	78	80	80	77	81	78	79
White-throated Sparrow	66	79	79	79	81	80	79	79	80	80	80	81	80	79	79
Dark-eyed Junco (Slate-colored)	82	78	78	76	79	80	76	79	78	79	77	78	79	78	78
Rose-breasted Grosbeak	152	130	133	132	131	132	133	135	125	128	127	124	127	125	125
Indigo Bunting	156	135	139	138	137	137	139	140	131	133	132	130	133	130	131
Common Grackle	144	134	134	135	132	131	135	133	131	132	133	131	131	134	133
Brown-headed Cowbird	133	122	123	124	122	122	124	124	120	122	121	120	121	121	121
Baltimore Oriole	186	166	169	170	165	165	170	169	156	160	160	156	159	158	159
Purple Finch	99	93	92	92	92	93	92	92	94	94	94	94	94	94	94
Red Crossbill	76	84	83	82	84	85	82	83	88	87	86	88	88	87	87
White-winged Crossbill	89	77	77	76	76	78	76	77	78	78	78	77	78	78	78
Pine Siskin	99	102	102	102	101	101	102	101	101	101	102	101	101	102	102
American Goldfinch	130	117	119	119	118	119	119	120	114	115	115	113	115	113	114
Evening Grosbeak	90	89	88	87	88	89	87	88	92	91	90	91	91	91	91

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-3: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Great Blue Heron	194	200	198	200	196	198	198	196	191	201	203	194	199	196	205
Wood Duck	70	77	78	77	78	77	77	77	87	88	87	87	86	87	86
Common Merganser	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Sharp-shinned Hawk	197	335	281	335	196	196	274	196	334	269	334	257	171	257	257
Broad-winged Hawk	105	108	108	108	108	108	108	108	112	110	111	111	110	111	110
Red-tailed Hawk	236	304	304	304	304	304	304	304	325	325	325	325	325	325	325
American Kestrel	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Merlin	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Mourning Dove	191	194	192	194	190	191	192	190	183	194	195	186	192	188	198
Black-billed Cuckoo	104	103	103	103	103	102	103	103	102	101	102	101	100	101	101
Yellow-billed Cuckoo	153	135	134	135	134	136	135	134	120	124	125	121	124	121	126
Barred Owl	14	15	15	15	15	15	14	14	17	17	17	17	17	17	16
Great Gray Owl	282	187	188	188	190	196	190	193	142	141	140	145	145	141	144
Boreal Owl	282	187	188	188	190	196	190	193	142	141	140	145	145	141	144
Northern Saw-whet Owl	57	59	60	59	61	57	60	59	58	58	58	57	56	58	58
Whip-poor-will	308	263	265	264	267	271	265	268	249	250	248	252	252	249	251
Ruby-throated Hummingbird	154	150	150	150	150	149	150	149	143	145	145	143	143	144	145
Red-headed Woodpecker	57	59	60	59	61	57	60	59	58	58	58	57	56	58	58
Red-bellied Woodpecker	224	200	200	200	200	198	199	199	159	160	159	162	161	160	158
Yellow-bellied Sapsucker	109	109	109	109	109	109	109	109	108	108	108	108	108	108	108
Downy Woodpecker	182	177	178	177	178	178	178	178	172	174	173	174	174	173	174
Hairy Woodpecker	107	111	111	111	111	111	111	111	115	115	115	114	114	114	114
Black-backed Woodpecker	102	105	106	105	106	105	106	105	104	105	105	104	103	103	103
Northern Flicker (Yellow-shafted)	125	125	126	125	125	125	125	125	124	124	125	124	124	124	124
Pileated Woodpecker	102	98	96	98	96	98	97	97	103	100	101	102	103	103	103
Olive-sided Flycatcher	106	108	107	108	106	105	107	105	106	105	106	105	102	104	105
Eastern Wood-Pewee	126	120	120	120	120	121	120	121	121	121	120	121	121	121	121
Yellow-bellied Flycatcher	98	98	99	98	99	99	99	99	97	98	98	98	98	98	98
Least Flycatcher	110	109	108	109	108	109	108	109	110	109	109	110	110	110	110
Eastern Phoebe	121	125	124	126	121	119	123	120	124	123	126	121	118	122	123
Great Crested Flycatcher	104	106	105	105	105	104	105	104	102	102	102	102	101	101	101
Yellow-throated Vireo	198	186	186	185	187	187	186	188	173	176	174	176	177	175	176
Blue-headed Vireo	98	98	97	98	97	98	97	97	98	98	98	98	98	98	98
Philadelphia Vireo	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Red-eyed Vireo	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
Gray Jay	106	103	102	103	101	102	102	102	105	103	104	104	105	105	105
Blue Jay	97	99	99	99	99	99	99	99	100	100	100	100	99	100	100
American Crow	93	97	97	97	96	96	97	96	104	101	103	101	100	102	101
Common Raven	157	155	156	155	155	154	155	155	152	152	151	152	151	152	151

EXHIBIT E-3: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Tree Swallow	129	130	129	130	128	128	129	127	127	133	134	128	131	130	135
Black-capped Chickadee	102	101	101	101	101	101	101	101	99	99	99	99	99	99	99
Boreal Chickadee	103	103	103	103	103	102	103	102	99	100	100	99	98	98	99
Red-breasted Nuthatch	81	84	84	84	84	84	84	84	88	87	87	88	87	88	87
White-breasted Nuthatch	91	87	87	87	87	87	87	87	84	84	84	84	84	84	84
Brown Creeper	94	98	98	98	98	98	98	98	102	101	101	102	101	101	101
House Wren	115	124	124	124	123	122	123	123	128	131	131	128	129	130	132
Winter Wren	85	87	87	87	87	87	87	87	87	88	88	88	88	88	87
Golden-crowned Kinglet	91	93	93	93	94	93	93	93	93	93	93	93	92	93	93
Ruby-crowned Kinglet	85	87	88	87	88	87	88	87	87	88	87	87	87	87	87
Eastern Bluebird	183	231	205	231	166	167	202	166	217	197	227	185	152	187	194
Veery	97	97	97	97	97	96	97	97	95	96	96	96	96	96	96
Swainson's Thrush	77	79	79	79	80	80	79	80	80	80	80	80	80	80	80
Hermit Thrush	115	116	116	116	115	115	116	115	116	116	116	116	115	116	116
Wood Thrush	55	54	54	54	54	55	54	54	54	55	55	54	55	54	55
American Robin	90	91	91	91	91	91	91	91	92	92	92	92	92	92	92
Gray Catbird	164	165	162	165	157	159	162	157	155	163	166	155	158	157	166
Brown Thrasher	65	72	71	72	71	72	72	71	76	77	77	76	77	77	77
Cedar Waxwing	91	93	93	94	93	93	93	93	97	96	97	96	96	96	96
Golden-winged Warbler	137	140	136	140	130	131	135	130	133	135	140	130	129	132	137
Tennessee Warbler	79	81	82	81	82	82	82	82	83	84	83	84	84	84	84
Nashville Warbler	108	108	108	108	108	107	108	107	107	107	107	107	107	107	107
Northern Parula	68	70	70	70	70	70	70	70	71	71	71	71	71	71	71
Yellow Warbler	97	93	92	93	91	94	92	93	103	98	99	101	103	103	102
Chestnut-sided Warbler	120	119	119	119	118	119	119	119	119	119	119	119	119	119	120
Magnolia Warbler	83	84	84	84	84	84	84	84	84	84	84	84	84	84	84
Cape May Warbler	95	95	95	95	96	95	95	95	94	95	94	94	94	94	94
Black-throated Blue Warbler	86	86	86	86	87	86	86	86	85	85	85	85	85	85	85
Yellow-rumped Warbler (Myrtle)	95	96	96	96	96	96	96	96	98	97	98	97	97	98	97
Black-throated Green Warbler	70	70	70	70	71	71	71	71	70	70	69	70	70	70	69
Blackburnian Warbler	92	93	93	93	93	93	93	93	95	94	94	95	95	95	94
Pine Warbler	88	96	96	96	96	95	96	96	108	105	106	106	104	106	105
Palm Warbler (Western)	81	95	90	95	80	79	89	80	94	87	94	85	75	85	85
Bay-breasted Warbler	79	78	78	78	79	79	78	79	76	77	76	77	77	77	77
Black-and-white Warbler	98	99	99	99	99	99	99	99	99	99	99	99	100	99	99
American Redstart	81	80	80	80	81	81	80	80	80	80	80	80	81	80	80
Ovenbird	103	103	103	103	103	103	103	103	103	102	102	103	103	103	102
Northern Waterthrush	83	81	82	81	82	82	82	82	80	80	80	80	80	80	80

