3.3.6 Other Species of Management Concern

3.3.6.1 Northern goshawk (Indicator 19)

(36CFR 219.19 Management Indicator Species and Sensitive Species)

Evaluation of goshawk habitat is based primarily on acres of nesting and foraging habitat indicators.

As an indicator, northern goshawk does a good job of highlighting differences among the alternatives because each alternative will result in varying habitat conditions. Northern goshawk is an "management indicator species" because: population changes may indicate effects of management; it is a high public interest species and Region 9 Forester's sensitive species; its habitat associations are well-documented in literature; it can function as umbrella species – (its large area requirements and use of multiple habitats encompass habitat requirements of many other species); and its breeding productivity and population and habitat trends can be monitored at site and landscape level. Finally, National Forests in the western Great Lakes region play a major role in contributing to viability and well-distributed habitats (species is also an MIS on the Chequamegon-Nicolet National Forest).

3.3.6.1.a Affected Environment for Northern Goshawk

The northern goshawk appears to be uncommon in Minnesota and there are concerns about its population status throughout the Lake States. The Minnesota Natural Heritage Program (2002) lists 49 rare element occurrences for northern goshawk in Minnesota. Smithers et al. (2002) discussed 42 sites in Minnesota, but some known sites are missing from their discussion. Their monitoring of 39 sites in 2002 indicated that 17 of the sites were occupied, and 10 of those fledged young. This is consistent with previous nest search and monitoring efforts in Minnesota since the early 1990's which indicate a range of 10-20 known active nest sites in any given year. Due to variable knowledge or protection, nest sites have been lost on federal, state, county, and private ownerships in northern Minnesota due to forest management since the early 1990s.

The northern goshawk in the eastern United States may have been negatively affected by deforestation and heavy and widespread timber harvest in previous centuries, peaking around 1900 (Kennedy 1997). It is speculated that these populations have since increased and continue to increase as forests in the eastern U.S. increase in acreage and maturity (Speiser and Bosakowski, 1984 in Squires and Reynolds, 1997). Annual fall migration counts of northern goshawks in recent years at Hawk Ridge near Duluth, MN have shown a decline over that of previous decades. Various data sources and analyses provide variable conclusions on the status and trends of goshawk habitat and populations in the Lake States. Kennedy (1997) concluded that a more rigorous approach was needed than has been undertaken previously to determine this species population trend, whether it is stable, increasing, or decreasing.

The northern goshawk is considered a habitat generalist at range-wide scales. However, there is general commonality in nest site selection, foraging habitat, and prey selection. Habitat preferences for northern goshawk are considered to be mature deciduous or mixed deciduous/coniferous forest in fairly contiguous blocks intermixed with younger forest and openings for production of prey species. Like other members of the genus *Accipiter*, the goshawk's morphological characteristics for maneuverability in flight (short rounded wings and long tail) are considered adaptations for foraging beneath the forest canopy, and they suggest that this is an important part of this species' biology (Nature Conservancy Species Status Sheet, USDA FS 2000). Goshawks eat mainly rabbits, hares, squirrels, ducks, gallinaceous and other birds; local diet partly depends on availability. Snags, downed logs, openings, large trees, shrubby understory, and interspersion of vegetation structural stages (grasses to old forests) are critical habitat for prey species used by the goshawk. Nest sites are usually in stands with large trees and well-developed canopies (Nature Conservancy Species Status Sheet, USDA FS 2000). Several nest stands may be associated with a single pair of birds. Goshawks may use the same nest in successive years. Disturbance to the nesting pair may result in nest failure and abandonment.

The effect of recent rates of harvest on forest spatial patterns is covered in detail in Ch. 3.2.2. Forest Spatial Patterns. Wolter and White (2002), Host and White 2002, and Host and White (2003) outline recent and historic changes to spatial patterns forest land in northern Minnesota that show a trend that has and may continue to impact the goshawk. These changes include a reduction in forest patch size, decreased interior forest, and increased forest edge. Rates of removal and growth from Forest Inventory and Analysis data (Leatherberry and Spencer 1996, Miles et al. 1995, Schmidt 1997) help to evaluate current conditions and predict habitat availability for the northern goshawk. Rates of removal on the Chippewa and Superior have been above the state-wide and Lakes States regional averages based on the 1990 FIA summary, exceeded only by private industrial forestland within Minnesota. This helps to place into context recent rates of disturbance of mature forest on National Forests in Minnesota, and thus, to goshawk habitat.

Harvest levels indicated by FIA data may be shifting to other ownership grouping based on an analysis of age and spatial pattern shifts from 1990 to 1995. Wolter and White (2002) identified a trend to increased impacts on state lands and on private non-industrial forest land that could influence other ownerships' ability to provide habitat in appropriate sized patches and distribution across the landscape.

Chapter 3.2.1. Forest Vegetation and the related appendix and planning record information covers in detail historic rates of disturbance and the resulting tree age and composition on the landscapes that include Minnesota's National Forests. Expressed as a range of conditions, this helps to define the ecological conditions in which the northern goshawk evolved.

3.3.6.1.b Environmental Consequences for Northern Goshawk

For management and analysis purposes, there are three components to goshawk habitat.

1) Nesting habitat is used for courtship and breeding, nesting, provisioning of young until fledged, and security for the female while nesting. It consists of the forest immediately around the nest tree or trees. This habitat is typically, older, closed canopy forest with few to no openings, in aspen, northern hardwood or pine forest types.

2) Post-fledging habitat is used for provisioning the young after fledging until dispersal occurs, security for the fledged young, foraging for the adult female during nesting, and territory defense. Post-fledging habitat typically surrounds the nesting habitat. It usually has similar characteristics to the nesting habitat, but may be partly lowland forest types.

3) Foraging habitat consists of the goshawks nesting home range. It is used for foraging by the male during nesting to feed himself and his mate, and after hatching, the young. Goshawks hunt in a variety of forest types, but tend to select foraging habitat that is a higher density of trees, higher canopy closure (Beier and Drennan, 1997, Doyle and Smith, 1994, Bright-Smith and Mannan, 1994) and trees of larger diameter at breast height (Austin, 1993, Hargis et al., 1994) than may be randomly present. Foraging habitat in Minnesota has been defined by radio telemetry data as mature forest stands with a moderately closed to closed canopy on upland landforms (Boal et al. 2001). Goshawks were not found to hunt in lowland forest types. Foraging habitat is determined by the availability of prey, canopy cover for protection, and availability of sub-canopy perch sites to facilitate hunting. Prey availability is a factor of prey abundance and ability of goshawks to hunt and capture the prey. Stand complexity is important in meeting

both of these factors. A mixed species forest with abundant defective, and dead trees, down logs and woody debris, some edge, dense stem densities and dense shrubs provides both abundant prey and goshawk hunting opportunities.

Telemetry data in Minnesota suggest that home ranges for goshawk pairs average approximately 15,948 acres in size (Boal et al. 2001). Home range in this context is synonymous with foraging habitat. The appropriate scale for analysis of alternatives for goshawk habitat is at the home range, or foraging habitat scale. As described above, foraging habitat is a combination of mature forest, stand complexity, early seral and young forest, and open habitats. The relative abundance of these elements, and how they are spatially arranged on the landscape are integral to defining the quality and quantity of goshawk habitat.

Effects Common to All Alternatives

Standards are established to manage for goshawk nesting and post-fledgling habitat conditions. Management of these habitat components would be the same between alternatives.

Direct and Indirect Effects for Northern Goshawk

Goshawk Indicator 1: Mature Forest Availability

The relative abundance of different vegetative growth stages is important to determining the quality and quantity of goshawk foraging habitat. Evaluations of goshawk foraging habitat requirements on the Chippewa National Forest have been conducted by looking at the habitat requirements of key prey species (Casson, 1996, Williamson et. al, 2001). These evaluations concluded that optimum foraging habitat consists of three upland vegetative growth stages having a relative abundance of approximately 20% open habitat and seedling-sapling forest, 20% pole sized forest, and 60% mature and older forest. The mature and older forest growth stage is considered to be the factor most critical to defining foraging habitat. The Chippewa evaluations determined that if mature forest availability drops below 40% of the landscape, goshawk territories become unsustainable and populations will experience declines and uncertain futures. For this analysis we used 80% for both forests as an upper end for mature forest. Mature forest availability for an upper amount may be described in terms of the range of natural variation (RNV) for landscape ecosystems found on each forest. This amount, 80%, reflects an average between the DLP and NSU sections for all landscape ecosystems for amounts of mature or older forest considering base rates of disturbance to produce young forest under the lower portion of the range of natural variation (RNV). This is a point, if exceeded, where prey availability may decline to a point where goshawk territories become unsustainable and populations may decline. This analysis uses these parameters to measure the quality and quantity of goshawk foraging habitat.

Goshawk Indicator 2: Patch size

Mature forest should be relatively contiguous, but interspersion of open habitat, young forest and edge are important for prey production. The actual spatial arrangement of these habitat elements to provide optimal foraging habitat is difficult to determine, and even more difficult to measure. Although goshawks are known to nest and forage in forest patches smaller than 100 acres, at the landscape scale, such conditions expose goshawks to negative energy balances because they have to travel further to acquire prey, and increased risk of predation as they travel through insecure habitat between patches of suitable foraging habitat. Patch sizes and forest spatial patterns are covered in more detail in Ch. 3.2.2. Forest Spatial Patterns. Therefore, this analysis looks at patch size, and selects 100 acres as the minimum patch size of mature or older forest, that reflects suitable goshawk foraging habitat.

Goshawk Indicator 3: Stand Complexity

Prey availability is a factor of prey abundance and ability of goshawks to hunt and capture the prey. Stand complexity is important in meeting both of these factors. The amounts and variety of management options (e.g. harvest methods, prescribed fire) used to achieve vegetative objectives and the condition of the forest that result from achieving objectives help indicate the effectiveness of alternatives to maintain well distributed habitat. This indicator examines the amounts and variety of proposed harvest treatments methods, the amounts of prescribed fire, and the acres not harvested to predict general effects of planning alternatives to within-stand complexity and native plant communities. These effects will influence prey abundance and suitability of forest for foraging habitat. This indicator will help to qualify forest condition that will result from the planning alternatives. This analysis is covered in detail in Ch.3.2.1. under Indicator 3: Use of Management Treatments Which Increase Within-stand Complexity. Results and conclusions of that analysis are summarized below.

Effects on Chippewa National Forest

Goshawk Indicator 1: Mature Forest Availability

Using 40% and 80% mature and older upland forest as the boundaries of a sustainable goshawk population, with 60% considered optimal, the existing condition on the Chippewa (Table WNG-1) provides a suitable relative abundance of upland forest vegetative growth stages.

Alternatives A and C do not provide suitable amounts of mature and older forest in any decade analyzed, and would provide conditions that are very high risk for maintaining viability within the forest for northern goshawks for the next century.

Table WNG-1: Goshawk-Indicator 1 - Percentage of All Upland Forest in Mature/Older Upland Forest within the Chippewa and Superior National Forests for existing condition and decades 1, 2, 5, and 10 for each alternative.

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
Chippewa 2002 Existing	49%	49%	49%	49%		49%	49%
2004 Existing					48%		
Decade 1	35%	47%	30%	46%	43%	46%	45%
2	31%	52%	28%	51%	45%	51%	47%
5	27%	78%	31%	79%	55%	75%	65%
10	28%	77%	36%	88%	58%	72%	64%
Superior 2002 Existing	56%	56%	56%	56%		56%	56%
2004 Existing					55%		
Decade 1	42%	52%	37%	51%	48%	50%	49%
2	38%	55%	32%	53%	46%	49%	47%
5	38%	72%	32%	76%	51%	60%	55%
10	37%	74%	38%	85%	58%	62%	58%
Superior 2002 Existing	51%	51%	51%	51%		51%	51%
2004 Existing					51%		
w/BWCAW Decade 1	45%	51%	42%	50%	47%	50%	49%
2	43%	53%	39%	52%	46%	49%	48%
5	49%	69%	47%	71%	48%	62%	60%
10	52%	74%	53%	80%	53%	67%	64%

Source: Based on existing data and harvest model output for decades 1,2,5,10 for Federal ownership only. Superior in BWCAW, acres of mature/older upland from MIH report 1.
Definitions: A patch is defined as a contiguous grouping of similar vegetative conditions.
‡Notes: Chippewa NF: Total upland acres: 455,880 ac, Total federal ownership: 666,471 ac, Superior NF: Total upland acres: 1,666,569 (outside the wilderness 960,270 ac. 706,299 ac. within the wilderness) Total federal ownership: 2,171,660 acres.

Modified alternative E provides marginally suitable amounts through decade 2, but provides improved amounts in future decades.

Alternative D provides suitable amounts of old forest through decade 2 and 5, but becomes marginally suitable in decade 10 with an over abundance of older forest and not enough prey production vegetative stages on the National Forest alone.

Alternatives B, F, and G provide sustainable goshawk habitat throughout the analysis period. On the National Forest alone, Alternative B maintains amounts of mature forest near the upper limit identified.

All of the alternatives predict a decrease in this indicator during the first decade of implementation of the Forest Plan. Alternatives B, F, D, G, and E, in this order, provide the smallest drop from existing condition while remaining above the 40% minimum for habitat suitability forest-wide.

Of the three components of northern goshawk habitat, maintenance of at least minimum amounts of foraging habitat (Casson, 1996, Williamson et. al, 2001) within goshawk territories is not assured in alternatives. Some goshawk foraging areas may drop below 40% mature forest and would result in higher risk to maintaining that breeding pair, and increased risk to maintaining viability within the planning unit. Project level decisions could spatially arrange harvests or other management disturbances on the landscape to maintain foraging areas at or above the 40% minimum. Management standards and guides would mitigate impacts closest to nest sites with regard to mature or older forest. Rates of disturbance in Alternatives B, F, and D would likely not adversely impact goshawk nest sites and make this management direction unnecessary.

Table WNG-2: Northern Goshawk- Indicator 2 - Area and Number of 100 acre or Larger Mature/Older Upland Forest Patches within the Chippewa National Forest for existing condition and decades 1, 2, 5, and 10 for each alternative.

	Alt. A No Action	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
Acres of Large Patches	Ac	Ac	Ac	Ac	Ac	Ac	Ac
2002 Existing	149,100	149,100	149,100	149,100		149,100	149,100
2004 Existing					141,400		
Decade 1	92,600	140,200	84,600	133,300	126700	136,800	129,200
2	86,100	166,000	87,500	158,200	139700	159,000	143,300
5	73,900	289,200	99,000	288,500	175500	268,500	216,700
10	79,200	285,700	112,700	337,900	197600	257,500	215,800
Numbers of Large Patches	#	#	#	#	#	#	#
2002 Existing	416	416	416	416		416	416
2004 Existing					405		
Decade 1	280	386	211	331	345	373	367
2	262	420	210	417	376	399	395
5	178	503	201	535	452	504	485
10	176	517	225	500	463	481	480

Source: Patch analysis based on existing data and harvest model output for decades 1,2,5,10 for Federal ownership only.
Definitions: A patch is defined as a contiguous grouping of similar vegetative conditions. Mature or older forest is based on forest type groupings for the mature, old growth, and old growth/multi-aged habitat groupings.
‡Notes: Chippewa NF: Total upland acres: 455,880 ac, Total federal ownership: 666,471 ac.

Table WNG-3: Goshawk-Indicator 2 Superior - Area and Number of 100 acre of Larger Mature/Older Upland Forest Patches within the Superior National Forest for existing condition and decades 1, 2, 5, and 10 for each alternative.