EXHIBIT E-3: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Connecticut Warbler	94	98	98	98	97	97	98	97	97	98	98	97	95	96	96
Mourning Warbler	122	120	120	120	120	120	120	120	118	119	119	119	119	119	120
Common Yellowthroat	107	110	110	110	108	108	109	108	109	109	110	108	107	108	109
Wilson's Warbler	107	111	111	111	111	110	111	111	110	112	111	110	109	110	110
Canada Warbler	83	82	82	82	83	83	82	83	82	82	82	82	82	82	82
Scarlet Tanager	96	95	95	95	95	95	95	95	93	93	93	93	93	93	93
Eastern Towhee	129	130	129	130	128	128	129	127	127	133	134	128	131	130	135
Chipping Sparrow	96	99	99	99	99	98	99	99	101	101	101	101	100	101	101
Song Sparrow	145	143	141	143	138	140	141	139	143	143	145	141	142	143	146
Lincoln's Sparrow	106	108	108	108	108	107	108	108	106	107	107	106	105	105	106
White-throated Sparrow	107	107	106	107	106	106	106	106	107	107	107	107	108	108	108
Dark-eyed Junco (Slate-colored)	82	83	83	83	82	82	83	82	82	81	82	81	80	81	81
Rose-breasted Grosbeak	86	86	86	86	86	86	86	85	85	86	86	85	86	85	86
Indigo Bunting	121	108	106	108	105	109	106	107	113	108	109	111	116	115	114
Common Grackle	75	76	77	76	78	76	77	77	75	77	76	75	76	77	77
Brown-headed Cowbird	136	129	129	129	128	128	129	128	123	125	125	123	123	123	125
Baltimore Oriole	63	70	69	70	69	70	69	69	78	77	77	77	77	78	77
Purple Finch	106	109	108	109	107	107	108	107	109	108	109	108	106	107	108
Red Crossbill	54	73	72	73	69	69	71	70	101	94	97	95	91	96	94
White-winged Crossbill	108	117	116	117	113	112	115	113	117	117	118	115	112	115	115
Pine Siskin	67	69	69	69	70	70	70	70	73	72	72	72	72	72	72
American Goldfinch	204	201	199	201	197	198	199	196	192	196	198	193	194	193	198
Evening Grosbeak	83	87	87	87	87	87	87	87	93	92	92	92	92	92	92

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-3 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name		Decade 3							Decade 4						
	Current Percent RNV	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Great Blue Heron	194	175	171	184	142	137	182	147	187	179	194	162	149	177	177
Wood Duck	70	92	93	94	92	93	91	93	90	90	93	87	85	93	89
Common Merganser	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Sharp-shinned Hawk	197	180	207	180	228	166	207	228	208	240	208	273	272	248	229
Broad-winged Hawk	105	115	114	114	115	114	113	115	115	114	114	115	114	113	114
Red-tailed Hawk	236	320	256	320	153	153	247	153	284	206	284	191	88	191	191
American Kestrel	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Merlin	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Mourning Dove	191	167	166	176	142	136	178	146	181	177	189	161	152	177	176
Black-billed Cuckoo	104	100	100	100	100	99	100	100	100	100	100	100	99	99	100
Yellow-billed Cuckoo	153	99	103	103	98	94	109	99	106	108	109	102	103	109	108
Barred Owl	14	20	20	18	20	20	18	18	23	21	20	22	23	20	20
Great Gray Owl	282	117	122	119	126	129	120	123	101	100	101	109	106	103	105
Boreal Owl	282	117	122	119	126	129	120	123	101	100	101	109	106	103	105
Northern Saw-whet Owl	57	60	57	60	55	56	59	57	52	53	54	50	50	51	52
Whip-poor-will	308	245	252	251	252	257	247	253	242	246	249	246	243	253	247
Ruby-throated Hummingbird	154	137	138	140	135	135	140	137	132	134	136	130	130	136	134
Red-headed Woodpecker	57	60	57	60	55	56	59	57	52	53	54	50	50	51	52
Red-bellied Woodpecker	224	137	137	136	139	140	136	138	120	121	121	125	125	123	122
Yellow-bellied Sapsucker	109	109	109	109	109	109	108	109	108	108	108	109	108	108	108
Downy Woodpecker	182	169	170	172	169	170	171	170	162	165	167	162	162	167	165
Hairy Woodpecker	107	120	119	119	119	118	118	119	121	121	121	121	120	119	121
Black-backed Woodpecker	102	104	105	105	105	103	103	105	111	111	111	111	108	109	111
Northern Flicker (Yellow-shafted)	125	124	124	125	124	123	124	124	123	123	124	123	122	123	123
Pileated Woodpecker	102	102	102	101	101	104	105	101	91	90	90	90	95	95	91
Olive-sided Flycatcher	106	104	104	104	105	103	104	105	106	106	106	107	106	105	106
Eastern Wood-Pewee	126	125	125	125	125	126	123	125	124	123	124	125	123	123	124
Yellow-bellied Flycatcher	98	98	98	98	98	98	98	98	100	100	100	100	99	99	100
Least Flycatcher	110	111	111	111	111	112	111	111	106	105	106	106	107	107	106
Eastern Phoebe	121	117	118	119	116	115	121	119	114	118	117	115	116	119	117
Great Crested Flycatcher	104	99	99	100	99	98	99	99	100	100	100	101	99	100	100
Yellow-throated Vireo	198	168	169	171	166	167	169	167	161	162	165	160	158	165	162
Blue-headed Vireo	98	99	99	98	99	99	99	99	98	98	98	98	99	98	98
Philadelphia Vireo	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Red-eyed Vireo	104	104	104	104	104	104	104	104	104	104	104	104	104	104	104
Gray Jay	106	103	103	103	102	104	105	103	95	95	95	94	98	98	95
Blue Jay	97	101	101	101	100	100	100	100	102	102	102	102	101	102	102
American Crow	93	107	105	106	106	104	105	106	108	107	107	108	106	105	107
Common Raven	157	151	150	152	150	150	150	151	144	145	146	144	143	146	145

EXHIBIT E-3 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name		Decade 3							Decade 4						
	Current Percent RNV	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Tree Swallow	129	120	125	126	117	114	131	120	130	133	136	123	124	135	133
Black-capped Chickadee	102	98	98	98	98	98	98	98	98	98	98	98	98	98	98
Boreal Chickadee	103	96	97	97	98	96	95	97	102	103	102	103	101	101	102
Red-breasted Nuthatch	81	92	91	91	92	92	90	91	94	93	92	94	93	92	93
White-breasted Nuthatch	91	81	82	81	82	82	81	82	80	80	80	81	81	81	80
Brown Creeper	94	106	106	105	106	106	105	106	108	107	107	108	108	107	107
House Wren	115	132	133	135	129	128	137	131	136	138	139	133	134	138	138
Winter Wren	85	90	89	89	90	90	89	89	92	91	91	92	91	91	91
Golden-crowned Kinglet	91	94	94	94	95	94	93	94	97	98	97	98	97	96	97
Ruby-crowned Kinglet	85	88	88	87	88	88	87	88	92	92	92	93	92	91	92
Eastern Bluebird	183	137	163	145	177	145	175	181	169	198	175	203	220	205	196
Veery	97	95	95	95	94	94	96	95	95	96	96	95	95	96	96
Swainson's Thrush	77	82	81	81	82	82	81	82	84	84	83	84	84	83	83
Hermit Thrush	115	115	116	116	116	115	116	116	115	116	116	116	115	116	116
Wood Thrush	55	53	53	53	52	52	55	52	58	58	57	57	58	57	58
American Robin	90	93	93	93	92	92	93	92	96	96	96	95	95	95	95
Gray Catbird	164	137	145	146	134	127	156	138	154	160	162	147	150	162	160
Brown Thrasher	65	80	80	80	80	80	82	80	87	86	85	86	87	85	86
Cedar Waxwing	91	99	99	99	99	98	99	99	101	101	101	101	100	100	101
Golden-winged Warbler	137	115	122	121	117	110	129	119	129	134	133	127	130	135	134
Tennessee Warbler	79	86	86	86	86	86	85	86	89	89	89	89	88	88	89
Nashville Warbler	108	106	106	107	106	106	106	106	106	107	107	106	106	107	107
Northern Parula	68	73	72	72	73	74	72	73	74	73	73	74	74	73	73
Yellow Warbler	97	103	103	102	101	105	107	102	89	88	88	87	94	94	89
Chestnut-sided Warbler	120	118	118	119	117	117	120	118	116	116	117	115	116	117	117
Magnolia Warbler	83	85	85	84	85	85	84	85	87	86	86	87	87	86	86
Cape May Warbler	95	94	94	94	94	94	93	94	96	97	96	97	96	96	96
Black-throated Blue Warbler	86	84	84	84	85	86	83	85	83	83	83	83	83	83	82
Yellow-rumped Warbler (Myrtle)	95	99	99	98	99	99	99	99	99	99	98	99	99	99	99
Black-throated Green Warbler	70	70	70	69	71	71	69	70	71	70	70	71	71	70	70
Blackburnian Warbler	92	97	96	96	97	97	96	97	96	96	95	96	97	96	96
Pine Warbler	88	119	116	117	117	115	115	117	120	118	118	119	117	115	118
Palm Warbler (Western)	81	78	83	77	90	83	83	90	82	89	82	93	97	90	88
Bay-breasted Warbler	79	77	77	76	77	77	76	77	79	78	78	79	79	78	78
Black-and-white Warbler	98	100	100	100	100	100	100	100	100	100	100	100	100	100	100
American Redstart	81	79	79	79	79	79	80	79	81	81	81	81	81	81	81
Ovenbird	103	103	103	103	103	103	102	103	102	102	102	102	102	102	102
Northern Waterthrush	83	80	79	79	78	79	78	78	81	80	80	80	79	79	79
Connecticut Warbler	94	98	98	98	99	97	96	98	104	104	104	105	103	102	104

EXHIBIT E-3 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name		Decade 3							Decade 4						
	Current Percent RNV	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Mourning Warbler	122	117	117	118	116	116	118	117	117	118	118	116	116	118	118
Common Yellowthroat	107	106	107	107	106	104	107	106	109	110	110	109	108	109	110
Wilson's Warbler	107	111	111	112	111	109	110	111	117	117	118	117	114	115	117
Canada Warbler	83	82	82	82	82	83	82	82	83	83	82	83	83	82	83
Scarlet Tanager	96	92	92	92	93	93	92	92	91	91	91	92	92	91	91
Eastern Towhee	129	120	125	126	117	114	131	120	130	133	136	123	124	135	133
Chipping Sparrow	96	103	103	103	103	103	103	103	106	106	106	106	105	105	106
Song Sparrow	145	134	138	137	134	133	144	136	132	135	135	130	135	139	135
Lincoln's Sparrow	106	104	105	105	105	104	104	105	110	111	111	110	108	109	110
White-throated Sparrow	107	107	107	107	106	107	108	107	105	106	106	105	106	107	106
Dark-eyed Junco (Slate-colored)	82	80	80	80	81	80	79	81	83	83	82	84	83	82	83
Rose-breasted Grosbeak	86	85	85	85	84	84	86	84	87	87	87	87	87	87	87
Indigo Bunting	121	108	108	107	104	111	115	107	81	80	81	78	90	91	82
Common Grackle	75	78	76	79	72	73	78	75	75	75	77	71	71	74	75
Brown-headed Cowbird	136	118	119	120	116	114	120	117	121	121	123	119	116	121	121
Baltimore Oriole	63	87	85	85	87	86	85	86	91	89	89	91	91	88	90
Purple Finch	106	106	107	106	108	106	107	108	109	111	110	111	110	110	110
Red Crossbill	54	124	118	120	122	118	116	121	130	126	125	131	127	120	127
White-winged Crossbill	108	115	117	116	120	116	116	119	124	126	124	128	127	124	126
Pine Siskin	67	76	75	75	76	76	74	75	79	77	77	79	78	76	77
American Goldfinch	204	177	183	183	178	175	189	181	184	190	189	182	185	192	189
Evening Grosbeak	83	98	97	97	98	97	96	97	100	99	99	100	99	98	99

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-4: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Great Blue Heron	224	221	222	221	224	226	222	224	233	235	236	228	224	233	230
Turkey Vulture	152	129	127	129	129	132	127	127	135	138	133	134	126	137	136
Wood Duck	70	77	78	77	78	77	77	77	87	88	87	87	86	87	86
Hooded Merganser	242	240	242	240	244	246	242	244	256	258	259	250	245	257	251
Common Merganser	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Osprey	148	148	148	148	150	152	149	150	157	157	157	154	152	156	155
Bald Eagle	195	203	206	208	188	173	203	190	155	156	165	154	163	164	161
Sharp-shinned Hawk	100	82	81	82	78	78	81	78	76	75	77	74	73	75	75
Cooper's Hawk	103	91	91	91	93	94	91	93	86	86	86	88	89	86	87
Northern Goshawk	242	240	242	240	244	246	242	244	256	258	259	250	245	257	251
Red-shouldered Hawk	89	76	77	76	79	80	77	79	73	73	73	71	72	73	71
Broad-winged Hawk	111	111	111	111	111	112	111	112	115	114	114	114	113	114	114
Red-tailed Hawk	136	137	137	139	131	125	136	131	119	119	122	118	121	122	121
American Kestrel	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Merlin	186	179	177	179	175	177	177	175	164	176	178	167	174	170	181
Mourning Dove	197	194	195	195	193	192	195	194	189	190	193	186	186	191	189
Black-billed Cuckoo	115	108	108	108	107	106	108	107	102	102	102	101	102	102	102
Yellow-billed Cuckoo	119	119	119	119	120	121	119	120	125	126	126	125	123	126	125
Great Horned Owl	194	204	205	204	205	207	205	206	225	230	228	225	217	228	225
Barred Owl	50	50	50	50	50	51	50	50	51	51	51	52	52	51	51
Great Gray Owl	282	187	188	188	190	196	190	193	142	141	140	145	145	141	144
Boreal Owl	282	187	188	188	190	196	190	193	142	141	140	145	145	141	144
Northern Saw-whet Owl	57	59	60	59	61	57	60	59	58	58	58	57	56	58	58
Whip-poor-will	103	99	98	99	99	101	99	99	101	100	99	101	101	100	101
Chimney Swift	151	148	149	148	150	152	149	150	156	157	157	153	151	156	153
Ruby-throated Hummingbird	102	103	103	103	104	103	103	103	102	103	103	103	103	102	103
Red-headed Woodpecker	192	191	192	191	194	194	192	194	202	203	204	197	193	202	198
Red-bellied Woodpecker	224	200	200	200	200	198	199	199	159	160	159	162	161	160	158
Yellow-bellied Sapsucker	116	112	112	112	113	113	112	113	111	111	111	111	111	111	111
Downy Woodpecker	144	137	137	137	138	138	137	138	133	134	134	133	134	134	134
Hairy Woodpecker	99	103	103	103	103	103	103	103	106	106	106	106	105	106	106
Black-backed Woodpecker	99	101	101	101	101	101	101	101	99	100	100	100	98	99	99
Northern Flicker (Yellow-shafted)	104	107	107	107	107	105	107	107	106	106	106	106	106	106	106

EXHIBIT E-4: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Pileated Woodpecker	113	109	108	109	108	110	109	109	113	111	112	112	113	114	113
Olive-sided Flycatcher	67	74	74	74	73	73	74	73	76	76	76	77	76	76	76
Eastern Wood-Pewee	107	105	105	105	106	107	105	106	107	107	107	107	107	107	107
Yellow-bellied Flycatcher	86	88	89	88	89	89	89	89	89	90	89	90	90	89	90
Least Flycatcher	108	105	105	105	105	107	105	105	106	106	106	106	106	106	106
Eastern Phoebe	141	135	135	135	135	134	135	135	135	136	137	133	132	135	134
Great Crested Flycatcher	118	112	113	113	112	112	113	112	109	110	110	109	109	110	109
Yellow-throated Vireo	138	134	134	134	135	136	134	135	135	136	135	134	133	135	134
Blue-headed Vireo	74	79	79	79	80	80	79	80	84	83	83	84	84	83	83
Warbling Vireo	137	122	123	122	123	123	123	123	110	110	110	110	112	111	112
Philadelphia Vireo	77	80	78	79	79	80	79	79	82	81	81	82	82	81	82
Red-eyed Vireo	109	107	107	107	107	108	107	107	107	107	107	107	107	107	107
Gray Jay	92	92	92	92	91	92	92	92	95	94	94	95	95	95	95
Blue Jay	102	102	102	102	102	102	102	102	103	103	103	103	102	103	103
American Crow	100	99	99	100	99	100	99	99	101	101	102	101	100	101	101
Common Raven	84	90	90	89	90	90	89	90	94	94	93	94	94	93	94
Tree Swallow	96	90	89	89	90	91	90	90	92	93	92	92	91	92	92
Black-capped Chickadee	105	103	103	103	103	103	103	103	102	102	102	102	102	102	102
Boreal Chickadee	98	97	97	97	97	97	97	97	94	95	95	94	93	93	94
Red-breasted Nuthatch	83	86	86	86	86	87	86	86	89	89	88	89	89	89	89
White-breasted Nuthatch	126	121	121	121	121	122	121	122	120	121	121	120	120	121	120
Brown Creeper	93	95	95	95	95	96	95	95	98	97	97	98	97	97	97
House Wren	159	159	160	160	157	155	159	157	151	152	154	149	152	153	152
Winter Wren	82	85	85	85	85	85	85	85	87	87	87	87	87	87	87
Golden-crowned Kinglet	87	89	89	89	89	89	89	89	89	90	89	90	89	89	89
Ruby-crowned Kinglet	84	86	87	86	87	86	87	86	86	87	86	86	86	86	86
Eastern Bluebird	122	123	123	124	122	121	123	122	120	119	121	118	119	120	119
Veery	125	122	123	123	122	121	123	122	118	119	119	118	118	119	119
Swainson's Thrush	79	81	81	81	82	82	81	82	82	82	82	82	82	82	82
Hermit Thrush	90	91	91	91	91	92	91	91	93	93	92	93	93	92	93
Wood Thrush	78	77	77	77	76	76	77	76	73	73	73	73	75	73	74
American Robin	89	90	90	90	90	90	90	90	91	91	91	91	91	91	91
Gray Catbird	185	185	187	188	178	169	186	179	156	157	162	154	160	161	159
Brown Thrasher	100	106	106	107	105	105	106	105	110	111	112	110	110	111	111