	Alt. A	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
Ac. Patches	Ac	Ac	Ac	Ac	Ac	Ac	Ac
Indicator 2002 Exist	411,000	411,000	411,000	411,000		411,000	411,000
Indicator 2004 Exist					399,700		
Forest-wide Exist	999,200	999,200	999,200	999,200	987900	999,200	999,200
Indicator Dec. 1	286,000	374,900	242,500	360,200	346,700	354,500	338,800
Forest-wide 1	874,200	963,100	830,700	948,400	934,900	942,700	927,000
Indicator Dec. 2	253,500	404,700	204,700	388,500	336,300	349,700	333,900
Forest-wide 2	841,700	992,900	792,900	976,700	924,500	937,900	922,100
Indicator Dec. 5	234,200	587,300	209,900	615,700	363,800	455,800	413,700
Forest-wide 5	822,400	1,175,500	798,100	1,203,900	952,000	1,044,000	1,001,900
Indicator Dec.10	244,300	612,600	254,500	724,700	439,600	480,700	427,800
Forest-wide 10	832,500	1,200,800	842,700	1,312,900	1,027,800	1,068,900	1,016,000
Numbers of Patches	#	#	#	#	#	#	#
Indicator 2002 Exist	922	922	922	922		922	922
Indicator 2004 Exist					911		
Forest-wide Exist	1,268	1,268	1,268	1,268	1,257	1,268	1,268
Indicator Dec. 1	727	854	653	867	834	850	835
Forest-wide 1	1,073	1,200	999	1,213	1,180	1,196	1,181
Indicator Dec. 2	654	861	589	875	818	836	807
Forest-wide 2	1,000	1,207	935	1,221	1,164	1,182	1,153
Indicator Dec. 5	690	911	613	962	879	929	839
Forest-wide 5	1,036	1,257	959	1,308	1,225	1,275	1,185
Indicator Dec.10	575	824	625	918	856	848	784
Forest-wide 10	921	1,170	971	1,264	1,202	1,194	1,130

Source: Patch analysis based on existing data and harvest model output for decades 1,2,5,10 for Federal ownership only. Indicator total is for the area outside the wilderness; Forest-wide totals include contribution of BWCAW.
Definitions: A patch is defined as a contiguous grouping of similar vegetative conditions. Mature or older forest is based on forest type groupings for the mature, old growth, and old growth/multi-aged habitat groupings.
‡Notes: Forest-wide total include wilderness and area outside the wilderness. Superior NF: Total upland acres: 1,666,569 (outside the wilderness 960,270 ac. 706,299 ac. within the wilderness) Total federal ownership: 2,171,660 acres

Table WNG-4: Goshawk-Indicator 2- Percentage of All Upland Forest within 100 acre of Larger Mature/Older Upland Forest Patches within the Chippewa and Superior National Forests for existing condition and decades 1, 2, 5, and 10 for each alternative.

National Forest	Alt. A	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
	Ac (#)	Ac (#)	Ac (#)	Ac (#)	Ac (#)	Ac (#)	Ac (#)
Chippewa 2002 Existing	33%	33%	33%	33%		33%	33%
2004 Existing					31%		
Decade 1	20%	31%	19%	29%	28%	30%	28%
2	19%	36%	19%	35%	31%	35%	31%
5	16%	63%	22%	63%	38%	59%	48%
10	17%	63%	25%	74%	43%	56%	47%
Superior 2002 Existing	60%	60%	60%	60%		60%	60%
2004 Existing					59%		
Decade 1	52%	58%	50%	57%	56%	57%	56%
2	51%	60%	48%	59%	55%	56%	55%
5	49%	71%	48%	72%	57%	63%	60%
10	50%	72%	51%	79%	61%	64%	61%

Source: Patch analysis based on existing data and harvest model output for decades 1,2,5,10 for Federal ownership only. Superior includes 588199 acres existing in BWCAW 100 acre or larger mature upland patches.
Definitions: A patch is defined as a contiguous grouping of similar vegetative conditions.
‡Notes: Chippewa NF: Total upland acres: 455,880 ac, Total federal ownership: 666,471 ac, Superior NF: Total upland acres: 1,666,569 (outside the wilderness 960,270 ac. 706,299 ac. within the wilderness) Total federal ownership: 2,171,660 acres.

Goshawk Indicator 2: Patch size

Looking at the amount of this older upland forest in patches suitable for goshawks provides a clearer picture of the condition of goshawk habitat by alternative. For instance, while 48% of upland forest is currently in mature or older forest, only 31% is within 100 acres or larger patches (Table WNG-2 and Table WNG-4, based on 2004 existing condition). The 17% of mature upland forest found in patches less than 100 acres may not be configured on the landscape to provide adequate security (i.e. alleviate risk to predation by other raptors such as great horned owls) or connectivity for foraging goshawks. All alternatives for the first and second decades provide less than 40% of mature upland forest in 100 acre or larger patches. Only by the fifth decade in Alternatives B, D, F, and G or the tenth decade in Modified Alternative E does the amount of mature upland forest in 100 acre or larger patches exceed 40% (Table WNG-4).

All alternatives predict a drop in this indicator in the first decade of plan. Alternatives B, F, D, and G or Modified E, in this order, show the smallest drops while maintaining at least the minimum amount of mature forest (40% in Goshawk Indicator 1). Alternative A and C show the greatest drops in this indicator and also do not maintain adequate amounts of mature or older forest (Goshawk Indicator 1). Management Objectives for Forest Vegetation Spatial Patterns have the potential to increase mature forest in large patches and interior forest conditions. However, achieving spatial management objectives while achieving age and composition objectives may be very difficult in alternatives with higher rates of harvest disturbance such as Alternative A and C. Spatial modeling for Modified E indicates that objectives to maintain or increase 300 acre or larger mature/older upland patches and mature or older interior forest can be met during the implementation period for the Chippewa Forest Plan. Meeting multiple objectives of forest composition, age, and spatial patterns at the project level will take a concerted effort with multi-scale planning.

Alternative B, D, and F recoup first decade declines in this indicator to exceed existing conditions for this indicator by the end of the second decade (Table WNG-4). While spatial modeling was not conducted for these alternatives, the forest is most likely to achieve the Forest Vegetation Spatial Pattern Objectives in these alternatives and could effectively avoid first decade drops in this indicator. As a result, habitat patterns for the goshawk are better in these alternatives than others by the end of the second decade.

Effects on Superior National Forest

Goshawk Indicator 1: Mature Forest Availability

In terms of the relative abundance of mature and older upland forest on the Superior, the Forest is presently providing a suitable amount of this vegetative growth stage for northern goshawks (Table WNG-1). The BWCAW will continue to provide a large amount of this habitat that is highly connected. However, the condition and distribution of habitat in the remainder of the forest outside of the wilderness remains at issue with regard to the goshawk. The Code of Federal Regulations (36 CFR 219.19) requires "that habitat must be well distributed so that those individuals can interact with others in the planning area.." Therefore, habitat is examined for the forest as a whole and the area outside the wilderness.

Alternatives A and C do not provide suitable amounts of mature and older forest by the end of the second decade, outside of the BWCAW. Alternative C shows a steeper rate of decline for this indicator, with decade 1 amounts below suitable levels. Considering the BWCAW, conditions are marginally suitable for goshawks, but habitat distribution is compromised and maintaining viable populations would be unlikely outside of the wilderness.

Alternatives B and D would provide suitable amounts of mature and older upland forest throughout all decades, except that Alternative D would exceed suitable amounts by decade 10. An over abundance of older forest would suppress prey production and may increase the risk to maintaining viable populations of goshawks when the National Forest is considered alone.

Alternatives Modified E, F, and G would both provide suitable goshawk habitat throughout the analysis period, both outside the BWCAW and including the BWCAW. Conditions approach optimal conditions for goshawks for much of the analysis period in Alternatives F and in decade 10 for Alternatives Modified E and G.

All of the alternatives predict a decrease from existing condition in this indicator during the first and second decades of the plan outside the wilderness. Alternatives B, D, F, G, and Modified E, in this order, provide the smallest drop from existing condition while remaining above the 40% minimum for habitat suitability forest-wide. Considering the BWCAW, only alternatives B and D would exceed existing levels of this indicator by the end of the second decade. All others would decrease from existing conditions.

Maintenance of at least minimum amounts of foraging habitat (Casson 1996, Williamson et. al, 2001) within goshawk territories is not assured through the Forest Plan. This would result in higher risk to maintaining breeding pairs, and increased risk to maintaining viability within the planning unit. Spatial management of harvests and other management disturbances could potentially distribute these disturbances on the landscape to maintain foraging areas at or above the 40% minimum. Management standards and guides (S WL-4, G WL-9) would mitigate impacts closest to nest sites with regard to mature or older forest.

Goshawk Indicator 2: Patch size

Looking at the amounts of mature and older upland forest in patches suitable for goshawks gives a clearer perspective of goshawk habitat conditions by alternative (Tables WNG-3 and WNG-4). Table WNG-4 reflects the Superior Forest within the proclamation boundary, including the BWCAW. While existing habitat conditions are different on the Superior, trends between the alternatives are relatively parallel between the Chippewa and Superior, except that Modified E has more large patches than Alternative G.

All alternatives predict a drop in this indicator in the first decade. Alternatives D, B, F, and G, in this order, eventually meet or exceed existing amounts of this indicator by decade 5.

Alternative A and C show the greatest drops in this indicator. Alternative C also would not maintain adequate amounts of mature or older forest (Goshawk Indicator 1) by the end of the second decade, either outside of the wilderness or the forest as a whole.

Management Objectives for Forest Vegetation Spatial Patterns have the potential to increase mature forest in large patches and interior forest conditions. However, achieving spatial management objectives while achieving age and composition objectives may be very difficult in alternatives with higher rates of harvest disturbance such as Alternative A, C, and E.

Only Alternative B would recoup first decade declines in this indicator to meet existing conditions for this indicator by the end of the second decade (Table WNG-4). The forest is most likely to achieve the Forest Vegetation Spatial Pattern Objectives in Alternatives B and D. The forest could effectively avoid first decade drops in this indicator in these alternatives. As a result, habitat patterns for the goshawk are better in these patches and interior forest conditions. However, achieving spatial management objectives while achieving age and composition objectives may be very difficult in alternatives with higher rates of harvest disturbance such as Alternatives A and C. Spatial modeling in Modified Alternative E indicates that efficiencies of meeting multiple coarse filter objectives (i.e. composition, age class, and spatial patterns) can potentially be attained by thoughtful management of harvest patterns and can result in relatively high harvest level.

Effects on Chippewa and Superior National Forests

Goshawk Indicator 3: Stand Complexity

Of the alternatives analyzed, Alternatives A and C alternatives propose to harvest on a relatively high amount of acres. The availability and proposed amounts of regeneration harvest cutting methods provides the least flexibility in terms of management practices for improving stand level compositional and structural components for both Forests. These alternatives would also provide the lowest potential to maintain habitat characteristics for the northern goshawk.

Overall, the regeneration harvest methods and prescribed fire uses in Alternative B provide both Forests with the ability to increase within-stand complexity and restore native plant communities through active management treatments. Of the alternatives analyzed, this alternative proposes to harvest on a relatively low amount of acres. The availability and proposed amounts of harvest cutting methods provides the best mix of management practices for improving stand level compositional and structural components for both Forests. This alternative has the greatest potential to maintain or increase habitat characteristics for the northern goshawk in managed forest stands.

Alternative D proposes to actively treat a relatively low amount of acres. The availability and proposed amounts of regeneration harvest cutting methods provides a limited mix of management practices for improving stand level compositional and structural components for both Forests.

Modified Alternative E proposes to harvest on a relatively moderate amount of acres. The availability and proposed amounts of regeneration harvest cutting methods provides limited flexibility for using management practices to improve stand level compositional and structural components for both Forests. This is especially true on the Superior, where clear-cutting is to be used for 75% of the regeneration harvests. Among alternatives that maintain adequate mature forest (Goshawk indicator 1), this alternative has the lowest potential to maintain habitat characteristics for the northern goshawk in managed forest stands.

Alternative F proposes to harvest on a relatively low to moderate amount of acres. The availability and proposed amounts of regeneration harvest cutting methods provides one of the best mixes of tools for improving stand level compositional and structural components on the Chippewa. This alternative on the Chippewa would improve habitat characteristics for the goshawk in managed forest stands. The predominant use of clearcutting as a regeneration method on the Superior limits the ability of that Forest to improve within-stand structural complexity through timber harvest. This alternative has a low potential for maintaining habitat characteristics for the northern goshawk in managed forest stands.

Alternative G proposes to harvest on a relatively moderate amount of acres. The availability and proposed amounts of regeneration harvest cutting methods provides one of the best mixes of management practices available for improving stand level compositional and structural components for the

Chippewa. This alternative on the Chippewa would improve habitat characteristics for the goshawk in managed forest stands. On the Superior, the regeneration harvest methods proposed in this alternative reduce its ability to increase within-stand complexity through timber harvest; however, the availability of prescribed fire for ecological purposes provides some ability to increase stand complexity and restore native plant communities. On the Superior this alternative would have a higher potential to maintain or improve habitat characteristics for the goshawk than Alternatives Modified E or F, but less than Alternative B.

Cumulative Effects for Northern Goshawk

The cumulative effects to the northern goshawk are conducted within the forest proclamation boundary and the relevant ecological Section. The lands within the proclamation boundary of each forest reflect the immediate role and context of each forest. Ecological sections are the Northern Minnesota Drift and Lake Plains (DLP) Section for the Chippewa, and the Northern Superior Uplands (NSU) Section for the Superior. The ecological Section is an appropriate scale for characterizing and considering conditions to sustain populations of northern goshawks that occurred on landscape ecosystems operating within the range of natural variability (RNV). This scale provides important insights for evaluating the effectiveness of coarse filter strategies to ensure long-term viability of this species. Cumulative effects to Forest Vegetation (Ch. 3.2.1.d.) and to Forest Spatial Patterns (Ch. 3.2.2.d.) are useful in examining broader landscape patterns.

Each of the proposed alternatives to revising the Forest Plans for the Chippewa and Superior National Forests implements differing coarse filter strategies that produce varying habitat patterns and qualities over time.

For purposes of this analysis, the effect of National Forest-wide vegetation management strategies (e.g. alternatives) on goshawk habitat are compared to the existing conditions and trends on all forested lands within the appropriate ecological Section. The information can be used to evaluate how individual alternatives for National Forest lands contribute to the overall conditions across the ecological Section.

Effects on Chippewa National Forest

Rates of timber removal in the decade ending in 1990 (Miles et al. 1995) place the Chippewa among the most highly managed land ownership classes in Minnesota. Based on harvest rates, this status likely continued through 1995. Currently, amounts of young forest greatly exceed amounts predicted under RNV (Ch. 3.2.1.). Harvest rates have declined in recent years on the Chippewa and harvests may be shifting to other ownerships. Recent trends in forest spatial patterns and harvest intensity (Wolter and White 2002, Host and White 2003) indicate that state and private non-industrial ownerships may have forest conditions that provide less foraging habitat and likely fewer patches of suitable habitat as forestland continues to be fragmented across the NSU and DLP sections. These past occurrences and current trends, combined with Alternative management strategies, helps to place into context the foreseeable effects to the northern goshawk.

Alternative A and C

These alternatives continue recent trends in changes to mature forest cover, forest spatial patterns, and stand complexity. Relatively high rates of disturbance, fragmentation of mature forest patches, and reliance on clear-cutting, combined with similar or greater trends on other ownerships within the forest and in the DLP section would create habitat conditions that would be a very high risk to maintaining viable populations of the northern goshawk during the first and second decades of the forest plan.

Alternatives B, D, and F

These alternatives make the greatest short-term and long-term changes in indicators for the northern goshawk. These alternatives work towards section-wide goals for landscape condition in the DLP to a greater degree than other alternatives. These conditions would benefit the northern goshawk. These alternatives would compensate for cumulative adverse effects on other ownerships within the proclamation boundary of the forest. For Alternative D, decade 10, amounts of mature forest higher than are thought to be sustainable for goshawks may be important refugia in a matrix of highly managed forest and where there is increased fragmentation due to mixed ownerships. In this context, this condition would be sustainable. Within the DLP section, the habitat provided by these alternatives on the forest would be significant to the viability of goshawk in the section.

Alternative G

This alternative makes significant long-term increases in habitat indicators for the northern goshawk. Projected drops in indicators for this species during the first 2 decades of the plan coupled with trends within the DLP section indicate that there is an increased risk for this species' viability section-wide than currently exists. Within the context of the proclamation boundary, management direction during the first 2 decades of the plan would maintain at least minimal conditions for most breeding pairs. Management direction along with management area allocations in this alternative would compensate for interspersed ownership patterns within the proclamation boundary.