EXHIBIT E-4: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Cedar Waxwing	98	99	99	99	99	99	99	99	100	100	100	100	100	100	100
Golden-winged Warbler	114	119	120	120	116	112	119	116	110	110	112	110	112	112	112
Tennessee Warbler	79	82	82	82	82	82	82	82	83	84	84	84	84	84	84
Nashville Warbler	89	91	91	91	91	91	91	91	92	92	92	92	92	92	92
Northern Parula	73	75	75	75	76	76	76	76	78	78	77	78	78	78	78
Yellow Warbler	127	125	125	126	122	119	125	122	116	115	117	115	117	118	117
Chestnut-sided Warbler	127	125	125	126	124	123	125	124	121	121	122	121	122	122	122
Magnolia Warbler	86	86	86	86	87	87	87	87	87	87	87	87	87	87	87
Cape May Warbler	98	98	98	98	99	98	98	98	97	98	98	97	97	97	97
Black-throated Blue Warbler	83	84	84	84	84	84	84	84	83	83	82	83	83	83	83
Yellow-rumped Warbler (Myrtle)	80	84	83	83	83	83	83	83	86	86	85	86	86	86	86
Black-throated Green Warbler	82	82	82	82	83	83	82	83	83	83	82	83	83	83	82
Blackburnian Warbler	94	94	94	94	94	95	94	94	96	95	95	96	96	96	95
Pine Warbler	85	86	85	86	86	87	86	86	89	88	88	89	89	88	88
Palm Warbler (Western)	62	69	68	70	66	66	69	66	69	68	69	69	68	69	69
Bay-breasted Warbler	78	78	78	78	78	79	78	78	77	78	77	78	78	77	78
Black-and-white Warbler	95	97	97	97	97	97	97	97	98	98	98	98	98	98	98
American Redstart	120	115	116	116	115	115	116	116	112	113	113	112	113	113	113
Ovenbird	104	103	103	103	103	104	103	103	104	104	104	104	104	104	104
Northern Waterthrush	88	84	85	84	85	85	85	85	84	84	84	84	84	84	83
Connecticut Warbler	75	79	79	79	80	79	79	79	81	82	81	82	81	81	81
Mourning Warbler	125	123	123	123	122	121	123	122	119	119	120	119	119	119	120
Common Yellowthroat	87	92	92	92	91	90	92	91	91	91	91	91	91	91	91
Wilson's Warbler	107	111	111	111	111	110	111	111	110	112	111	110	109	110	110
Canada Warbler	87	87	87	87	87	88	87	87	87	87	87	87	88	87	87
Scarlet Tanager	124	122	122	122	122	122	122	122	121	121	121	120	120	121	121
Eastern Towhee	134	136	137	137	132	127	136	132	122	122	125	121	124	125	123
Chipping Sparrow	97	97	97	97	96	96	97	96	97	96	97	97	97	97	97
Song Sparrow	159	157	157	158	152	148	157	152	143	144	147	141	144	146	145
Lincoln's Sparrow	105	107	107	107	107	106	107	106	104	105	105	104	103	104	104
White-throated Sparrow	84	88	88	87	88	88	87	88	90	90	90	91	91	90	90
Dark-eyed Junco (Slate-colored)	82	83	82	83	81	81	82	81	81	80	81	80	79	80	80

EXHIBIT E-4: RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 1 and 2. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 1							Decade 2						
		A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS	A	A&P	A&P &SS	B	B&P	B&P &SF	B&P &SS
Rose-breasted Grosbeak	116	115	115	115	113	111	115	113	107	108	109	107	108	108	108
Indigo Bunting	145	140	140	141	137	134	140	138	131	129	132	129	133	133	132
Common Grackle	126	121	122	121	123	124	122	123	123	124	124	123	122	124	123
Brown-headed Cowbird	133	130	130	130	129	128	130	129	125	125	126	124	125	126	125
Baltimore Oriole	145	146	147	147	144	142	146	145	143	144	146	141	142	145	143
Purple Finch	101	99	98	99	98	98	98	98	98	98	98	98	97	98	98
Red Crossbill	74	78	77	77	77	78	77	77	82	81	81	82	82	81	81
White-winged Crossbill	98	99	98	99	96	96	98	96	96	96	97	95	94	95	95
Pine Siskin	76	78	78	78	78	79	78	78	82	82	81	82	81	81	81
American Goldfinch	135	134	135	136	131	128	134	132	124	125	127	124	126	126	126
Evening Grosbeak	85	87	87	87	87	88	87	87	91	90	90	91	91	91	90

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

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EXHIBIT E-4 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS	A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS
Great Blue Heron	224	214	215	221	205	203	218	209	202	205	208	201	203	209	209
Turkey Vulture	152	144	153	151	147	145	151	145	138	140	141	134	136	141	137
Wood Duck	70	92	93	94	92	93	91	93	90	90	93	87	85	93	89
Hooded Merganser	242	235	236	243	227	225	239	232	221	225	227	221	225	230	230
Common Merganser	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Osprey	148	150	149	152	146	146	151	148	146	147	148	146	147	149	149
Bald Eagle	195	153	163	158	160	162	162	170	140	147	143	139	146	135	139
Sharp-shinned Hawk	100	68	67	69	65	65	70	67	66	67	66	66	68	68	67
Cooper's Hawk	103	89	88	87	89	90	87	88	94	93	93	94	92	94	93
Northern Goshawk	242	235	236	243	227	225	239	232	221	225	227	221	225	230	230
Red-shouldered Hawk	89	68	68	70	66	66	69	67	68	68	68	68	68	70	69
Broad-winged Hawk	111	115	114	115	114	114	114	114	114	114	114	115	114	114	115
Red-tailed Hawk	136	121	125	123	124	124	124	127	116	118	117	115	118	114	115
American Kestrel	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Merlin	186	146	154	157	140	134	169	145	168	174	177	157	161	175	174
Mourning Dove	197	178	180	183	174	173	182	178	170	174	174	170	172	174	175
Black-billed Cuckoo	115	100	99	100	99	99	100	100	99	99	99	99	98	98	99
Yellow-billed Cuckoo	119	118	119	120	117	116	120	118	113	115	116	114	115	116	116
Great Horned Owl	194	203	205	209	198	196	207	203	179	186	191	182	183	189	189
Barred Owl	50	55	54	53	55	56	54	54	57	56	55	57	57	56	56
Great Gray Owl	282	117	122	119	126	129	120	123	101	100	101	109	106	103	105
Boreal Owl	282	117	122	119	126	129	120	123	101	100	101	109	106	103	105
Northern Saw-whet Owl	57	60	57	60	55	56	59	57	52	53	54	50	50	51	52
Whip-poor-will	103	104	104	103	105	106	103	104	107	106	106	107	106	107	106
Chimney Swift	151	147	147	150	143	143	149	145	142	144	145	143	144	146	146
Ruby-throated Hummingbird	102	103	103	103	103	103	103	103	102	103	103	102	102	102	102
Red-headed Woodpecker	192	187	187	193	180	179	190	184	174	178	180	174	177	181	181
Red-bellied Woodpecker	224	137	137	136	139	140	136	138	120	121	121	125	125	123	122
Yellow-bellied Sapsucker	116	110	110	110	109	110	110	110	110	110	110	110	110	111	110
Downy Woodpecker	144	130	131	131	129	130	131	130	128	129	129	127	128	130	129
Hairy Woodpecker	99	108	108	108	108	107	108	107	107	107	108	108	107	107	107
Black-backed Woodpecker	99	100	100	100	100	99	98	100	105	106	106	106	103	104	105
Northern Flicker (Yellow-shafted)	104	107	107	107	107	107	107	107	106	106	106	106	106	105	106
Pileated Woodpecker	113	111	111	111	110	112	114	111	102	102	102	101	105	105	103
Olive-sided Flycatcher	67	78	79	78	80	79	78	79	79	79	79	80	79	78	78
Eastern Wood-Pewee	107	107	107	107	107	107	107	106	108	108	108	108	108	109	109
Yellow-bellied Flycatcher	86	91	91	91	91	91	90	91	92	92	92	92	92	92	92
Least Flycatcher	108	106	105	105	105	105	105	105	106	105	106	106	106	106	106
Eastern Phoebe	141	127	128	131	125	124	130	127	123	124	125	123	124	126	125

EXHIBIT E-4 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS	A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS
Great Crested Flycatcher	118	106	106	107	105	105	107	106	104	105	105	104	105	105	105
Yellow-throated Vireo	138	130	131	132	129	129	131	130	128	129	129	128	128	130	129
Blue-headed Vireo	74	86	86	86	87	86	86	86	87	86	86	88	87	86	86
Warbling Vireo	137	112	114	114	114	114	114	114	117	116	117	115	114	116	115
Philadelphia Vireo	77	85	84	83	85	86	84	84	90	88	88	89	89	88	89
Red-eyed Vireo	109	106	106	107	106	106	106	106	106	106	106	106	106	107	107
Gray Jay	92	94	94	94	94	95	96	94	90	89	90	90	92	91	90
Blue Jay	102	103	103	103	102	102	103	102	103	103	103	103	103	103	103
American Crow	100	100	100	100	99	99	100	100	98	99	99	98	99	99	99
Common Raven	84	96	96	95	96	96	95	96	95	95	95	95	94	95	94
Tree Swallow	96	90	89	90	87	88	90	88	87	88	88	87	88	89	89
Black-capped Chickadee	105	101	101	101	101	101	101	101	101	101	101	101	101	101	101
Boreal Chickadee	98	92	92	92	93	92	91	93	97	97	97	97	96	95	97
Red-breasted Nuthatch	83	92	91	91	92	92	91	91	94	93	93	94	94	93	94
White-breasted Nuthatch	126	117	117	118	116	116	117	116	115	116	116	115	116	117	116
Brown Creeper	93	100	99	100	100	100	99	99	102	101	101	102	102	101	102
House Wren	159	149	150	151	147	147	152	150	147	149	149	146	148	148	149
Winter Wren	82	89	89	89	89	89	88	88	90	90	90	90	90	89	90
Golden-crowned Kinglet	87	91	90	90	91	91	90	91	94	94	93	94	93	93	93
Ruby-crowned Kinglet	84	87	87	87	88	87	86	87	91	91	91	92	91	90	91
Eastern Bluebird	122	118	118	119	117	117	119	119	118	119	118	118	120	118	119
Veery	125	116	116	117	115	115	117	116	114	115	115	113	114	115	115
Swainson's Thrush	79	83	83	83	84	84	83	83	85	85	85	85	85	84	85
Hermit Thrush	90	94	94	94	95	94	94	94	95	95	95	95	95	95	95
Wood Thrush	78	74	74	73	74	75	74	74	77	77	76	76	77	76	76
American Robin	89	92	91	91	92	92	91	91	94	93	93	93	93	93	93
Gray Catbird	185	152	159	157	156	156	158	161	145	149	147	143	148	143	144
Brown Thrasher	100	109	110	109	108	108	110	109	108	109	109	108	109	108	109
Cedar Waxwing	98	101	101	101	101	101	101	101	101	101	101	101	101	101	101
Golden-winged Warbler	114	110	113	111	112	111	113	114	107	109	108	107	108	106	107
Tennessee Warbler	79	86	86	86	86	86	85	86	89	89	89	89	88	88	88
Nashville Warbler	89	93	93	93	93	93	93	93	93	93	93	94	93	93	93
Northern Parula	73	80	79	79	80	80	79	79	81	80	80	81	81	80	80
Yellow Warbler	127	114	116	115	115	116	117	117	108	109	108	107	110	108	108
Chestnut-sided Warbler	127	120	121	121	120	120	121	121	118	119	119	117	118	118	118
Magnolia Warbler	86	88	88	87	88	88	87	88	89	89	89	89	89	88	89
Cape May Warbler	98	97	97	97	97	97	96	97	99	99	99	99	98	98	99
Black-throated Blue Warbler	83	82	82	82	83	83	82	82	82	81	81	82	82	82	81
Yellow-rumped Warbler (Myrtle)	80	88	88	87	89	88	87	88	89	88	88	89	89	88	88

EXHIBIT E-4 (CONT): RANGE OF NATURAL VARIATION VALUES FOR BIRD SPECIES IN THE DRIFT AND LAKE PLAINS AND NORTHERN SUPERIOR UPLANDS FOR CURRENT POPULATION AND FOR FOUR DECADES UNDER SCENARIO A AND B. This table displays Decades 3 and 4. Values are percent below a species mid-point RNV population. Values of 100 indicate that a species population is at its RNV midpoint, values above or below 100 indicate the percent of the species mid-point RNV value.

Common Name	Current Percent RNV	Decade 3							Decade 4						
		A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS	A	A&P	A&P&SS	B	B&P	B&P&SF	B&P&SS
Black-throated Green Warbler	82	83	83	82	83	83	82	82	84	84	83	84	85	84	84
Blackburnian Warbler	94	98	97	97	97	98	97	97	98	97	97	98	98	97	98
Pine Warbler	85	92	91	90	92	92	90	91	95	94	94	95	95	94	94
Palm Warbler (Western)	62	69	70	68	72	71	69	72	69	70	69	71	71	70	69
Bay-breasted Warbler	78	79	78	78	79	79	78	78	81	81	80	81	81	80	81
Black-and-white Warbler	95	99	99	99	99	99	99	99	98	98	98	98	98	98	98
American Redstart	120	111	111	111	110	111	111	111	110	111	111	110	110	111	111
Ovenbird	104	104	103	103	103	103	103	103	104	103	103	104	104	104	104
Northern Waterthrush	88	83	82	83	81	82	82	82	83	83	83	83	82	83	83
Connecticut Warbler	75	83	83	83	84	83	83	83	86	86	86	87	85	85	85
Mourning Warbler	125	117	118	118	117	117	119	118	117	118	118	116	117	117	117
Common Yellowthroat	87	91	92	91	92	92	92	92	91	91	91	91	91	90	90
Wilson's Warbler	107	111	111	112	111	109	110	111	117	117	118	117	114	115	117
Canada Warbler	87	88	87	87	88	88	87	87	88	88	88	88	88	88	88
Scarlet Tanager	124	118	119	119	118	118	119	118	116	117	117	116	117	117	117
Eastern Towhee	134	123	125	124	124	125	125	127	121	122	120	120	123	119	120
Chipping Sparrow	97	98	98	98	98	99	98	98	100	100	100	100	100	99	100
Song Sparrow	159	136	140	140	137	138	142	141	130	133	133	129	133	132	132
Lincoln's Sparrow	105	103	103	103	103	102	102	104	107	109	108	108	106	106	108
White-throated Sparrow	84	92	92	92	92	92	92	91	91	91	91	92	91	91	91
Dark-eyed Junco (Slate-colored)	82	79	79	78	80	80	78	80	81	81	80	82	81	80	81
Rose-breasted Grosbeak	116	105	107	106	106	106	107	107	105	106	105	104	105	104	105
Indigo Bunting	145	127	129	128	127	129	132	130	116	117	117	114	120	118	116
Common Grackle	126	119	118	120	116	116	120	117	116	117	118	115	115	118	118
Brown-headed Cowbird	133	122	123	123	122	122	123	123	120	122	121	120	121	121	121
Baltimore Oriole	145	140	141	142	139	139	142	142	134	136	136	134	136	135	136
Purple Finch	101	97	97	97	97	97	97	97	99	99	99	100	100	100	100
Red Crossbill	74	88	85	85	87	87	85	86	91	90	89	91	91	89	90
White-winged Crossbill	98	95	96	95	97	96	95	97	99	101	100	101	101	100	100
Pine Siskin	76	84	83	83	83	83	82	83	85	84	84	85	85	84	85
American Goldfinch	135	121	124	123	122	123	124	125	119	121	120	118	120	119	119
Evening Grosbeak	85	95	94	94	95	95	94	95	98	97	97	98	97	96	97

Note: A = No-Build, aspen from private land, no species substitution; A&P = Build, aspen from private land, no species substitution; A&P&SS = Build, aspen from private land, with species substitution; B = No-Build, less aspen from private land, no species substitution; B&P = Build, less aspen from private land, no species substitution; B&P&SFS = Build, less aspen from private land, species substitution including spruce-fir; B&P&SS = Build, less aspen from private land, with species substitution.