Modified Alternative E

This alternative makes long-term increases in habitat indicators for the northern goshawk, but these increases are realized at a relatively low rate. Projected drops in indicators for this species coupled with trends within the DLP section indicate that there is increased risk for this species' viability section-wide than currently exists. Within the context of the proclamation boundary, management direction during the first 2 decades of the plan would maintain at least minimal conditions for most breeding pairs. During the first 2 decades of the plan, management direction along with relatively few management area allocations in this alternative would allow for a limited amount of compensation for interspersed ownership patterns within the proclamation boundary. The indicators show that federal lands within the Chippewa, and to the section as a whole, would contribute to a greater degree to goshawk viability in later decades as habitat conditions improve.

Effects on Superior National Forest

Rates of timber removal in the decade ending in 1990 (Miles et al. 1995) place the Superior above the statewide average among land ownership classes in Minnesota. With the exception of some landscape ecosystems represented with the BWCAW, current amounts of young forest exceed amounts predicted under RNV (Ch. 3.2.1.). The limited ability to manage forest within the wilderness for the goshawk (or other species habitat) coupled with LE-wide vegetation age and composition objections may be creating gaps in distribution of habitat. Areas adjacent to the wilderness in Spatial Zone 3 would be harvested and fragmented to a higher degree creating gaps in habitat that increase risk to foraging goshawks. Recent trends in forest spatial patterns and harvest intensity (Wolter and White 2002, Host and White 2003) indicate that state and private non-industrial ownerships may have forest conditions that provide less foraging habitat and likely fewer patches of suitable habitat as forestland continues to be fragmented across the NSU and DLP sections. These past occurrences and current trends, combined with Alternative management strategies, helps to place into context the foreseeable effects to the northern goshawk.

Alternative A and C

These alternatives continue recent trends in changes to mature forest cover, forest spatial patterns, and stand complexity. Outside of the wilderness relatively high rates of disturbance, fragmentation of mature forest patches, and reliance on clear-cutting, combined with similar or greater trends on other ownerships within the forest and in the NSU section would create habitat conditions that would be a high risk to maintaining a viable population of northern goshawk during the first 2 decades of the plan. Considering the wilderness, conditions within the section and within the proclamation boundary improve marginally. However, these alternatives would create gaps between suitable habitat and would likely reduce the distribution of the goshawk on the forest.

Alternatives B, D, F, and G

These alternatives create short-term decreases and long-term increases to habitat conditions for the northern goshawk. The decreases predicted during the first 2 decades of the plan coupled with trends on other ownerships may increase risk to the goshawk outside of the wilderness. Only in Alternatives B and D are decreases recouped to existing conditions forest-wide by the end of the second decade.

These alternatives would work towards section-wide goals for landscape condition in the NSU to a greater degree than other alternatives. These conditions would benefit the northern goshawk. These alternatives, coupled with the contributions of the BWCAW, would compensate for cumulative adverse effects on other ownerships within the proclamation boundary of the forest. For Alternative D, decade 10 outside of the BWCAW, amounts of mature forest higher than are thought to be sustainable for goshawks may be important refugia in a matrix of highly managed forest and where there is increased fragmentation due to mixed ownerships and management. In this context, this condition would be sustainable for the goshawk. Within the NSU section, the habitat provided by these alternatives on the forest would be significant to the viability of goshawk in the section.

Modified Alternative E

Rates of forest disturbance outside of the BWCAW reduce habitat indicators below existing condition for all decades. The contribution of the BWCAW does not compensate for this effect during the first 2 decades of the plan. Amounts remain below existing condition. There does appear to be a compensatory effect by the BWCAW in later decades. Projected changes in spatial distribution of habitat coupled with similar or greater trends on other ownerships within the forest and in the NSU section would create habitat conditions that would increase risk to maintaining a viable population of goshawk than currently exists. Management direction, predicted amounts of habitat, and other ownerships working towards section-wide desired conditions within the NSU may reduce this risk.

3.3.6.2 White pine (Indicator 20)

(36CFR 219.19 Management Indicator Species)

White pine has been identified as a management indicator species. It is a high profile tree species in the forests of northern Minnesota. White pine is selected as a “management indicator species” because its population changes are believed to indicate effects of forest management. It is a species of high public interest because of its many social, economic, and ecological values. It addresses major management issues about how much and where to promote white pine for its important wildlife habitat features, timber value, scenic quality, and role in maintaining ecologically healthy forest composition and structure. It is considered to be a keystone species, in that its overall effects on critical ecological processes and biodiversity are greater than would be predicted by its abundance. Additionally, the National Forests in Minnesota play a significant role in its management.

Finally, populations of white pine can be practically monitored. Population monitoring and evaluation under plan implementation would be based on stem counts under FIA and vegetation plots. Additionally, acres of white pine type and age (vegetative growth stage) and acres planted with white pine would be tracked.

As an indicator, white pine populations can be used to quantify differences among the alternatives because each alternative provides varying amounts of white pine forest type and age classes (or vegetation growth stages) and differing availability of management practices needed to establish it as a forest type or as an important component in other upland forest types.

Analysis of white pine is based on two indicators: 1) one that reflects white pine forest type and age and 2) one that addresses white pine as a component of other forest types. These indicators combine a quantitative and qualitative analysis. A strictly quantitative evaluation of white pine populations for plan alternatives is problematic because of 1) limitations of Dualplan as a tool for predicting white pine occurrence and 2) objectives in all alternatives to increase white pine as a component in other forest types are general, rather than specific measurable objectives. These and other limitations are discussed further under the indicators.

White Pine Indicator 1– Acres of white pine forest type and age

The first indicator is Dualplan projections for the total acres of white pine forest type in Decades 1, 2, 5, and 10 (Table WPN-1) and white pine forest type in two age classes (vegetation growth stages): young (0-9 years) in Decade 1 and 2 (Table WPN-2) and old growth (120+ years) in Decade 10 (Table WPN-3). This indicator provides information as to the amount, distribution, and long-term sustainability of white pine on the landscape. The amount and distribution of white pine in different growth stages may have direct implications on available wildlife habitat, biological diversity, old-growth forest conditions, scenic quality, recreational opportunities, and forest products.

Young forest (0-9 years) in Decades 1 and 2 was chosen because it provides one indicator of alternatives' objectives to restore white pine for the future. We chose old-growth in Decade 10 because at this vegetative growth stage white pine provides some of the important habitat features preferred by many species of management concern. At this stage it generally also provides other ecological values that are currently rare on the landscape compared to historical conditions, high scenic quality, and high timber product value.

This is a good indicator because it varies by alternative and directly addresses white pine issues. However, this indicator also has limitations. First, the focus on white pine as a forest type should not be interpreted as the principal measurement of how much white pine is restored in alternatives. To varying degrees in all alternatives, white pine would be inter-planted, underplanted, or naturally regenerated to promote its survival in amounts greater than if not treated. These are generally not typed as white pine forest.

Secondly, vegetation treatments included planting white pine in the understory of aspen types without a harvest. In this situation the forest type would change to white pine at the time of succession of aspen. Thus, the figures displayed in Table WPN-1 do not include the acres of white pine established in the understory until three decades or so after the planting. It is conceivable that the resulting stand after this type of treatment will contain a mixture of species including both white pine and aspen; and that it may not result in a white pine forest type until the stand reaches maturity or older.

Finally, ecologically white pine may not become dominant enough within a stand to characterize as white pine type until the white pine becomes mature or older. On the landscape, many stands may succeed to white pine type (or a white pine-dominated vegetative growth stage) but Dualplan does not identify where this may happen. Thus these stands are not predicted as future white pine types and may be "undercounted" as white pine type in later decades.

White Pine Indicator 2 – Amount of white pine as a component of other forest types, based upon acres of management treatments that increase within-stand complexity.

This indicator combines qualitative and quantitative evaluation of management activities that increase within-stand complexity and provide opportunities to restore white pines as a component within other forest types. This indicator addresses the presence and relative abundance of white pine trees in other upland forest types. Because white pine trees were frequently an important component in many of northern Minnesota's upland forests, the presence and abundance of this species may have direct implications on the species diversity and within-stand structural complexity of upland forests.

Table WPN-1: Amount of White Pine Forest Type in thousands of acres and by percent of total upland forest. For Superior the totals are outside the BWCAW.‡

	Alt. A No Action		Alt. B		Alt. C		Alt. D		Modified Alt. E		Alt. F		Alt. G	
Chippewa	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
Existing: 4.0 acres (1%); Range of Natural Variability Value‡‡: 8%														
Decade 1	4.4	1%	5.0	1%	6.0	1%	6.8	2%	6.1	1%	6.2	1%	6.0	1%
Decade 2	4.7	1%	7.3	2%	8.0	2%	11.9	3%	8.9	2%	8.4	2%	9.1	2%
Decade 5	5.1	1%	17.1	4%	16.2	4%	34.1	8%	19.5	4%	19.5	4%	18.5	4%
Decade 10	5.4	1%	43.4	10%	18.9	4%	48.7	11 %	28.7	6%	35.0	8%	32.1	7%
Superior														
Existing 29.7 acres (3%); Range of Natural Variability Value‡‡: 9%														
Decade 1	29.8	3%	31.1	3%	31.0	3%	36.4	4%	30.7	3%	31.7	3%	30.7	3%
Decade 2	30.3	3%	32.6	3%	33.6	3%	40.4	4%	33.3	3%	34.8	4%	34.4	4%
Decade 5	31.0	3%	53.5	6%	36.6	4%	75.1	8%	52.2	5%	54.8	6%	54.1	6%
Decade 10	31.1	3%	77.4	8%	31.5	3%	74.4	8%	57.8	6%	78.1	9%	69.2	8%

Source: Dualplan model output
Notes:
‡Within the BWCAW white pine and red pine are combined and cannot be detected or measured separately. Based on vegetation classified by Natural Resources Research Institute, existing total of both types is estimated at about 22,000 acres (4% of total upland acres).
‡‡Range of Natural Variability value is described in Chapter 3.2 and represents the median %

Table WPN-2: Acres of White Pine Forest Type in young age class (0-9 years) in Decades 1 and 2. For the Superior acres are outside the BWCAW. ‡

National Forest	Exist	Alt. A No Action	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Chippewa	700							
Decade 1		400	900	1,800	1,800	2,000	2,100	1,800
Decade 2		300	200	1,100	0	600	300	1,100
Superior	10,200							
Decade 1		600	1,300	1,300	6,000	900	2,000	1,000
Decade 2		611	1,300	2,400	1,000	2,600	2,300	3,200

Source: Dualplan model output
‡Notes: Within the BWCAW white pine and red pine are combined and cannot be detected or measured separately. Based on vegetation classified by Natural Resources Research Institute existing total of both types in 0-9 years is estimated at about 7,900 acres

Table WPN-3: Acres of White Pine Forest Type 120+ years of age in Decade 10. For the Superior acres are outside the BWCAW. ‡

National Forest	Exist	Alt. A No Action	Alt. B	Alt. C	Alt. D	Mod. Alt. E	Alt. F	Alt. G
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Chippewa	500	1,600	2,700	2,200	2,800	2,300	2,300	2,400
Superior	3,500	14,800	17,900	15,600	17,900	16,200	17,900	17,200
Total	4,000	16,400	20,600	17,800	20,600	18,400	20,200	19,600

Source: Dualplan model output
‡Notes: Within the BWCAW white pine and red pine are combined and cannot be detected or measured separately. Based on vegetation classified by Natural Resources Research Institute existing total of both types in 120+ years is estimated at about 7,900 acres.

Table WPN-4: Percent of white pine trees of all trees within Landscape Ecosystems (all ownerships).

Landscape Ecosystem	Historical Condition[1]	Existing Condition[2]
	Percent	Percent
Drift and Lakes Plains - Chippewa		
Dry Pine	5	1
Dry-mesic pine	12	1
Dry-mesic pine-oak	7	3
Boreal hardwood conifer	5	1
Mesic northern hardwoods	9	0.5
White cedar swamp	3	<1
Northern Superior Uplands - Superior		
Jack pine-black spruce	4	1
Dry-mesic red and white pine	11	2
Mesic red and white pine	19	1
Mesic birch-aspen-spruce-fir	9	<1
Sugar maple	9	<1

1. Historical conditions are based on an analysis of bearing trees in the late 1800s to early and 1900s in the Government Land Office land survey notes.

2. Current conditions are based on 1990 Forest Inventory and Assessment (FIA) plot data estimates of stem density by species.

This is a good indicator as it also varies by alternative and directly relates to the issue. Chapter 3.2 provides discussion and explanation of how the indicator for use of management treatments that increase within-stand complexity is used for analysis of effects on forest structure and composition. The assumption we use in this section is that those treatments that increase complexity, such as prescribed fire, partial cuts, and multi-aged/selection cuts also promote conditions most suitable for restoring white pine as a component of the regenerating stand. Two treatments specifically modeled partial cut in aspen types and planted white pine in the understory. These partial harvest stands would result in mixed stands with an increased white pine component.

The main limitation of this indicator is that white pine can also be successfully restored using treatments that do not increase within-stand complexity, treatments such as clearcutting. However, the occurrence of young, relatively pure white pine stands would have been relatively minimal.

Analysis Area

The analysis area is the land administered by the Chippewa NF and Superior NF for direct/indirect effects. For cumulative effects the analysis area includes the State of Minnesota. Several time frames are examined in terms of model outputs.

3.3.6.2.a Affected Environment for White Pine

White pine can grow on a large range of site conditions allowing it to exist on most upland sites (Stearns 1992). Prior to the exploitative logging and slash-fueled fires that occurred during the mid to late 19th century, white pines were a prominent component of the upland forests of northern Minnesota (Spencer et. al. 1992). White pine dominated the tree species stocking in some stands, which can be identified as the white pine forest type. The ability for white pine to express dominance in most stands generally occurred with age, and usually did not occur until the stand reached maturity (Frelich 1992). More frequently however, white pine was a component within younger stands identified as a forest type other than white pine. The presence and relative abundance of white pines within these stands varied depending on the ecological characteristics of the site and the type, intensity, and frequency of natural disturbances.

White pines were and continue to be an important ecosystem component whether in a white pine-dominated community or mixed with other tree species (Green 1992). As wildlife habitat white pine provides many ecological values – from being an obligate symbiotic partner to a small mushroom (*Suillus pictus)* to providing highly preferred nesting habitat for the bald eagle. For wildlife, much of white pine's value derives from its ability to grow to one of the largest trees in northern Minnesota's native plant communities. Large scattered supercanopy white pines perform a different wildlife function than do white pine communities. For example, they add structural diversity to the forest communities in which they occur and provide important habitat features, including some that would not otherwise be available. These include compositional, structural, and functional features such as: (Rogers and Lindquist 1992)

- Supercanopy trees with strong large branches capable of supporting heavy nests for eagles and ospreys.
- Large diameter trees suitable for primary and secondary cavity nesters such as pileated woodpecker and boreal owl, respectively.
- Structure for black bears to escape predators because rough bark allows safe climbing
- Foraging sites for woodpeckers, warblers, finches, and other birds on its bark, needles, and cones.
- Roosting or hunting perches for birds and mammals.

Large diameter white pines also provide important habitat after they have fallen. Because of their size, they persist longer than other smaller woody debris and logs. They provide important habitat niches such as: moist sites for seedling establishment; foraging and cover for small mammals, amphibians, invertebrates, and insects; and micro-sites for mosses, lichens, and other microorganisms (Hunter 1990).

White pines, especially older large trees, are important raw material for sawmills due to their high value. Historically, white pine was the primary species that supported the initial logging in Minnesota. By 1920, most of the merchantable white pine had been harvested in Minnesota and mills were closing (Larson 1949). Depending on the location and the time at which the harvesting occurred, varying amounts of overstory white pines were retained as a seed source for the future.

White pine blister rust (*Cronartium ribicola*) was introduced into the United States and was first documented in Minnesota in 1916 (Minnesota Dept. of Natural Resources 1996). Its alternative host plant is currant and gooseberry, which were hand picked by the Civilian Conservation Corps in an attempt to reduce blister rust infections in white pine. This disease resulted in a greatly reduced amount of white pine management.