EXHIBIT E-5: ENDANGERED, THREATENED, AND SPECIAL CONCERN PLANT SPECIES LIST

Vascular plants - endangered

Agalinis auriculata (Michx.) Blake, Scrophulariaceae **eared false foxglove**
Agalinis gattingeri (Sm.) Sm. ex Britt., Scrophulariaceae **round-stemmed false foxglove**
Asclepias stenophylla Gray, Asclepiadaceae **narrow-leaved milkweed**
Astragalus alpinus L., Fabaceae **alpine milk-vetch**
Bartonia virginica (L.) B.S.P., Gentianaceae **Virginia bartonia**
Botrychium gallicomontanum Farrar & Johnson-Groh, Ophioglossaceae **Frenchman's Bluff moonwort**
Botrychium oneidense (Gilbert) House, Ophioglossaceae **blunt-lobed grapefern**
Botrychium pallidum W.H. Wagner, Ophioglossaceae **pale moonwort**
Cacalia suaveolens L., Asteraceae **sweet-smelling Indian-plantain**
Caltha natans Pallas ex Georgi, Ranunculaceae **floating marsh-marigold**
Carex formosa Dewey, Cyperaceae **handsome sedge**
Carex pallescens L., Cyperaceae **pale sedge**
Carex plantaginea Lam., Cyperaceae **plantain-leaved sedge**
Castilleja septentrionalis Lindl., Scrophulariaceae **northern paintbrush**
Cheilanthes lanosa (Michaux) D.C. Eaton, Pteridaceae **hairy lip-fern**
Chrysosplenium iowense Rydb., Saxifragaceae **Iowa golden saxifrage**
Cristatella jamesii T. & G., Capparidaceae **James' polanisia**
Dodecatheon meadia L., Primulaceae **prairie shooting star**
Draba norvegica Gunn., Brassicaceae **Norwegian whitlow-grass**
Eleocharis wolfii Gray, Cyperaceae **Wolf's spike-rush**
Empetrum eamesii Fern. & Wieg., Empetraceae **purple crowberry**
Empetrum nigrum L., Empetraceae **black crowberry**
Erythronium propullans Gray, Liliaceae **dwarf trout lily** (E)
Escobaria vivipara (Nutt.) Buxbaum, Cactaceae **ball cactus**
Fimbristylis puberula (Michx.) Vahl var. interior (Britt.) Kral, Cyperaceae **hairy fimbristylis**
Glaux maritima L., Primulaceae **sea milkwort**
Hydrastis canadensis L., Ranunculaceae **golden-seal**
Iodanthus pinnatifidus (Michx.) Steud., Brassicaceae **purple rocket**
Isoetes melanopoda Gay & Dur., Isoetaceae **blackfoot quillwort**
Lechea tenuifolia Michx., Cistaceae **narrow-leaved pinweed**
Lesquerella ludoviciana (Nutt.) S. Wats., Brassicaceae **bladder pod**
Listera auriculata Wieg., Orchidaceae **auricled twayblade**
Malaxis paludosa (L.) Sw., Orchidaceae **bog adder's-mouth**
Marsilea vestita Hooker & Greville, Marsileaceae **hairy water clover**
Montia chamissoi (Ledeb. ex. Spreng.) Greene, Portulacaceae **montia**
Oryzopsis hymenoides (R. & S.) Ricker ex Piper, Poaceae **Indian ricegrass**

Osmorhiza berteroi H. & A., Apiaceae **Chilean sweet cicely**
Oxytropis viscida Nutt., Fabaceae **sticky locoweed**
Paronychia fastigiata (Raf.) Fern., Caryophyllaceae **forked chickweed**
Parthenium integrifolium L., Asteraceae **wild quinine**
Platanthera flava (L.) Lindl. var. herbiola (R. Br.) Ames & Correll, Orchidaceae **tubercled rein-orchid**
Platanthera praeclara Sheviak & Bowles, Orchidaceae **western prairie fringed orchid** (T)
Polemonium occidentale Greene ssp. lacustre Wherry, Polemoniaceae **western Jacob's-ladder**
Polygala cruciata L., Polygalaceae **cross-leaved milkwort**
Polystichum braunii (Spenner) Fee, Dryopteridaceae **Braun's holly fern**
Potamogeton bicupulatus Fern., Potamogetonaceae **snailseed pondweed**
Potamogeton diversifolius Raf., Potamogetonaceae **diverse-leaved pondweed**
Psoralidium tenuiflora (Pursch) Rydb., Fabaceae **slender-leaved scurf pea**
Sagina nodosa (L.) fenzl ssp. borealis Crow, Caryophyllaceae **knotty pearlwort**
Saxifraga cernua L., Saxifragaceae **nodding saxifrage**
Scleria triglomerata Michx., Cyperaceae **tall nut-rush**
Sedum integrifolium (Raf.) A. Nels. ssp. leedyi (Rosend. & Moore) Clausen, Crassulaceae **Leedy's roseroot** (T)
Selaginella selaginoides (L.) Link, Selaginellaceae **northern spikemoss**
Senecio canus Hook., Asteraceae **gray ragwort**
Talinum rugospermum Holzinger, Portulacaceae **rough-seeded fameflower**
Tofieldia pusilla (Michx.) Pers., Liliaceae **small false asphodel**
Xyris torta Sm., Xyridaceae **twisted yellow-eyed grass**

Vascular plants - threatened

Achillea sibirica Ledeb., Asteraceae -- **Siberian yarrow**
Allium cernuum Roth, Liliaceae -- **nodding wild onion**
Allium schoenoprasum L. var. sibiricum (L.) Hartm., Liliaceae -- **wild chives**
Ammophila breviligulata Fern., Poaceae -- **beachgrass**
Arabis holboellii Hornem. var. retrofracta (Graham) Rydb., Brassicaceae -- **Holboell's rockcress**
Arnica lonchophylla Greene, Asteraceae -- **long-leaved arnica**
Arnoglossum plantagineum Raf., Asteraceae -- **tuberous Indian-plantain**
Asclepias hirtella (Pennell) Woodson, Asclepiadaceae -- **prairie milkweed**
Asclepias sullivantii Engelm., Asclepiadaceae -- **Sullivant's milkweed**
Asplenium trichomanes L., Aspleniaceae -- **maidenhair spleenwort**
Aster shortii Lindl., Asteraceae -- **Short's aster**
Aureolaria pedicularia (L.) Raf., Scrophulariaceae -- **fernleaf false foxglove**
Besseya bullii (Eaton) Rydb., Scrophulariaceae -- **kitten-tails**
Botrychium lanceolatum (S.G. Gmelin) Angstr., Ophioglossaceae -- **triangle moonwort**
Botrychium lunaria (L.) Sw., Ophioglossaceae -- **common moonwort**