Historically, fire is attributed with creating conditions that allowed white pine to regenerate successfully. Fire reduced the competing plants allowing sufficient sunlight and created good seedbed conditions for germination. Natural regeneration of white pine normally does not occur when a dense shrub layer is present (Jones 1992). The effective control of fire is partially responsible for the reduced natural regeneration of white pine (Minnesota Dept. of Natural Resources 1996).

Until recently, very few acres of white pine have been planted on the Chippewa and Superior National Forests due to problems associated with establishing white pine. Plantations losses have usually been attributed to animal browsing (deer is most common) and blister rust (Pastor 1992). Weevil causes deformed trees, but normally doesn't cause mortality (Katovich 1992). Such actions as bud capping, pathological pruning and careful site selection should allow white pine seedlings to survive in a plantation environment. These practices are expensive, thus have not been widely used.

However, since 1986, white pine planting has been increasing. For example, since 1986, 12,561 acres of white pine have been planted on the Superior NF (USDA Forest Service 2004). After white pine is planted, survival checks are performed to assess successful establishment of the white pine seedlings. Planted white pine stands are visited multiple times subsequent to survival checks for pathological pruning, controlling deer browse damage, and for hand release from shrub competition. Although no comprehensive, quantitative stand monitoring for planted white pine occurs beyond the survival checks, subsequent qualitative assessments suggest that successful establishment of planted white pines is occurring on both the Chippewa and Superior NFs. Both Forests recognize the challenges that establishing this ecologically and potentially economically important species pose. However, both Forests are successfully establishing white pine at present, and they would use this experience plus any new research or monitoring results to improve white pine management in the future.

White Pine Indicator 1: Acres of white pine forest type and age.

The current amount and distribution of white pine is a result of timber harvesting, planting, insects and diseases, deer herbivory, fire suppression, as well as human development. Tables FAC-1 and FAC-2 in Chapter 3.2 show white pine, as a forest type, comprises 1% and 3% of the uplands on the Chippewa and Superior National Forests, respectively. These tables also indicate the historical condition was 8 to 9 percent respectively on the two Forests.

White Pine Indicator 2: White pine component, based upon use of management treatments that increase within-stand complexity.

Chapter 3.2 Forest Vegetation provides a description of affected environment related to this indicator. The reader is referred to this section as well as information on the alternatives relevant to the amount white pine forest type projected and to an alternative's ability to introduce a white pine component to other upland forest types.

Table WPN-4 paints a picture of historical and current conditions for white pine that differs somewhat from Tables FAC-1 and FAC-2 (historical conditions of 8% and 9% white pine type Forest-wide on Chippewa and Superior respectively). It shows current and historical total amounts of white pine on the landscape, whether it occurred within a white pine type or as a component. An interpretation of this information is that white pine occurred more frequently as a component than as forest type and that the trend for both type and component is a considerable decline from historical conditions in most Landscape Ecosystems.

3.3.6.2.b Environmental Consequences for White Pine

Effects Common to All Alternatives

Resource Protection Methods

All alternatives have objectives of increasing acres of white pine type from the current condition. Objectives are established by Landscape Ecosystem and vary by alternative. See Tables in Chapter 3.2.1.d (Direct and Indirect Effects).

All alternatives have objectives for restoring white pine as components, where ecologically suitable, in other upland forest types. Objectives are established by Landscape Ecosystem and vary by alternative. These objectives, however, are not quantified, and the degree of restoration is relative among alternatives, based on the overall theme of the alternative.

Standards and guidelines are established for retaining reserve trees within harvest areas. White pine is a preferred leave tree because it provides forest structural and compositional diversity, seed trees, and wildlife habitat. Thus some would be retained whenever they are present.

All alternatives have objectives to increase acres of old-growth white pine. Objectives vary by alternative.

General Effects Common to All Alternatives

Of the wide variety of management activities implemented by forest plan alternatives, vegetation management has greatest effect on white pine. White pine is a tree universally valued by the public for its many values and the public agrees that white pine should be restored to at least some degree on the landscape (public scoping, planning record). White pine has greatly declined on the landscape and its loss provides a risk to the sustainability of native plant communities (Frelich 1995). For these reasons, the analysis of effects assumes the following effects on wildlife habitat and ecosystem sustainability:

- Vegetation management that increases white pine from current conditions has positive effects.
- Vegetation management that decreases white pine from current conditions has negative effects.

An additional analysis factor is the relationship between the current, past, and future (Decade 10) projected conditions of white pine forest types. The range of natural variability (RNV) is used as a reference tool for amount of forest type. The principals of the use of RNV as a tool are described in the introduction to Appendix G. Chapter 3.2 also provides analysis comparing current, future, and historical conditions under the range of natural variability.

Although projected amounts of white pine types and components vary by alternative, all alternatives maintain or increase white pine on a landscape scale. All alternatives, in varying amounts and timeframes, move white pine further towards the range of natural variability. Therefore, in general, all alternatives have an overall “no impact” or beneficial impacts (as described above) to white pine and associated wildlife. The degree to which an alternative benefits white pine varies by alternative.

Boundary Waters Canoe Areas Wilderness

The effects to white pine in the Boundary Waters Canoe Areas Wilderness (BWCAW) will not vary by alternative.

On the Superior National Forest, the BWCAW provides habitat for white pine. Existing acres or populations are not specifically known, because our forest inventory does not separate white pine from red pine types or measure white pine as a forest component. Tables WPN-1 to WPN-3 display the acres for the combined red and white pine types based on forest classification by the Natural Resources Research Institute.

Changes and effects to the white and red pine communities and populations of pine are analyzed in the Final EIS for storm recovery (USDA Forest Service 2001a). The FEIS grouped forest types into vegetative growth stages (refer to Appendix G) and this results in a discrepancy between FEIS and NRRI estimates of total acres projected in red and white pine. Tables WLD-7a and 7b in Section 3.3.1 above display red and white pine estimates for the BWCAW. In brief, the vegetation growth stage grouping of mature and multiaged red and pine is projected to increase slightly from the current condition over the next 10 decades. Young pines are projected to decrease substantially from estimated current condition, indicating the potential for major losses of white pine communities and, probably white pine components, in the Wilderness over the long-term.

Direct and Indirect Effects for White Pine

White Pine Indicator 1 : Acres of White Pine Forest Type and Age.

Table WPN-1 above displays the projected amount of white pine forest type for each alternative. Tables WPN-2 and WPN-3 above displays acres of white pine in young and old growth age classes.

White Pine Indicator 2: White pine as a component of other upland forest types.

Tables FAC-44 and FAC-45 in Chapter 3.2 display the projected amount of management treatments that increase within-stand complexity.

Alternative A

Acres of white pine forest type and age

Alternative A shows a slight increase in the amount of white pine forest type, however the percentage remains the same from the first decade through the tenth decade, well below what would have been expected historically. This alternative projects very little white pine planting. It has a low ecological representation of white pine forest type over 120 years of age in decade 10. As described above (under the indicator description), the acres of restoration of white pine may be undercounted. However, the theme of this alternative does not emphasize white pine restoration, so even with additional planting, this alternative is not likely to increase white pine much from existing conditions.

White pine component

This alternative is expected to have a very low amount of planting of white pine as a component in other forest types or other management treatments that increase within-stand complexity. Refer to Chapter 3.2 for analysis of this indicator.

Because Alternative A does not increase white pine, it will not benefit white pine or species and ecosystem functions that benefit from its occurrence. The continued low ecological representation of white pine poses a risk to ecosystem sustainability.

Alternative B

Acres of White Pine Forest Type and Age

Alternative B increases white pine forest type acres to amounts that are similar to what would have occurred historically. It projects a relatively high amount old-growth forest and a moderate amount of young forest. In a relative way, Dualplan probably accurately portrays the amount of restoration of white pine type, since the 100-year projections are similar to long-term objectives.

White pine component

This alternative would have a high level of planting of white pine as a component in other forest types and management treatments that increase within-stand complexity. Refer to Chapter 3.2 for analysis of this indicator. The treatment levels may underestimate the amount of white pine component restoration that would occur in this alternative.

This alternative is likely to have a high level of benefit to white pines for several reasons. Thematically, this alternative places a high emphasis on restoring white pine and is likely to have high increases in the amount of white pine over what currently exists. This alternative restores white pine type to conditions similar to what would have occurred historically. This alternative provides a high amount of opportunities to restore white pine as a component to other forest types.

Alternative C

Acres of White Pine Forest Type and Age

By Decade 10, this alternative increases white pine forest type acres from the current low amounts to close to nearly 50% of what would have occurred historically on the Chippewa. It maintains the current percentage over the 10-decade period on the Superior. It projects a considerable increase in old-growth and young in white pine from existing conditions. Dualplan probably accurately portrays the amount of restoration of white pine type, since the 100-year projections are similar to long-term objectives.

White pine component

This alternative would have a low level of planting of white pine as a component in other forest types and management treatments that increase within-stand complexity. Refer to Chapter 3.2 for analysis of this indicator. The treatment levels probably do not greatly underestimate the amount of white pine component restoration that would occur in this alternative.

This alternative is likely to have a low to moderate level of benefit to white pines for several reasons. Thematically, this alternative places a moderate emphasis on restoring white pine and is likely to have high increases on the Chippewa in the amount of white pine over what currently exists. It generally maintains the existing amounts of white pine forest type on the

Superior. Thematically, this alternative does not place an emphasis on restoring white pine as a component and therefore the landscape-wide benefits to white pine are not as high as if just type was considered.

Alternative D

Acres of White Pine Forest Type and Age.

Alternative D increases white pine forest type acres to amounts that are greater than what would have occurred historically on the Chippewa and similar to what would have occurred on the Superior. It projects a relatively high amount of old-growth forest, a moderate amount of young forest in Decade 1, and no young forest in Decade 2. Dualplan does not accurately portray the likely amount of restoration of white pine type, even though 100-year projections are similar to long-term objectives. That is because management under Alternative D would be likely to continue to reestablish at least minimal levels of young white pine. This would occur with management activities other than those modeled by Dualplan (such as management ignited fire and underplanting).

White pine component

This alternative would have a high level of planting of white pine as a component in other forest types. This alternative proposes to harvest on only a relatively small portion of either Forest. On these acres, it relies primarily on partial cut even-aged harvest, an even-aged management treatment that increases complexity. The use of prescribed fire in relatively high amounts would also increase complexity. After Decade 2 forests would be managed primarily for vegetation succession with a relatively low amount of management treatments that would increase complexity. Because of the difficulty in predicting how much prescribed fire would be used relative to allowing forests to succeed, the treatment levels may underestimate the amount of white pine component restoration that would occur in this alternative. Overall, we assume that in the long term, Alternative D would provide a low to moderate amount of white pine component restoration because of the high amount of succession. Refer to Chapter 3.2 for analysis of this indicator.

This alternative is likely to have a moderate to high level of benefit to white pines for several reasons. Thematically, this alternative places a high emphasis on restoring white pine and is likely to have high increases in the amount of white pine over what currently exists. This alternative restores white pine type to conditions similar to or greater than what would have occurred historically. However, this alternative provides a low to moderate amount of opportunities to restore white pine as a component to other forest types. Thematically, this alternative seeks to compensate for historical losses of white pine on the landscape by a strong emphasis for restoration of type, old-growth, and component of white pine on National Forest lands, so the prediction for low to moderate amount of white pine component restoration may underestimate treatments.

Modified Alternative E

Acres of White Pine Forest Type and Age

Modified Alternative E increases white pine forest type acres from current low amounts to amounts that by Decade 10 are somewhat less, but similar to, what would have occurred historically. It projects a relatively high increase in amount of old-growth forest and a moderate amount of young forest in Decade 1. For both National Forests there is a drop in young forest in Decade 2. In a relative way, Dualplan probably accurately portrays the amount of restoration of white pine type, since the 100-year projections are similar to long-term objectives. However, to continue to promote development of white pine type after Decade 10, it is likely that Modified Alternative E would continue to plant white pine in Decade 2 similar to Decade 1. Thus, Dualplan may underestimate acres planted in Decade 2.

White pine component

This alternative would have a low to moderate level of planting of white pine as a component within other forest types. Refer to Chapter 3.2 for analysis of this indicator. The treatment levels may underestimate the amount of white pine component restoration that would occur in this alternative.

This alternative is likely to have a moderate level of benefit to white pines for several reasons. Thematically, this alternative places a moderate to high emphasis on restoring white pine and is likely to have high increases in the amount of white pine type over what currently exists. This alternative restores white pine type to conditions that are similar to what would have occurred historically and thus is very likely to provide adequate ecological representation of white pine type. The theme of this alternative does emphasize restoring pine for its multiple values. However, the relatively low opportunity for restoring white pine component provides somewhat of a contradiction between theme (desired conditions) and what Dualplan predicts as opportunities for increase of white pine component. Thus this alternative is projected to have a moderate, rather than relatively high, likely benefit to white pines.

Alternative F

Acres of White Pine Forest Type and Age

Alternative F increases white pine forest type acres from current amounts to amounts that are the same as what would have occurred historically. It projects a relatively high amount old-growth forest and young forest. In a relative way, Dualplan probably accurately portrays the amount of restoration of white pine type, since the 100-year projections are similar to long-term objectives.

White pine component

This alternative would have a high level of planting of white pine as a component in other forest types and a relatively moderate amount of management treatments that increase within-stand complexity – this includes a relatively low amount of timber harvest treatments and relatively high amount of prescribed fire treatments that increase stand complexity. Refer to Chapter 3.2 for analysis of this indicator. The treatment levels may underestimate the amount of white pine component restoration that would occur in this alternative.

This alternative is likely to have a high level of benefit to white pines for several reasons. Thematically, this alternative places a high emphasis on restoring white pine to the same amounts as would have been estimated to occur historically. This alternative also thematically seeks to increase the white pine component from what currently exists to what was estimated to have occurred historically.

Alternative G

Acres of White Pine Forest Type and Age

Alternative G increases white pine forest type acres to amounts that are very similar to what would have occurred historically. It projects a relatively high amounts old-growth forest and young forest. In a relative way, Dualplan probably accurately portrays the amount of restoration of white pine type, since the 100-year projections are similar to long-term objectives.

White pine component

This alternative would have a relatively high level of planting of white pine as a component in other forest types. It has a moderate level of management treatments that increase within-stand complexity on the Superior, and a relatively high level of management treatments that increase within-stand complexity on the Superior. Refer to Chapter 3.2 for analysis of this indicator. The treatment levels may underestimate the amount of white pine component restoration that would occur in this alternative.

This alternative is likely to have a relatively moderate to high level of benefit to white pines for several reasons. Thematically, this alternative places a moderate to high emphasis on restoring white pine and is likely to have high increases in the amount of white pine over what currently exists. This alternative restores white pine type to conditions similar to what would have occurred historically. This alternative provides a moderate to high amount of opportunities to restore white pine as a component to other forest types.

Cumulative Effects for White Pine

The GEIS completed on timber harvesting in Minnesota and the work done for the Minnesota Forest Resource Council both indicate the acres of white pine forest type will increase in the future. These efforts also indicate an increase in the older white pine and suggest strategies that include planting white pine in other forest types.

The direction the alternatives are moving in regard to white pine on national forests is similar to what is proposed to happen within the State of Minnesota on other ownerships. State, county and private landowners (including at least one timber company) have planted white pine.

All of the alternatives work toward the direction established in the two efforts mentioned. Alternatives A, C, and Modified E do less than the other alternatives and Alternatives B, D, F and G do the most.

Because the ability and costs needed to improve or increase the white pine component on a landscape is potentially related to herbivory by white-tailed deer, the reader is referred to 3.3.6.4 White-tailed deer (Indicator 22) for a discussion on how each alternative effects deer populations over the long-term.

3.3.6.3 American woodcock (Indicator 21)

As an indicator the woodcock does a good job at highlighting differences among the alternatives because each alternative will result in varying habitat conditions. Woodcock is a species of management concern because it is a high public interest game species for which there is concern about population declines rangewide.

Amount of Woodcock Breeding Habitat

In order to evaluate the impact of the alternatives on woodcock, we analyze the indicator that represents the amount (acres) of woodcock breeding habitat that would occur under each alternative. This indicator does a good job of highlighting the differences among alternatives because availability of breeding habitat influences local population levels of woodcock.