Botrychium rugulosum W.H. Wagner, Ophioglossaceae -- **St. Lawrence grapefern**
Carex careyana Torr. ex Dewey, Cyperaceae -- **Carey's sedge**
Carex conjuncta Boott, Cyperaceae -- **jointed sedge**
Carex davisii Schwein. & Torr., Cyperaceae -- **Davis' sedge**
Carex festucacea Schkuhr ex Willd., Cyperaceae -- **fescue sedge**
Carex garberi Fern., Cyperaceae -- **Garber's sedge**
Carex jamesii Schwein., Cyperaceae -- **James' sedge**
Carex katahdinensis Fern., Cyperaceae -- **Katahdin sedge**
Carex laevivaginata (Kukenth.) Mackenzie, Cyperaceae -- **smooth-sheathed sedge**
Carex laxiculmis Schwein., Cyperaceae -- **spreading sedge**
Carex sterilis Willd., Cyperaceae -- **sterile sedge**
Crassula aquatica (L.) Schoenl., Crassulaceae -- **pigmyweed**
Crataegus douglasii Lindl., Rosaceae -- **black hawthorn**
Cyperus acuminatus Torr. & Hook., Cyperaceae -- **short-pointed umbrella--sedge**
Cypripedium arietinum R. Br., Orchidaceae -- **ram's-head lady's-slipper**
Diplazium pycnocarpon (Spreng.) M. Broun, Dryopteridaceae -- **narrow-leaved spleenwort**
Dryopteris marginalis (L.) Gray, Dryopteridaceae -- **marginal shield-fern**
Eleocharis nitida Fern., Cyperaceae -- **neat spike-rush**
Eleocharis olivacea Torr., Cyperaceae -- **olivaceous spike-rush**
Eleocharis rostellata Torr., Cyperaceae -- **beaked spike-rush**
Eupatorium sessilifolium L., Asteraceae -- **upland boneset**
Floerkea proserpinacoides Willd., Limnanthaceae -- **false mermaid**
Heteranthera limosa (Sw.) Willd., Pontederiaceae -- **mud plantain**
Huperzia porophila (Lloyd & Underwood) Holub, Lycopodiaceae -- **rock clubmoss**
Lespedeza leptostachya Engelm., Fabaceae -- **prairie bush clover**(T)
Melica nitens (Scribn.) Nutt. ex Piper, Poaceae -- **three-flowered melic**
Moehringia macrophylla (Hook.) Fenzl, Caryophyllaceae -- **large-leaved sandwort**
Napaea dioica L., Malvaceae -- **glade mallow**
Nymphaea leibergii (Morong) Boivin, Nymphaeceae -- **small white waterlily**
Paronychia canadensis (L.) Wood, Caryophyllaceae -- **Canadian forked chickweed**
Phegopteris hexagonoptera (Michx.) Fee, Thelypteridaceae -- **broad beech-fern**
Plantago elongata Pursh, Plantaginaceae -- **slender plantain**
Poa paludigena Fern. & Wieg., Poaceae -- **bog bluegrass**
Polystichum acrostichoides (Michx.) Schott, Dryopteridaceae -- **Christmas fern**
Rhynchospora capillacea Torr., Cyperaceae -- **hair-like beak-rush**
Rotala ramosior (L.) Koehne, Lythraceae -- **tooth-cup**
Rubus chamaemorus L., Rosaceae -- **cloudberry**
Salicornia rubra Nelson, Chenopodiaceae -- **red saltwort**
Saxifraga paniculata P. Mill., Saxifragaceae -- **encrusted saxifrage**
Scleria verticillata Muhl., Cyperaceae -- **whorled nut-rush**

Scutellaria ovata Hill, Lamiaceae -- **ovate--leaved skullcap**
Shinnersoseris rostrata (Gray) S. Tomb, Asteraceae -- **annual skeletonweed**
Silene nivea (Nutt.) Muhl. ex Otth., Caryophyllaceae -- **snowy campion**
Subularia aquatica L., Brassicaceae -- **awlwort**
Sullivantia sullivantii (Torr. & Gray) Britt., Saxifragaceae -- **reniform sullivantia**
Vaccinium uliginosum L., Ericaceae -- **alpine bilberry**
Valeriana edulis Nutt. var. ciliata (Torr. & Gray) Cronq., Valerianaceae -- **valerian**
Viola lanceolata L., Violaceae -- **lance-leaved violet**
Viola nuttallii Pursh, Violaceae -- **yellow prairie violet**
Woodsia glabella R. Br., Dryopteridaceae -- **smooth woodsia**
Woodsia scopulina D.C. Eat., Dryopteridaceae -- **Rocky Mountain woodsia**

Vascular plants - special concern

Adoxa moschatellina L., Adoxaceae -- **moschatel**
Agrostis geminata Trin., Poaceae -- **twin bentgrass**
Androsace septentrionalis L. ssp. puberulenta (Rydb.) G.T. Robbins, Primulaceae -- **northern androsace**
Antennaria parvifolia Nutt., Asteraceae -- **small-leaved pussytoes**
Aristida purpurea Nutt. var. longiseta (Steud.) Vasey, Poaceae -- **red three-awn**
Aristida tuberculosa Nutt., Poaceae -- **sea-beach needlegrass**
Asclepias amplexicaulis Sm., Asclepiadaceae -- **clasping milkweed**
Asplenium platyneuron (L.) Britt., Aspleniaceae -- **ebony spleenwort**
Astragalus flexuosus (Hook.) Dougl., Fabaceae -- **slender milk-vetch**
Astragalus missouriensis Nutt., Fabaceae -- **Missouri milk-vetch**
Bacopa rotundifolia (Michx.) Wettst., Scrophulariaceae -- **water-hyssop**
Baptisia alba (L.) Bent., Fabaceae -- **white wild indigo**
Baptisia bracteata Muhl. ex Ell. var. leucophaea (Nutt.) Kartesz & Gandhi, Fabaceae-- **plains wild indigo**
Botrychium campestre W.H. Wagner & Farrar, Ophioglossaceae -- **prairie moonwort**
Botrychium minganense Victorin, Ophioglossaceae -- **Mingan moonwort**
Botrychium mormo W.H. Wagner, Ophioglossaceae -- **goblin fern**
Botrychium simplex E. Hitchc., Ophioglossaceae -- **least moonwort**
Buchloe dactyloides (Nutt.) Engelm., Poaceae -- **buffalo grass**
Calamagrostis lacustris (Kearney) Nash, Poaceae -- **marsh reedgrass**
Calamagrostis montanensis Scribn. ex Vasey, Poaceae -- **plains reedgrass**
Calamagrostis purpurascens R. Br., Poaceae -- **purple reedgrass**
Callitriche heterophylla Pursh, Callitrichaceae-- **larger water-starwort**
Carex annectens Bickn., Cyperaceae -- **yellow-fruited sedge**
Carex crus-corvi Shuttlw. ex Kunze, Cyperaceae -- **raven's foot sedge**
Carex exilis Dew., Cyperaceae -- **coastal sedge**

Carex flava L., Cyperaceae -- **yellow sedge**
Carex hallii Olney, Cyperaceae -- **Hall's sedge**
Carex michauxiana Boeckl., Cyperaceae -- **Michaux's sedge**
Carex obtusata Lilj., Cyperaceae -- **blunt sedge**
Carex praticola Rydb., Cyperaceae -- **prairie sedge**
Carex scirpoidea Michx., Cyperaceae -- **northern singlespike sedge**
Carex supina Willd. ex Wahlenb. var. spaniocarpa (Steud.) Boivin, Cyperaceae -- **weak arctic sedge**
Carex typhina Michx., Cyperaceae -- **cattail sedge**
Carex woodii Dew., Cyperaceae -- **Wood's sedge**
Carex xerantica Bailey, Cyperaceae -- **dry sedge**
Chamaesyce missurica (Raf.) Shinners, Euphorbiaceae -- **Missouri spurge**
Cirsium hillii (Canby) Fern., Asteraceae -- **Hill's thistle**
Cladium mariscoides (Muhl.) Torr., Cyperaceae-- **twig-rush**
Claytonia caroliniana Michx., Portulacaceae -- **Carolina spring-beauty**
Cymopterus acaulis (Pursh) Raf., Apiaceae -- **wild parsley**
Cypripedium candidum Muhl., Orchidaceae -- **small white lady's-slipper**
Dalea candida Willd., var. oligophylla (Torr.) Shinners, Fabaceae -- **western white prairie-clover**
Decodon verticillatus (L.) Ell., Lythraceae -- **waterwillow**
Deschampsia flexuosa (L.) Trin., Poaceae -- **slender hairgrass**
Desmanthus illinoensis (Michx.) MacM, Fabaceae -- **prairie mimosa**
Desmodium cuspidatum (Muhl. ex Willd.) DC. ex Loud. var. longifolium (Torr. & Gray) Schub., Fabaceae -- **big tick-trefoil**
Desmodium nudiflorum (L.) DC., Fabaceae -- **stemless tick-trefoil**
Diarrhena obovata (Gleason) Brandenburg, Poaceae -- **American beakgrain**
Dicentra canadensis (Goldie) Walp., Fumariaceae -- **squirrel-corn**
Draba arabisans Michx., Brassicaceae -- **rock whitlow-grass**
Drosera anglica Huds., Droseraceae -- **English sundew**
Drosera linearis Goldie, Droseraceae-- **linear-leaved sundew**
Dryopteris goldiana (Hook.) Gray, Dryopteridaceae -- **Goldie's fern**
Eleocharis parvula (Roemer & J.A. Schultes) Link ex Bluff, Nees & Schauer, Cyperaceae -- **dwarf spike-rush**
Eleocharis quinqueflora (F.X. Hartmann) Schwarz, Cyperaceae -- **few-flowered spike-rush**
Eryngium yuccifolium Michx., Apiaceae -- **rattlesnake-master**
Euphrasia hudsoniana Fern. & Wieg., Scrophulariaceae Hudson Bay -- **eyebright**
Fimbristylis autumnalis (L.) Roemer & J.A. Schultes, Cyperaceae -- **autumn fimbristylis**
Gaillardia aristata Pursh, Asteraceae -- **blanket-flower**
Gentiana affinis Griseb., Gentianaceae -- **northern gentian**
Gentianella amarella (L.) Borner ssp. acuta (Michx.) Gillett, Gentianaceae-- **felwort**
Hamamelis virginiana L., Hamamelidaceae -- **witch-hazel**
Helianthus nuttallii Torr. & Gray ssp. rydbergii (Br.) Long, Asteraceae -- **Nuttall's sunflower**