Evaluation of American woodcock is based primarily on indicators of breeding habitat (grass-forb-shrub openings, shrub wetlands, and aspen/birch forest under 20 years old).

Analysis Area

The analysis area for woodcock habitat for direct and indirect effects is the land administered by the Chippewa and Superior National Forests. The timeframe looks at decade 2 and decade 10 model outputs to display the differences among alternatives.

Cumulative effects look at all lands in northern Minnesota and attempts to relate the Forests information to larger landscapes.

3.3.6.3.a Affected Environment for American Woodcock

Woodcock are a species associated with young forests and abandoned farmlands. Given the species' habitat preferences, it is likely that early logging and settlement of the northern Lake States' forests improved habitat conditions in the breeding grounds for woodcock, allowing population growth to occur (USDA Forest Service 2002l; Gregg 1984, p. 46). Settlement and abandoning of farmland likely benefited woodcock until those abandoned lands reverted back to forest and became too old for woodcock (USDA Forest Service 2002l).

American woodcock are currently locally common on the Chippewa and Superior National Forests, with abundant potential habitat available (USDA Forest Service 2002l). Northern areas within the Great Lakes states contain relatively high population densities of American woodcock, and are therefore considered to be important to regional woodcock populations (Partners In Flight 2001; Keppie and Whiting 1994; Sauer and Bortner 1991).

Population trends for American woodcock have been declining from the late 1960s through present in Minnesota (Kelley 2002, Sauer et al. 2001), the Lake States, and the Central woodcock management region (Kelley 2002). The population trends on the Chippewa and Superior are somewhat difficult to separate from those of greater Minnesota due to sample size, but it would appear that they are either declining (USDA Forest Service 2000h) or stable (USFS 2000i) over the past 10 years (USDA Forest Service 2002l).

Amount of Woodcock Breeding Habitat

Woodcock have specific habitat structural and moisture requirements (USDA Forest Service 2002l). Ideal woodcock habitat is provided by young forest and abandoned farmlands mixed with forest (Keppie and Whiting 1994). Forest openings and old fields are used as singing grounds as young trees move in. Adjacent young hardwoods and mixed woods with shrubs, especially young alder, provide moist ground for daytime feeding.

Ideal brood habitat is characterized by dense, hardwood cover on good soils that support an abundance of earthworms (Straw et al. 1994), an important food source for woodcocks. A dense canopy provides broods with protection from avian predators, and shades out herbaceous plants, allowing broods ready access to earthworms (Straw et al. 1994).

Conifer stands are inferior to hardwoods or mixed stands for woodcock habitat (Coulter and Baird 1982), although woodcocks have been found displaying in conifer forests on some cutover sites, bogs, burnt land, and poorly regenerated areas selectively logged in the past (Keppie et al. 1984). Young aspen and birch provide a forest mixture appropriate for woodcocks in the north-central woodcock range (Keppie and Whiting 1994).

Major causes of observed woodcock population declines over the past 30 years are believed to be degradation and loss of suitable habitat on both the breeding and winter grounds due to forest succession and various human uses (Kelley 2001). The quantity and likely quality of habitat is decreasing as rate of change of farmland into young growth forests decreases (Keppie and Whiting 1994). Reduction in even-aged forest management may discriminate against this species, although it may favor species with other habitat needs (Keppie and Whiting 1994; Dessecker and McAuley 2001; Dessecker and Pursglove 2000).

On the Chippewa and Superior National Forests, primary woodcock breeding habitat includes grass-forb-shrub openings (vegetation types 50, 51, 52 and 53), shrub wetlands (vegetation type 66), and aspen/birch forest under 20 years old (USDA Forest Service 2002l). Differences among alternatives in providing woodcock breeding habitat are determined by comparing the acres of these forest and vegetation types potentially in a suitable condition, based on age category. These comparisons are made at a forest-wide level for each National Forest.

Additionally, the amount of woodcock breeding habitat for each alternative will be compared to vegetation conditions predicted to occur at the ecological Section level when those landscapes were functioning within the range of natural variability (RNV). See Appendix B for details on how RNV values were defined for Landscape Ecosystems within the Northern Minnesota Drift and Lake Plains and the Northern Superior Uplands.

3.3.6.3.b Environmental Consequences for American Woodcock

General Effects Common to All Alternatives for American Woodcock

The amount of woodcock breeding habitat provided by acres of shrub wetlands on both national forests does not vary through the decades regardless of the alternative. These are relatively permanent habitat conditions on the landscapes. The habitat quality for woodcock provided by these areas was influenced by fire and hydrology. Generally speaking, these habitat conditions provided a relatively stable amount of woodcock breeding habitat, although habitat quality likely varied with fire frequency. The relative importance or overall preference for young aspen/birch forest to shrub wetlands is not well-understood; however, the shrub wetland portion of the habitat base may be a locally important breeding habitat condition buffer to the boom and bust young forest conditions created through natural stand replacement disturbance events.

Direct and Indirect Effects for American Woodcock

Amount of Woodcock Breeding Habitat

Woodcock breeding habitat is comprised of grass-forb-shrub openings, shrub wetlands, and young aspen/birch forest. Forest plan modeling output does not predict changes in the openings and wetland components. Hence, only the young aspen/birch component varies by alternative (Figures WCK-1, 2, 3, 4).

Decades 1 and 2 represent the likely implementation life of the Forest Plan, although potential effects of Alternatives are analyzed through decade 10. Alternatives A and C provide the greatest amount of young aspen/birch woodcock breeding habitat, exceeding existing conditions on both national forests during decades 1 and 2. The other alternatives provide less young aspen/birch woodcock breeding habitat. They provide relatively similar amounts in decade 1, with marked declines in later (2, 10) decades under Alternatives B and D, eventually resting below RNV. Modified Alternative E remains above RNV throughout the analysis period. On the Chippewa NF, it provides about half of this habitat component during decades 1 and 2 as currently exists. On the Superior NF, Modified Alternative E provides about 80% of the amount of this habitat component as currently exists.

Cumulative Effects for American Woodcock

The declining woodcock populations in Minnesota, the Lake States and the Central woodcock management region (larger area than Lake States), suggest the habitat on the National Forests in Minnesota is important. The habitat requirements for this species are more complex than our comparison of the young aspen/birch forest suggests, since this habitat is plentiful on the Superior NF yet populations are declining. Currently, habitat conditions for this species on the Superior would appear to be the best they have been in 40-50 years (USDA Forest Service 2000h).

Figure WCK 1: Woodcock Breeding Habitat: Acres of Aspen-Birch Habitat (Chippewa National Forest)

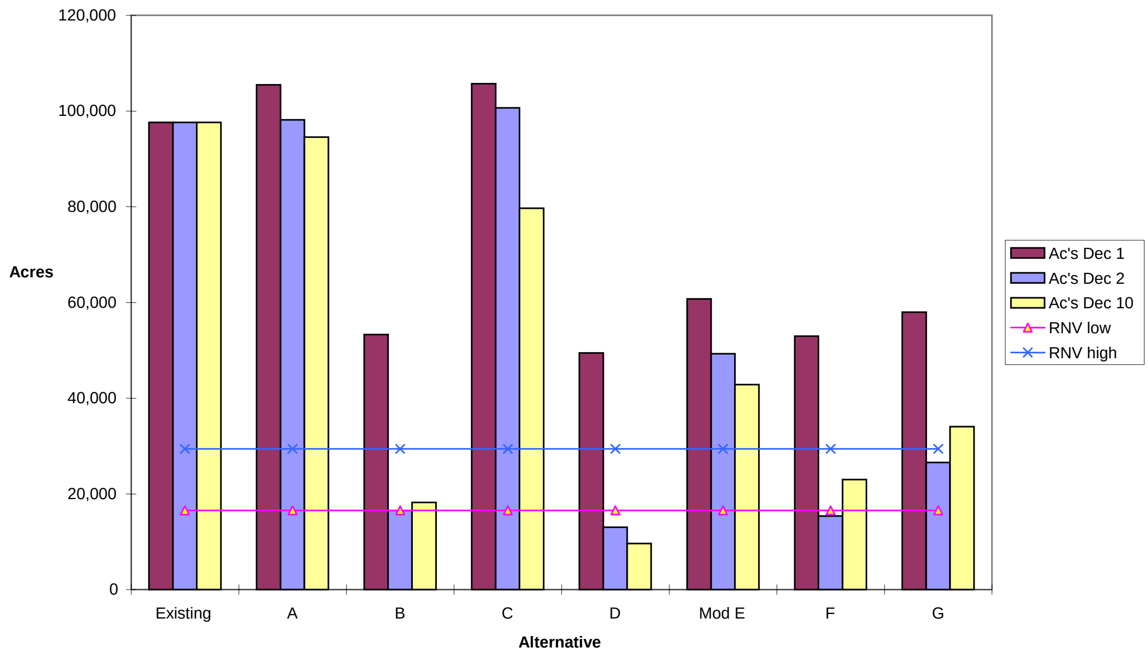


Figure WCK-2: Woodcock Breeding Habitat: Acres of Aspen-Birch Habitat (Superior National Forest)

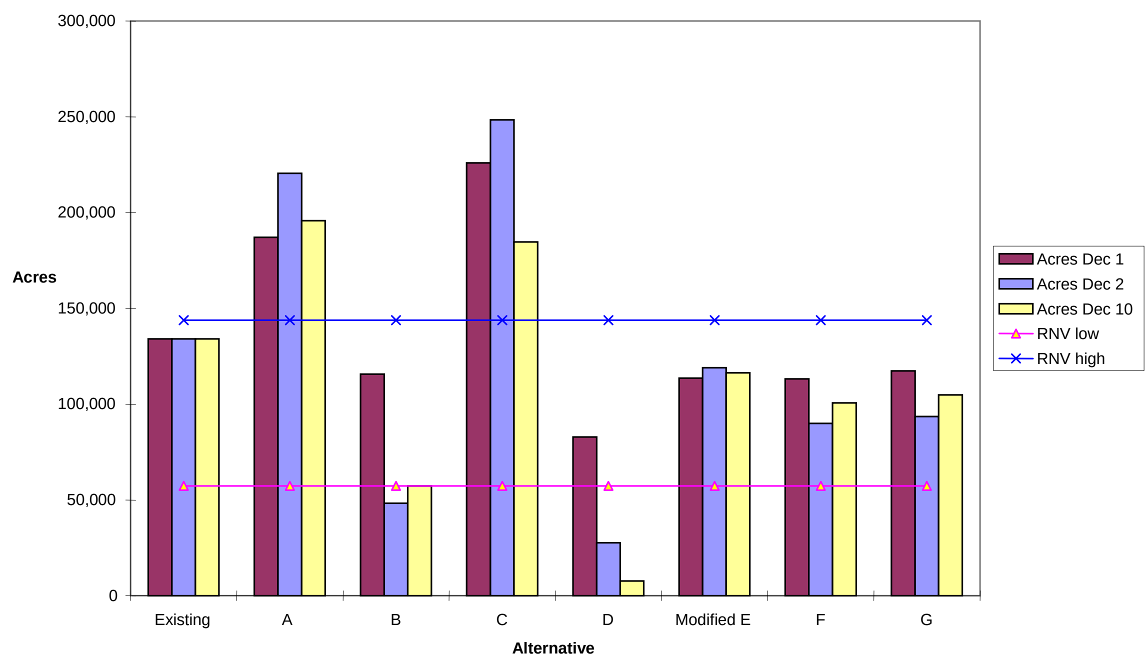


Figure WCK-3: Acres of Woodcock Habitat (Chippewa National Forest)

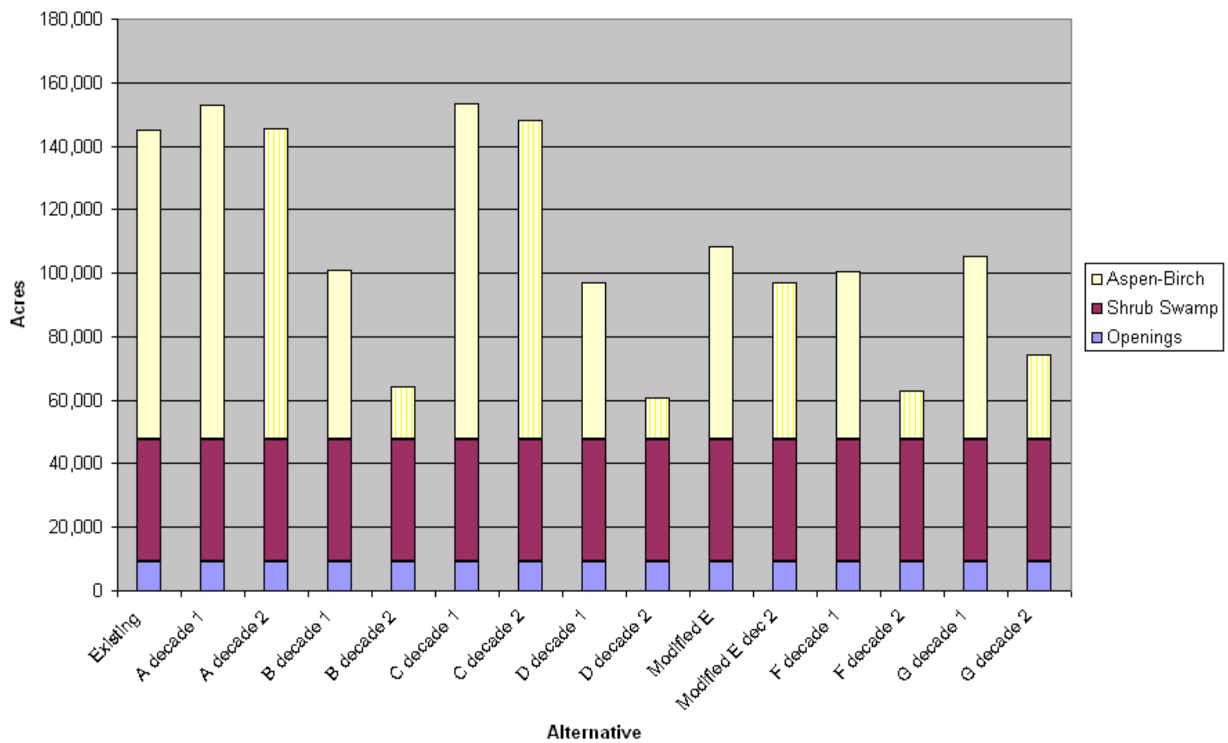
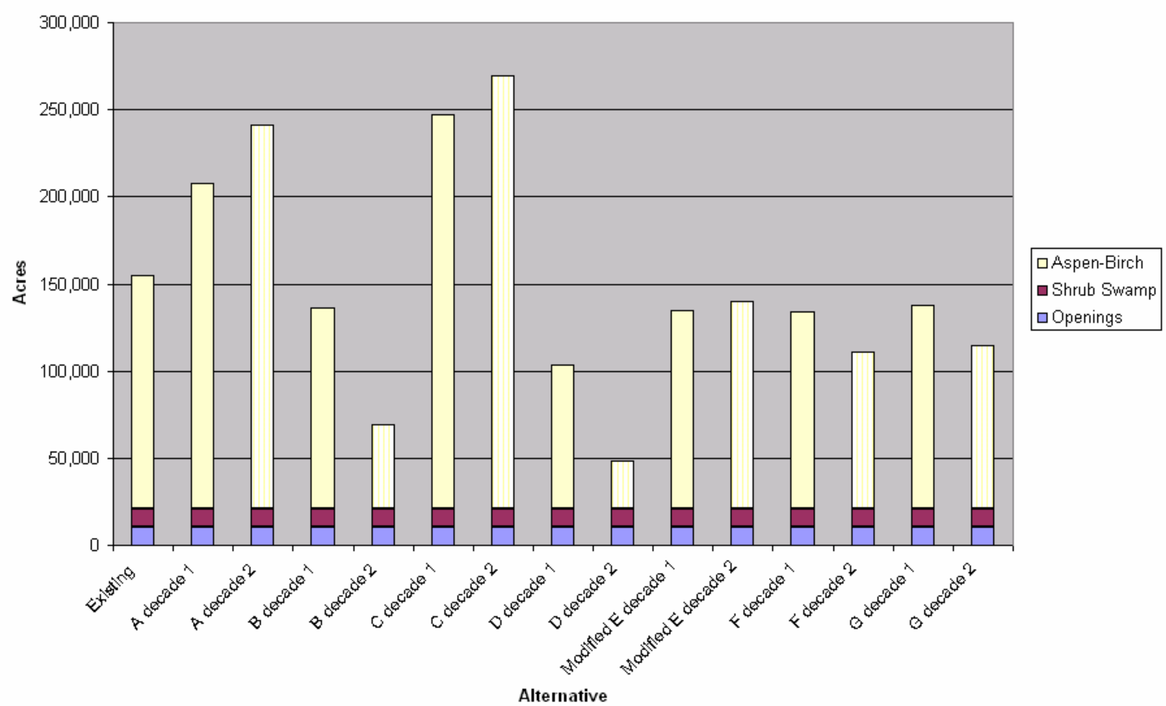


Figure WCK-4: Acres of Woodcock Habitat (Superior National Forest)



As it is on NFS land, the shrub wetlands breeding habitat through out the forested portions of northern Minnesota will remain relatively stable. Since the amount of young aspen/birch is directly related to the amount of harvesting that generates young aspen/birch in Minnesota, we can expect this to reduce in the future (see Appendix G on cumulative effects) as the MFRC landscape committees are recommending reductions in aspen. The amount and extent of this projected reduction in young aspen/birch forest on other land ownerships is largely unknown at this time. For both NFS land and all forested lands in northern Minnesota, the extent to which woodcock populations will be dependent on shrub wetlands breeding habitat over temporary habitat conditions created through natural disturbance or timber harvest is related to the overall increase or reduction in young aspen/birch forest.

Woodcock apparently occupied the area prior to European settlement. Therefore it is assumed that alternatives which manage vegetation to more closely approach the conditions that occurred under RNV should not cause a loss of viability. Additional information is needed to do a thorough analysis to determine reasons for apparent population declines.

3.3.6.4 White-tailed deer (Indicator 22)

Evaluation of white-tailed deer is based primarily on indicators of acres of forage habitat (aspen-birch forest under 25 years old) and suitable conifer thermal cover habitat.

As an indicator the deer does a good job at highlighting differences among the alternatives because each alternative will result in varying habitat conditions. Deer is a species of management concern because: it is a key prey species for the federally endangered gray wolf; it is a very high public interest species with important social, ecological, and economic values and impacts, both positive and negative.

The current forest plans emphasize habitat for popular and economically important game species such as white-tailed deer. Concern exists that a change in management of the forests could result in an undesirable decline in deer populations. Concern also exists for continuing high deer populations.

Historically, the northern Great Lakes States were marginal white-tailed deer range (Blouch 1984). Forestry and agricultural practices have allowed a northward extension of white-tail range (Hesselton and Hesselton 1982).

Although white-tailed deer currently occur across the two National Forests, before European settlement, deer in Minnesota were associated primarily with the deciduous woods and prairie edges of the south and west central parts of the State (Jaakko Poyry Consulting, Inc. 1992b, p. 18). Only after the northern coniferous forests were logged and cut-over lands burned, did white-tails become abundant in the north (Stenlund 1958; USDA Forest Service 2002c).

It is estimated that the current statewide population of deer in Minnesota is 1 million animals (Dickson 2002). From 1989 to 2001, pre-fawn deer densities (that is, densities prior to the spring birth of fawns) on the Superior NF varied from 1 to 18 deer per square mile; densities varied from 7 to 30 deer per square mile on the Chippewa NF (USDA Forest Service 2002c).

Concern exists that landscapes which are particularly favorable for deer, a common species, do not necessarily provide adequately for the long-term sustainability of some other species, including some which are considerably more rare. There is also concern that at high population levels, white-tailed deer can cause major changes in the composition and structure of forest communities by browsing shrubs and tree seedlings, and grazing understory forbs.

A variety of herbaceous plants may decline under sustained deer foraging (Augustine and Frelich 1998, Shelton and Inouye 1995, Strong 1990, Alverson et al. 1988, Augustine and Jordan 1998). Canada yew, listed as a sensitive species on the two National Forests, is an uncommon coniferous shrub across most of the northwoods because it is a preferred food of deer and doesn't recover well after browsing (USDA Forest Service 2002c).

Regenerating forest stands can be damaged by high population levels of deer. Deer browsing can alter species composition (Van Deelen et al. 1996a, Blouch 1984). Regeneration of northern white cedar (Davis et al. 1998) and eastern white pine can be very difficult due to deer depredation.

Deer Indicator 1 – Amount of Deer Winter Thermal Cover

The first indicator for deer is the amount (acres) of winter thermal cover. This indicator does a good job of highlighting the differences among the alternatives because thermal cover (that is, suitable conifer cover) may affect survival of deer during harsh winters.

The amount of winter thermal cover for white-tailed deer for each alternative will be compared to existing amounts and to the vegetation conditions predicted to occur at the ecological Section level when those landscapes were functioning within the range of natural variability (RNV). See Appendix B for details on how RNV values were defined for landscape ecosystems within the Northern Minnesota Drift and Lake Plains and the Northern Superior Uplands.

Deer Indicator 2 – Amount of Deer Foraging Habitat

Indicator 2 for deer is the amount (acres) of deer foraging habitat. This indicator does a good job of highlighting the differences among alternatives because abundant deer foraging habitat helps to support high populations of deer.

The amount of foraging habitat for white-tailed deer for each alternative will be compared to existing amounts and to the amounts predicted to occur at the ecological Section level when those landscapes were functioning within RNV.

Analysis Area

The analysis area for deer habitat for direct and indirect effects is the land administered by the Chippewa and Superior NFs. Differences among alternatives are based on Dualplan model outputs and are displayed for decades 1, 2 and 10. Decades 1 and 2 represent the likely implementation life of the Forest Plan, although potential effects of alternatives are analyzed through Decade 10.

Cumulative effects look at all lands within each Forest and northern Minnesota.

3.3.6.4.a Affected Environment for White-tailed Deer

Amount of Deer Thermal Cover

White-tailed deer are very adaptable, living in a variety of habitats across Minnesota. This species is limited in northern Minnesota by severe winters (USDA Forest Service 2002c). Conifer thermal cover is an important habitat component, particularly in severe winters.

Numbers of northern white-tail fluctuate from year to year in response to alternating periods of mild and severe winters (Blouch 1984; Erickson et al. 1961). At the northern limit of white-tail ranges, a greater-than-normal snow accumulation causes starvation, die-offs and lowered productivity (USDA Forest Service 2002c).

For northern Minnesota, it is believed by most biologists that conifer cover is critical both for thermal protection and for reducing snow depth and surface crusting (Jaakko Poyry 1992b, p. 19). In Minnesota's Forest Zone, conifer thermal cover for deer typically includes dense stands of northern white cedar, spruce, and balsam fir, and in some areas, also jack pine and red pine (Mangipane and DelGiudice 1999).

During severe weather, deer concentrate, or "yard up" in areas of dense conifer cover. Snow restricts deer movement and covers nourishing food; cold temperature and wind tap the white-tails' energy reserves. Heavy conifer cover blocks snow and reduces wind and radiation heat loss (Hesselton and Hesselton 1982; Blouch 1984).

On the Superior NF, deer migrate to winter range every year, regardless of winter severity. This may be due to higher snow depths and winter severity; or it could also be influenced by traditional deer feeding near major deer yards (M. Lenarz, pers. comm.). Most northeastern Minnesota deer migrate up to 55 miles each year between summer and winter ranges, which remain the same each year (Nelson 2000). Deer also use winter range on the Chippewa NF, especially in more severe winters. In milder winters, however, they are more dispersed.

A research study in progress on the Chippewa NF has documented winter deer mortality associated with high winter severity, suggesting that in harsh winters, habitat is limiting at current population levels (USDA Forest Service 2002c). The limited habitat is likely a combination of the amount, availability, and arrangement of both conifer cover and browse proximate to it (G. DelGiudice, pers. comm. 2002).

Differences among alternatives in providing winter thermal cover is determined by comparing the acres of appropriate conifer types (cedar, lowland conifers, spruce/fir, jack pine and red pine) potentially in a suitable condition to serve as thermal cover, based on age category (project record contains age criteria specific to each forest type). These comparisons are made at a forest-wide level for each National Forest.

Amount of Deer Foraging Habitat

Habitat quality for deer in northern Minnesota increases as acreages of early stage, broad-leaf forest increase (Jaakko Poyry 1992b, p. 61). Young clearcuts, and moderately stocked aspen-birch forests less than 25 years old, provide some of the best summer foraging for deer in northern Minnesota (USDA Forest Service 2002c; Jaakko Poyry 1992b, p. 20).

Differences among alternatives in providing deer foraging habitat is determined by comparing the acres of aspen-birch forest less than 25 years old. These comparisons are made at a forest-wide level for each National Forest.

3.3.6.4.b Environmental Consequences for White-tailed Deer

Effects Common to All Alternatives

Habitat for deer will not vary by alternative in the BWCAW.

Deer in the BWCAW are analyzed in the FEIS for the BWCAW fuel treatment (USDA Forest Service 2001a). In the BWCAW, deer habitat was predicted to decline over the next 100 years (USDA Forest Service 2001, p. 3.8-52) based on analysis of deer forage habitat. Forage habitat in the BWCAW was included in the analysis below for the Superior.

Deer thermal cover habitat was not analyzed for the BWCAW. However, based on other forest vegetation analyses in the FEIS for BWCAW Fuel Treatment (USDA Forest Service 2001a), thermal cover is expected to increase significantly as mature spruce-fir and other conifer increases. Deer thermal cover in the BWCAW is not included in the analysis below for the Superior.

Direct and Indirect Effects for White-tailed Deer

Amount of Deer Winter Thermal Cover

Early in the planning period (decades 1, 2), most alternatives provide relatively similar amounts of deer thermal cover habitat, with Alternative D somewhat higher on the Superior NF.

By the end of the planning period (decade 10), Alternatives D and B provide the most deer winter thermal cover (Figures WTD-1 AND WTD-2) with amounts that are generally twice the existing acreages. Alternatives A and C provide the least, with relatively slight increases over existing amounts. Alternatives F, G, and E provide relatively moderate increases in thermal cover, with F providing somewhat more than G which provides somewhat more than E.

Alternatives A and C provide less thermal cover than would have occurred across the broader landscape under the range of natural variability (RNV). The amount of thermal cover afforded by Modified Alternative E is less than would have occurred under RNV on the Chippewa NF and very near the amounts expected to have occurred under RNV on the Superior NF. Alternatives B, F and G provide amounts within RNV for both National Forests. Alternative D exceeds the amounts of thermal cover that would have occurred under RNV on both forests.

Amount of Deer Foraging Habitat

Alternatives A and C (Figures WTD-3 and WTD-4) provide the greatest amount of deer foraging habitat, exceeding existing conditions on both National Forests during decades 1 and 2. The other alternatives provide less deer foraging habitat. They provide relatively similar amounts in decade 1, with marked declines in later (2, 10) decades under Alternatives B and D, eventually resting below RNV. Modified Alternative E remains above RNV throughout the analysis period. On the Chippewa NF, Modified E provides about 60% of this habitat component during decade 2 compared to what currently exists. On the SNF, Modified E provides nearly the same amount of this habitat component during decade 2 as currently exists.

Deer Winter Thermal Cover/Foraging Habitat Interactions

Early in the planning period (decades 1, 2), Alternatives A and C provide increases in foraging habitat, and about the same amount of thermal cover as presently exists. This should provide a continuation of habitat conditions supporting high local deer populations when winter severity is low. The other alternatives provide combinations of foraging habitat and thermal cover relatively similar to each other in decade 1, with declines in the foraging habitat component occurring for some alternatives in decade 2. Modified Alternative E would provide similar quantities as currently exists of both habitat components through the end of decade 2 on the Superior NF; on the Chippewa NF, the foraging habitat component would be less than existing conditions, and decline through the planning period. However, increases in thermal cover would occur.

By the end of the planning period, Alternative D is likely to result in substantial decline in deer habitat capability and carrying capacity on the two National Forests. Large increases in thermal cover, even beyond RNV levels, accompanied by large declines in foraging habitat, considerably below RNV levels, would result in habitat conditions on the National Forests that are unfavorable for white-tailed deer, particularly where solid blocks of Federal land ownership occur. Where land ownerships are more intermixed, foraging conditions may be provided by non-Federal lands, although they will not be as closely proximate to each other as are most beneficial to deer during hard winters.

Cumulative Effects for White-tailed Deer

Statewide white-tailed deer are increasing, and current populations are estimated at 1 million deer. Rangewide, white-tailed deer are increasing. In Province 212 in Minnesota, Wisconsin, and Michigan white-tailed deer are increasing. If two severe winters occur back-to-back, there would likely be a temporary decrease in deer populations in these areas. Cumulative effects of management on the Superior and Chippewa NFs will not likely increase or decrease deer populations substantially over the next 2 decades, although local increases or decreases may be possible, based upon large blocks of federal ownership.

Population viability for white-tailed deer does not appear to be an issue in the foreseeable future.

Resource damage, caused by white-tailed deer, will likely continue under any selected alternative. Recreational hunting can help control deer populations, but climate appears to be more influential in causing population changes.

The Superior NF has large blocks of land with few other ownership in-holdings. Thus, the direct effects on potential deer populations discussed are most likely to occur within the Forest boundary. Most of the Chippewa NF administered lands are interspersed within other land ownerships. This tends to reduce the direct effects discussed, as thermal cover and forage will likely exist on adjacent land ownerships. How each alternative contributes to changes in the carrying capacity for deer on the Chippewa NF is similar to that described above for the Superior NF. However, the ability to alter the overall deer population, especially decreasing it, within the broader landscape is influenced to a much greater degree by habitat conditions on adjacent ownerships. Thus, with the exception of those areas where NFS land exists in large continuous blocks, the ability for an alternative to have a long-term effect on deer populations on the Chippewa is highly dependent on forest management activities on other ownerships.

Within northern Minnesota (see Appendix G on Cumulative Effects) the amount of young aspen is expected to decrease over time, reducing forage habitat for deer. Conifer acreage is expected to increase, thus thermal cover should also increase. It is unknown if forage habitat will become limiting in the future as white-tailed deer are extremely adaptable.