Helictotrichon hookeri (Scribn.) Henr., Poaceae -- **oat-grass**
Hudsonia tomentosa Nutt., Cistaceae -- **beach-heather**
Hydrocotyle americana L., Apiaceae -- **American water-pennywort**
Jeffersonia diphylla (L.) Pers., Berberidaceae -- **twinleaf**
Juglans cinerea L., Juglandaceae -- **butternut**
Juncus marginatus Rostk., Juncaceae -- **marginated rush**
Juncus stygius L. var. americanus (Buch.) Hulten, Juncaceae -- **bog rush**
Juniperus horizontalis Moench, Cupressaceae -- **creeping juniper**
Leersia lenticularis Michx., Poaceae -- **catchfly grass**
Limosella aquatica L., Scrophulariaceae -- **mudwort**
Listera convallarioides (Sw.) Nutt. ex Ell., Orchidaceae -- **broad-lipped twayblade**
Littorella uniflora (L.) Aschers., Plantaginaceae -- **American shore-plantain**
Luzula parviflora (Ehrh.) Desv. ssp. melanocarpa (Michx.) Hamet-Ahti, Juncaceae -- **small-flowered woodrush**
Lysimachia quadrifolia L., Primulaceae -- **whorled loosestrife**
Machaeranthera pinnatifida (Hook.) Shinners, Asteraceae -- **cutleaf ironplant**
Malaxis monophyllos (L.) Sw. var. brachypoda (Gray) Morris & Eames, Orchidaceae -- **white adder's-mouth**
Minuartia dawsonensis (Britt.) House, Caryophyllaceae-- **rock sandwort**
Muhlenbergia uniflora (Muhl.) Fern., Poaceae -- **one flowered muhly**
Najas gracillima (A. Braun ex Engelm.) Magnus, Najadaceae-- **slender naiad**
Najas marina L., Najadaceae -- **sea naiad**
Oenothera rhombipetala Nutt. ex Torr. & Gray, Onagraceae -- **rhombic-petaled evening primrose**
Opuntia macrorhiza Engelm., Cactaceae -- **plains prickly pear**
Orobanche fasciculata Nutt., Orobanchaceae -- **clustered broomrape**
Orobanche ludoviciana Nutt., Orobanchaceae -- **Louisiana broomrape**
Orobanche uniflora L., Orobanchaceae -- **one-flowered broomrape**
Osmorhiza depauperata Phil., Apiaceae -- **blunt-fruited sweet cicely**
Panax quinquefolius L., Araliaceae -- **American ginseng**
Pellaea atropurpurea (L.) Link, Adiantaceae -- **purple cliff-brake**
Phacelia franklinii (R.Br.) Gray, Hydrophyllaceae -- **Franklin's phacelia**
Pinguicula vulgaris L., Lentibulariaceae -- **butterwort**
Platanthera clavellata (Michx.) Luer, Orchidaceae -- **club-spur orchid**
Poa wolfii Scribn., Poaceae -- **Wolf's bluegrass**
Polygonum careyi (Olney), Polygonaceae -- **Carey's smartweed**
Polygonum viviparum L., Polygonaceae -- **alpine bistort**
Polytaenia nuttallii DC., Apiaceae-- **prairie-parsley**
Potamogeton vaginatus Turcz., Potamogetonaceae -- **sheathed pondweed**
Potamogeton vaseyi Robbins, Potamogetonaceae -- **Vasey's pondweed**
Prenanthes crepidinea Michx., Asteraceae -- **nodding rattlesnake-root**

*Pyrola minor*L., Pyrolaceae -- **small shinleaf**
Ranunculus lapponicus L., Ranunculaceae -- **Lapland buttercup**
Rhynchospora fusca (L.) Ait. f., Cyperaceae -- **sooty-colored beak-rush**
Rorippa sessiliflora (Nutt.) A.S. Hitchc., Brassicaceae -- **sessile-flowered cress**
Rudbeckia triloba L., Asteraceae -- **three-leaved coneflower**
Ruppia maritima L., Ruppiaceae -- **ditch-grass**
Salix maccalliana Rowlee, Salicaceae -- **Maccall's willow**
Salix pellita (Anderss.) Anderss. ex Schneid., Salicaceae -- **satiny willow**
Sanicula trifoliata Bickn., Apiaceae -- **beaked snakeroot**
Schedonnardus paniculatus (Nutt.) Trel., Poaceae -- **tumblegrass**
Scirpus clintonii Gray, Cyperaceae -- **Clinton's bulrush**
Senecio indecorus Greene, Asteraceae -- **elegant grounsel**
Silene drummondii Hook., Caryophyllaceae -- **Drummond's campion**
Solidago mollis Bartl., Asteraceae-- **soft goldenrod**
Solidago sciaphila Steele, Asteraceae -- **cliff goldenrod**
Sparganium glomeratum Laest., Sparganiaceae -- **clustered bur-reed**
Stellaria longipes Goldie, Caryophyllaceae -- **long-stalked chickweed**
Symphoricarpos orbiculatus Moench, Caprifoliaceae -- **coralberry**
Tephrosia virginiana (L.) Pers., Fabaceae -- **goat's-rue**
Torreyochloa pallida (Torr.) Church, Poaceae -- **Torrey's manna-grass**
Trillium nivale Riddell, Liliaceae -- **snow trillium**
Trimorpha acris (L.) Nesom var. asteroides (Anderz. ex Bess.) Nesom, Asteraceae -- **bitter fleabane**
Trimorpha lonchophylla (Hook.) Nesom, Asteraceae-- **shortray fleabane**
Triplasis purpurea (Walt.) Champm., Poaceae -- **purple sand-grass**
Tsuga canadensis (L.) Carr., Pinaceae -- **eastern hemlock**
Utricularia purpurea Walt., Lentibulariaceae -- **purple-flowered bladderwort**
Utricularia resupinata B.D. Greene ex Bigelow, Lentibulariaceae -- **lavender bladderwort**
Verbena simplex Lehm., Verbenaceae -- **narrow-leaved vervain**
Vitis aestivalis Michx., Vitaceae -- **silverleaf grape**
Waldsteinia fragarioides (Michx.) Tratt., Rosaceae -- **barren strawberry**
Woodsia alpina (Bolton) Gray, Dryopteridaceae -- **alpine woodsia**
Xyris montana Ries, Xyridaceae -- **montane yellow-eyed grass**

Lichens, mosses & fungi

Lichens

Endangered
Buellia nigra (Fink) Sheard
Caloplaca parvula Wetm.
Dermatocarpon moulinsii (Mont.) Zahlbr.

Leptogium apalachense (Tuck.) Nyl.
Lobaria scrobiculata (Scop.) DC.
Parmelia stictica (Del.) Nyl.
Pseudocyphellaria crocata (L.) Vain.
Umbilicaria torrefacta (Lightf.) Schrad.

Threatened
Cetraria oakesiana Tuck.
Coccocarpia palmicola (Sprengel) Arvid & Galloway
Parmelia stuppea Tayl.

Special Concern
Anaptychia setifera Rs.
Cetraria aurescens Tuck.
Cladonia pseudorangiformis Asah.
Lobaria quercizans Michx.
Peltigera venosa (L.) Hoffm.
Sticta fuliginosa (Dicks.) Ach.

Mosses
Endangered
Schistostegia pennata (Hedw.) Web. & Mohr **luminous moss**

Special Concern
Bryoxiphium norvegicum (Brid.) Mitt. **sword moss**
Tomenthypnum falcifolium (Ren. ex Nich.) Tuom.

Fungi
Endangered
Fuscoboletinus weaverae A.H. Smith & Shaffer
Psathyrella cystidiosa (Peck) A.H. Smith
Psathyrella rhodospora Weaver & A.H. Smith

Special Concern
Laccaria trullisata (Ellis) a species of fungus
Lactarius fuliginellus A.H. Smith & Hesler
Lysurus cruciatus (Lepr. & Mont.) Lloyd.