Figure WTD-1: Acres of Deer Thermal Cover Habitat (Chippewa National Forest)

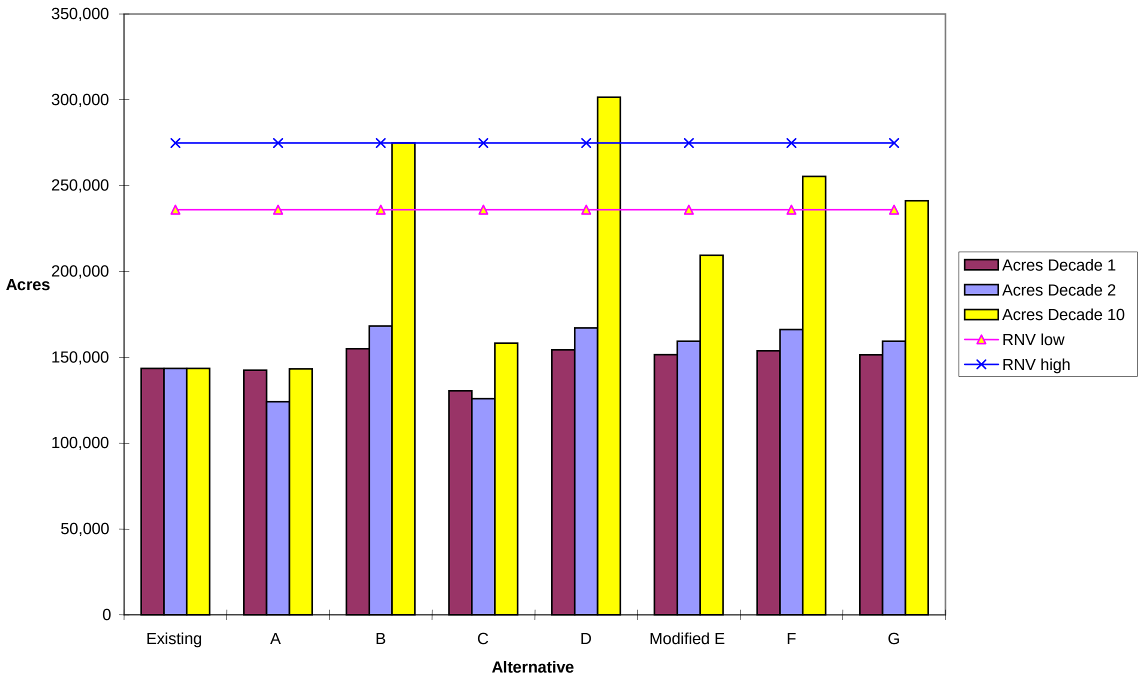


Figure WTD-2: Acres of Deer Thermal Cover Habitat (Superior National Forest)

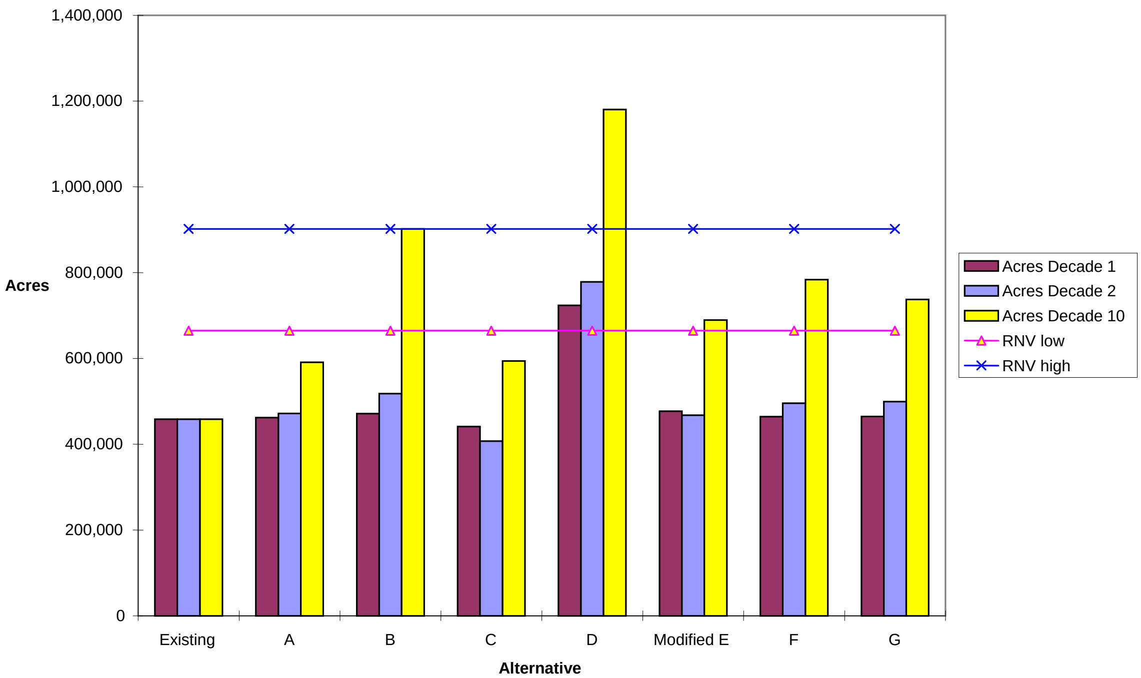


Figure WTD-3: Acres of Deer Foraging Habitat (Chippewa National Forest)

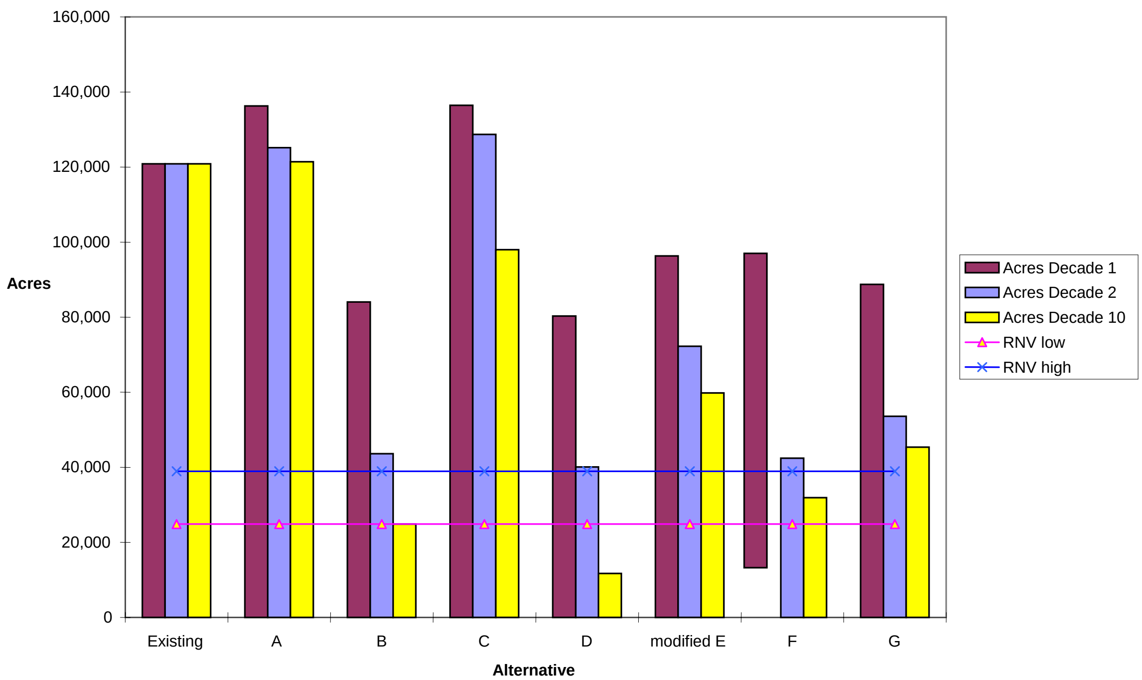
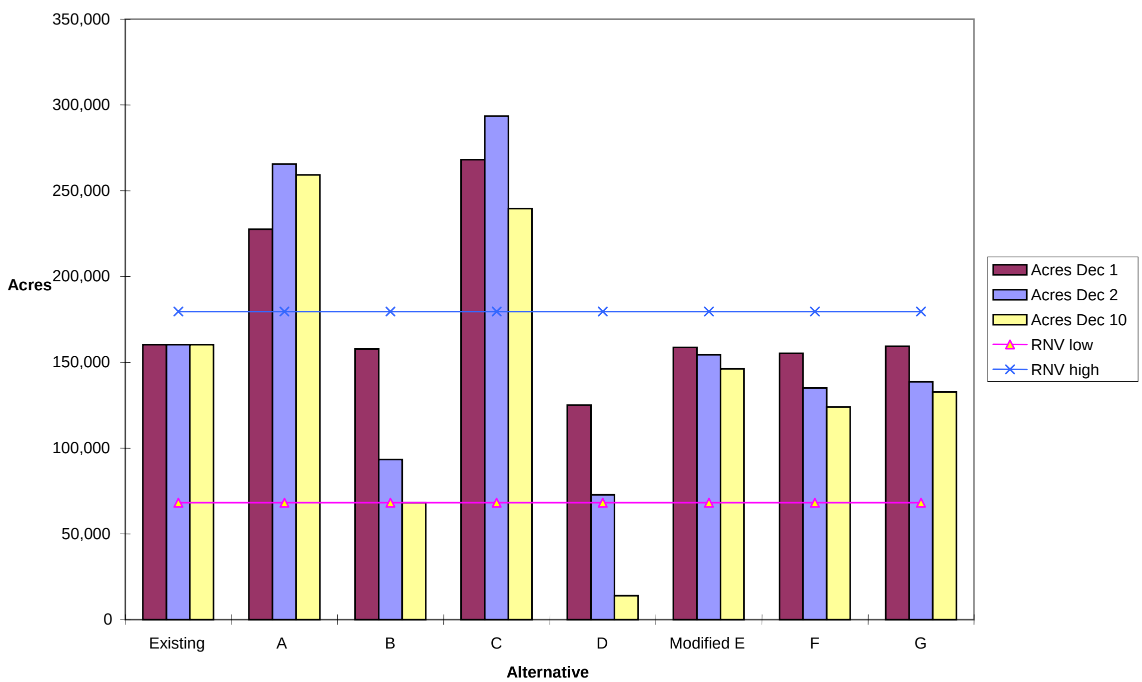


Figure WTD-4: Acres of Deer Foraging Habitat (Superior National Forest)



3.3.6.5 Ruffed grouse (Indicator 23)

Evaluation of ruffed grouse is based primarily on indicators of acres of suitable breeding and forage habitat.

As an indicator the ruffed grouse does a good job at highlighting differences among the alternatives because each alternative will result in varying habitat conditions. Ruffed grouse is a species of interest because it is a high public interest game species.

The current forest plans emphasize forest management favorable for the ruffed grouse, a popular game species. Concern exists that landscapes which are particularly favorable for ruffed grouse, a common species, do not necessarily provide adequately for the long-term sustainability of some other wildlife species, including some which are considerably more rare. Concern also exists that a change in management of the forests could result in an undesirable decline in grouse populations.

The ruffed grouse is a widely distributed species, with fairly specific habitat requirements (US Forest Service 2002m; Gullion 1984; Thompson and Dessecker 1997). Although they occur throughout the deciduous and coniferous forests of North America, they are most abundant in early-successional forests dominated by aspens and poplars (*Populus* spp.) (Rusch et al. 2000). Although the relationship between ruffed grouse and the distribution of aspen is not obligatory, ruffed grouse achieve their greatest abundance in northern regions where aspen, especially quaking aspen, are a dominant component of the forest (Cade and Sousa 1985; Thompson and Fritzell 1989).

Highest densities of ruffed grouse are achieved only if there is an interspersion of young and old forest stands to provide the proper intermixture of necessary food and cover (Gullion 1984; US Forest Service 2002m). Optimum grouse habitat is created through the disturbance of mature forest stands, by processes such as fire, blowdown, timber harvest, or succession of open lands back to forest (Thompson and Dessecker 1997e; US Forest Service 2002m).

General trends in grouse populations have been surmised based on habitat changes associated with European settlement. Currently, there is twice as much aspen within the 5 terrestrial native plant communities on the Chippewa NF as there was 150 years ago (US Forest Service unpublished report on aspen, 4 pp, no date, Shadis 1997b, Cleland et al. 2001, Frelich 2000). Euro-American settlement in the 1800s brought land clearing, timber harvesting, and subsequent widespread wildfires that increased aspen-birch acreages considerably in the Lake States (Cleland et al., 2001). The severity of this ecological disturbance that resulted in the Lake States aspen forests was quite uncommon before human exploitation (Hunter 1999, p. 34). Fire control, succession, conversion, and land development have resulted in some aspen-birch decline since the 1930s (USDA Forest Service unpublished report on aspen, 4 pp, no date; Cleland et al. 2001).

Grouse likely declined with initial forest harvest, increased with early regrowth of these forests, and are apparently again declining as the young forests age (US Forest Service 2002m; Rusch et al. 2001). Since ruffed grouse mainly occupy early successional deciduous forests created by fire, logging, or other large-scale disturbance, Rusch et al. (2001) suggest that fire control, opposition to clear-cut logging practices, and conifer management have allowed a maturation and conversion of the eastern deciduous forests since their original harvest, resulting in the recent decline in habitat suitability for ruffed grouse

Minnesota's grouse population today is probably higher than before European settlement (Minnesota DNR 1997c). Because of the habitat preferences of the species, increased forest harvesting in Minnesota in the past may have led to an increase in overall grouse numbers from presettlement times (Natural Resources Research Institute 2001). Some habitats occur at 3 to 5 times the levels that likely occurred under the natural range.

Ruffed grouse have shown a declining population trend in Minnesota over the past 25 years, based on Breeding Bird Survey data (Sauer et al. 2001; Natural Resources Research Institute 2001), but the importance of this is unknown due to the cyclical nature of ruffed grouse populations. MDNR drumming counts also indicate the species is generally declining in the State, with the decline being greater in the southeast and transition zone where land development is rapid, and less so in the northern parts of the state (B. Berg, pers. comm.).

In 2001, Minnesota had the highest ruffed grouse population of any state in the country (Minnesota DNR 2001. *Ruffed and sharp-tailed grouse numbers drop.* http://www.dnr.state.mn.us/information center/news releases/nr992280956.html [Accessed 3/6/2002]). Grouse population levels on the Chippewa and Superior NFs are within the population levels seen in the variable 10-year grouse cycle over the past 50 years, as measured by the MDNR cooperative grouse survey (MDNR 2001. *Minnesota grouse and hares*. Forest wildlife populations and research group. Grand Rapids, MN; US Forest Service 2000i).

Ruffed Grouse Indicator – Amount of Grouse Habitat

The first indicator for ruffed grouse is amount (acres) of grouse habitat that would occur under each alternative. This indicator does a good job of highlighting the differences among alternatives because the density of grouse is closely linked to the availability of habitat (aspen-birch forests).

Ruffed Grouse Indicator – Quality of Grouse Habitat

The second indicator for ruffed grouse is quality of grouse habitat that would occur under each alternative. Grouse habitat quality is a combination of age class distribution, stem density, patch size, and conifer component. This indicator does a good job of highlighting the differences among alternatives because grouse populations achieve highest densities when there is a good interspersion of young and old forest stands in close proximity to each other, to provide for the habitat needs of grouse. Forests that are lacking in young age classes do not provide the best cover for young birds; forests that are lacking in older age classes do not provide adequate food resources. Grouse populations are highest where these different forest stages are located closely proximate to each other; hence, relatively small patches within the larger forest landscape produce the most grouse. Grouse populations are highest in aspen forests with sufficient stem densities. Conifer cover within northern grouse habitat can be detrimental, as it tends to favor avian predators (Gullion and Alm 1983; Gullion 1990; Barber 1989). Alternatively, small patches of aspen regeneration in conifer stands (a conifer matrix) can support high densities of ruffed grouse (Gullion 1990). The issues of scale and configuration of aspen habitat versus conifer species or conifer forest appear to be important in determining grouse densities.

Analysis Area

The analysis area for this issue is the Chippewa NF and the Superior NF. The timeframes include the existing condition, RNV, decade 2 model output and decade 10 model output.

For cumulative effects the analysis area moves up to the State of Minnesota and a larger area including Province 212 (northeastern U.S. and parts of Canada).

3.3.6.5.a Affected Environment for Ruffed Grouse

Amount and Quality of Grouse Habitat

Aspen-dominated forests provide the optimum habitat for grouse (US Forest Service 2002m; Jaakko Poyry 1992b, p. 41-42). Optimal year-round habitat is a mixture of young and older forest, providing both cover and food.

Gullion (1984b) indicated grouse need aspen in 3 age classes: sapling stands about 4-15 years old for brood cover; sapling and small pole-stage stands 6-25 years old for fall and spring cover; and older aspen for food, and as wintering and nesting cover. From fall through leaf-out in spring, grouse prefer to have activity areas that include mature male aspen, a prime source of their preferred dormant season food – buds and flower catkins (Jaakko Poyry 1992b, p. 42).

Larger, contiguous blocks of forest are better grouse habitat than are smaller, isolated or fragmented woodlots surrounded by agricultural fields (Rusch et al. 2000; Kubusiak 1989). Grouse concentrated at (hard) edges are more vulnerable to predation (Gullion 1984a; Green 1995, p. 99).

Within the larger forest matrix, highest densities of grouse occur where habitat components are closely interspersed (US Forest Service 2002m; Gullion 1984; Jaakko Poyry 1992b). According to Gordon Gullion, the optimum grouse habitat management prescription is a mosaic of 2.5-acre stands, one-fourth of which are cut each decade leading to a 40-year rotation. Stands this small, however, are generally not economical for commercial operations, so Gullion recommended the same pattern in 10-acre blocks (Jaakko Poyry 1992b, p. 42). Blocks of suitable habitat should not be less than 1.0 acres in size (Gullion 1984a).

Stem densities within regenerating aspen stands are a habitat component of increasing interest as aspen harvest methods vary. Residual overstory trees in aspen regeneration harvests have the effect of reducing sucker growth in aspen (Perala 1977, Huffman 1997). Huffman (1997) found stem densities in 10 year old aspen stands of about 6,000 stems/acre with a residual overstory tree basal area of 35 sq ft/acre. This basal area is similar to what would be found after the shelterwood harvest method. Reserving some residual canopy cover within aspen harvest units is being tested as a way of reducing aspen sucker density enough to facilitate the restoration of other stand components (Stone et al. 2001). A range of "optimal" stem densities are described within the literature (U.S. Forest Service 2002). Results from studies have similarities but conclusions regarding "optimal" conditions sometimes conflict. Gullion (1984a) indicates that although stem densities of initial regeneration in secondary hardwood succession are often in the range of 20,000-50,000 stems/acre, ruffed grouse seldom use these stands until they have thinned to total densities of less than 15,000 stems/acre.

Dessecker and McAuley (2001) describe optimum grouse habitats as including young (6-15-year old), even-age, deciduous stands that typically support 8,100-10,121 stems/acre. Kubisiak (1989) describes good grouse shelter as habitat with more than 8,100 stems/acre. Jaakko Poyry (1992, p. 42) described brood rearing habitat (4-15 years old) with stem densities of 4,900-12,000/acre, and winter habitat (10-25 years old) with stem densities of 2,000-6,000 stems/acre. Cade and Sousa (1985) describe optimal drumming sites (13-25 years old) in Minnesota as 2,000-6,000 stems/acre. Optimal drumming cover in Wisconsin is 6-25 year old aspen stands with 1,800-6,000 stems/acre (Cade and Sousa 1985).

Gullion (1984a) suggests that when ruffed grouse have a choice, stand use usually ceases when total stem densities decline below 6,900 stems/acre. Gullion states that grouse will use habitat with lower stem densities in areas where cover is poorer, but that grouse densities there will also be lower. Cade and Sousa (1985) state that habitat has "gone by" and rather abruptly ceases to support drumming grouse when stem densities decrease to below 2,000 stems/acre.

The desirability of evergreen cover as it relates to grouse winter habitat has been a controversial topic (US Forest Service 2002m). In the southern grouse range, where snow cover used for winter burrowing is limited, ruffed grouse use evergreen cover extensively in winter (Barber 1989). However, in the northern grouse range, coniferous cover tends to favor avian predators over grouse (Gullion and Alm 1983), due to a higher risk of predation and shorter survival for grouse when conifers are present (Gullion 1990). Stands of conifers can expose grouse to severe losses from predation (Barber 1989); maximum grouse densities and survival rates of grouse are lower in forests where conifers are the predominant trees (Cade and Sousa 1985, citing Gullion and Marshall 1968, Kubusiak et al. 1980). However, Gullion (1990) observed high grouse densities in a configuration of aspen regeneration pockets within a matrix of conifer forest (red and jack pine).

In their habitat suitability index model for ruffed grouse, Cade and Sousa (1985) assumed that the presence of any conifers in an otherwise suitable habitat will reduce suitability of fall to spring cover. However, they also indicate that predation on grouse is not always a significant decimating factor associated with coniferous habitats, stating that conifers with low-growing branches (such as spruce and firs) may have greater cover value for grouse than concealment value for raptors, and should not be considered as detrimental as "high pine" conifers.

On the Chippewa and Superior NFs, optimal grouse habitat is found in aspen-birch forest (types 91, 92, 93, 94, 95), comprised of 3 habitat classes:

4-15 years	brood cover
6-25 years	spring/fall cover
>25 years	food; winter/nesting cover

Differences among alternatives in providing grouse habitat is determined by comparing the acres of these forest types potentially in a suitable condition, based on habitat category. Differences among alternatives are further refined by comparing the distribution of habitat between the desired habitat classes.

Maximal grouse densities are associated with small patches of appropriately aged forest, located proximate to each other. Acres of small, young upland forest patches are used as an indicator of this aspect of grouse habitat quality.

Alternatives fostering conifer development within the aspen-birch patches also provide opportunity for distinguishing among the alternatives, as this management practice will tend to diminish grouse habitat quality in northern Minnesota. Percent conifer composition and acres of treatment type within aspen-birch forest are used as indicators of this aspect of grouse habitat quality.

3.3.6.5.b Environmental Consequences for Ruffed Grouse

Effects Common to All Alternatives

Habitat for ruffed grouse will not vary by alternative in the BWCAW. Grouse habitat in the BWCAW is analyzed in the FEIS for the BWCAW fuel treatment (USDA Forest Service 2001a).

Decades 1 and 2 represent the likely implementation life of the Forest Plan, although potential effects of alternatives are analyzed through Decade 10.

Direct and Indirect Effects for Ruffed Grouse

Amount of Grouse Habitat

Early in the planning period (decade 1), all alternatives provide relatively similar amounts of total grouse habitat (Table WRG-1), similar in quantity to existing conditions, and well in excess of RNV. By decade 2, Alternatives A and C provide the greatest total amount of grouse habitat (Table WRG-2), with all alternatives still providing habitat quantities well exceeding RNV values.

By decade 10, Alternatives A and C provide the greatest total amount of grouse habitat (Table WRG-3). Alternatives B and D provide the least total amount of grouse habitat. Alternative Modified E provides more habitat than does Alternative G, which provides more habitat than does Alternative F. By the end of the analysis period (decade 10), all alternatives provide less grouse habitat than currently exists on the Chippewa and Superior NFs, although all alternatives except D provide at least as much habitat as shown by RNV values.

Early in the planning period, the greatest amounts of brood cover and spring/fall cover are provided by Alternatives A and C, similar to or increasing from existing conditions, and exceeding RNV. By decade 2, Alternative B, D and F provide the least brood cover and spring/fall cover.

By decade 10, Alternatives B and D provide the least brood cover and spring/fall cover. Modified Alternative Modified E provides more habitat than do Alternatives B, D, F and G. All alternatives except D provide at least as much habitat as RNV.

Early in the planning period (decades 1, 2), Alternatives A and C provide the least nesting/winter/food cover (> 25 years old), declining from existing conditions. By the 10th decade, nesting/winter/food cover (> 25 years old) declines from existing conditions under all alternatives, at which time Alternatives A, C and Modified E provide the most cover; Alternatives B and D provide the least cover.

Table WRG-1: Ruffed Grouse Habitat in Thousands of Acres – Decade 1												
Type of Habitat			RNV		Alternatives							
		Exist	low	high	A	B	C	D	Mod E	F	G
Total Habitat	Chip	258	50	81	257	244	248	236	240	240	242
	Sup	534	147	302	527	517	525	486	506	519	511
Brood Cover(4-15)	Chip	55	10	17	57	31	57	29	34	31	33
	Sup	75	31	79	101	65	121	49	63	64	66
Spring-Fall (6-25)	Chip	98	18	32	100	79	100	78	83	79	81
	Sup	125	46	136	160	133	176	119	126	131	132
Nest-Winter (>25)	Chip	141	26	44	125	165	117	161	150	161	158
	Sup	378	80	129	306	366	267	369	355	372	360
Small Patch	Chip	32	na	na	38	11	40	14	24	13	18
	Sup	37	na	na	48	23	57	24	40	28	34
Conifer Comp.	Chip	27%	47%	57%	27%	30%	29%	31%	30%	30%	30%
	Sup	41%	64%	80%	41%	42%	41%	46%	43%	42%	42%
Source: Dualplan output												

Quality of Grouse Habitat

Overall highest quality of grouse habitat would occur with Alternatives A and C; lowest quality of habitat would occur with Alternatives B and D. Habitat quality associated with Alternatives Modified E, F and G would lie in between. Grouse habitat quality varies by quality component, alternative, and Forest.

Grouse Habitat Class Distribution

In decades 1 and 2, highest quality grouse habitat is provided by Alternatives A and C (Tables WRG-1 and WRG-2); poorest quality grouse habitat is provided by Alternatives B and D. An even distribution of habitat classes is associated with the highest quality of grouse habitat. An even distribution among the three habitat classes does not occur for existing conditions, or under any of the alternatives. Because the oldest class (>25 years) spans a greater range of ages, it contains a greater proportion of acres than do the two younger classes (4-15 years; 6-25 years). This is particularly evident for the Superior NF, due to the inclusion of the BWCAW data in the analysis.

Alternatives A and C increase quality of grouse habitat over existing conditions by increasing the 4-15 year habitat class, while decreasing the >25 year habitat class. Alternatives B and D reduce habitat quality by increasing the >25 year habitat class, and reducing the 4-15 year habitat class. Alternatives Modified E, F and G are very similar in habitat class distribution, and lie between the other Alternatives.

Amount of Small Patches

In decades 1 and 2, highest quality grouse habitat would occur under Alternatives A and C (Tables WRG-1 and WRG-2); lowest quality would occur for Alternatives B and D. Alternatives A and C provide the greatest amount of small patches; alternatives B and D provide the least. Modified Alternative Modified E provides more small patches than does Alternative G, which provides more than does Alternative F.

Conifer Composition

Highest quality grouse habitat would occur under Alternatives A and C (Tables WRG-1 and WRG-2); lowest quality would occur under Alternatives B and D. Alternatives Modified E, F and G provide intermediate quality habitat, particularly by the 10th decade. By the 10th decade (Table WRG-3), all alternatives increase acres of conifer stands over the existing conditions within the aspen-birch forest, resulting in a decline in habitat quality for grouse. Alternative D on the Superior NF increases conifer composition beyond RNV.

Table WRG-2: Grouse Habitat in Thousands of Acres – Decade 2

Type of Habitat		Exist	RNV		Alternatives						
			low	high	A	B	C	D	Mod E	F	G
Total Habitat	Chip	258	50	81	250	215	237	213	220	207	219
	Sup	534	147	302	514	482	511	444	473	490	478
Brood Cover(4-15)	Chip	55	10	17	55	9	56	7	27	8	14
	Sup	75	31	79	121	26	139	15	65	49	51
Spring-Fall (6-25)	Chip	98	18	32	103	39	104	35	56	38	45
	Sup	125	46	136	231	108	265	91	116	134	138
Nest-Winter (>25)	Chip	141	26	44	129	176	113	177	152	169	170
	Sup	378	80	129	256	396	225	379	324	362	347
Small Patch	Chip	32	na	na	27	10	28	10	20	12	18
	Sup	37	na	na	40	18	43	18	30	27	34
Conifer Comp.	Chip	27%	47%	57%	28%	34%	31%	35%	34%	34%	34%
	Sup	41%	64%	80%	42%	45%	42%	49%	46%	46%	47%

Source: dualplan output

Table WRG-3: Ruffed Grouse Habitat in Thousands of Acres – Decade 10

Type of Habitat			RNV		Alternatives						
		Exist	low	high	A	B	C	D	Mod E	F	G
Total Habitat	Chip	258	50	81	224	50	200	36	155	65	114
	Sup	534	147	302	416	147	404	138	328	224	274
Brood Cover(4-15)	Chip	55	10	17	52	10	44	5	24	14	19
	Sup	75	31	79	108	31	102	4	64	55	57
Spring-Fall (6-25)	Chip	98	18	32	92	18	124	8	48	25	35
	Sup	125	46	136	203	46	188	11	111	91	96
Nest-Winter (>25)	Chip	141	26	44	107	26	105	25	99`	35	71
	Sup	378	80	129	167	80	173	125	187	104	146
Small Patch	Chip	32	na	na	37	12	34	6	20	16	19
	Sup	37	na	na	46	25	44	9	35	35	39
Conifer Comp.	Chip	27%	47%	57%	31%	57%	36%	58%	42%	52%	51%
	Sup	41%	64%	80%	52%	80%	53%	81%	61%	72%	67%

Source: Dualplan output

Harvest treatments (Figures WRG-1 and WRG-2) have a direct bearing on grouse habitat quality. Clearcuts (Treatment 2) result in fewer conifers within aspen stands than do partial harvests (Treatment 5) or partial harvest designed to increase conifer component (Treatments 7-10). Highest quality grouse habitat is expected to result from Alternatives A, C and Modified E; least quality from Alternatives B and D, due to amount of each treatment type potentially applied.

Stem Density

Highest quality grouse habitat would occur under Alternatives A, C and Modified E (Figures WRG-1 and WRG-2); poorest quality grouse habitat would occur under Alternative D (Figures WRG-1 and WRG-2).

Harvest treatments have a direct bearing on grouse habitat quality through the resulting stem densities in young aspen regeneration. Clearcuts (Treatment 2) result in highest stem densities in regenerating aspen; partial harvests (Treatments 5, 7-10) have reduced stem densities, with stem density declining as residual overstory increases. Landscapes that include the availability of higher stem densities in young regenerating aspen stands (5,000-12,000 stems/acre) support higher densities of grouse than do landscapes in which the regenerating stands are sparser. Below 2,000 stems/acre is likely to be unsuitable for grouse habitat.

Treatment 5 leaves 30 sq. ft/acre basal area (BA) of residual overstory in place in regenerating aspen stands. Treatments 7-10 leave 60 sq. ft/acre BA of residual overstory. Although residual BA and residual canopy are not interchangeable measurements, they are correlated with each other (Huffman et al. 1999). Huffman et al. (1999) found a range of stem densities resulting from leaving residual canopy in aspen regeneration harvests, from 10,361 stems/acre at 10% canopy cover, to 2,990 stems/acre at 65% canopy cover. At 40-50% canopy cover of residuals, a range of 3,200-8,900 stems/acre were observed (Huffman 1997, p. 100). Palik et al. (in press) found sucker densities 62% higher in clearcuts than in partial harvests with 54 sq. ft/acre BA residual cover. Three years post-harvest, the clearcut units had about 7,000 stems/acre; partial harvest units had about 4,000 stems/acre. Sucker biomass is also reduced by leaving residual canopy cover. These research results suggest that although best quality grouse habitat is achieved through clearcutting, and the practice of leaving 30 or even 60 sq. ft./acre residual BA canopy cover reduces aspen stem density in the regenerating stand, some stands will still support minimal grouse densities.

Summary

Alternatives A and C provide the most grouse habitat, of highest quality. Alternatives B and D provide the least grouse habitat, of lowest quality. Amount and quality of grouse habitat under Alternatives Modified E, F and G lie in between.

Under the “coarse-filter” approach, the belief is that forest conditions within RNV will generally provide for the maintenance of native species because they evolved under similar circumstances (Hunter 1999). Applying that rationale to grouse habitat suggests at least a minimum sustainable grouse population would occur under any of the alternatives early in the implementation period of the plan (decade 1). By decade 2, brood cover may be limiting under Alternative B and D on both Forests, and Alternative F on the Chippewa NF. By decade 10, multiple habitat components are lacking for Alternatives B and D on both Forests.

Cumulative Effects for Ruffed Grouse

The cumulative effects to the ruffed grouse are conducted within the forest proclamation boundary. The lands within the proclamation boundary of each forest reflect the immediate role and context of each forest.

On the Chippewa NF, rates of timber removal in the decade ending in 1990 (Miles et al. 1995) place the forest among the most highly managed land ownership classes in Minnesota. Based on harvest rates, this status likely continued through 1995. On the Superior NF, rates of removal place the forest above the state-wide average. Currently, amounts of young forest greatly exceed amounts predicted under RNV (Ch. 3.2.1.), with the exception of some landscape ecosystems represented with the BWCAW. Harvest rates have declined and harvests may be shifting to other ownerships. Recent trends in forest spatial patterns and harvest intensity (Wolter and White 2002, Host and White 2003) indicate that state and private non-industrial ownerships may be providing forest conditions that provide more habitat for the ruffed grouse. There is a limited ability to manage forest within the wilderness for the ruffed grouse, but base rates of disturbance predicted would continue to provide habitat for the foreseeable future.

Recent trends of increased habitat for ruffed grouse are likely to continue for the next 10 to 20 years when all ownerships are considered in each forest. It is doubtful that this relatively high level of disturbance can be sustained in the long-term without perpetuating a habitat boom and bust cycle in the future. The supply of aspen and birch available for harvest is projected to decline during this time (USDA Forest Service 1997) within the Chippewa and Superior NFs. Landscape committees organized through MFRC (Appendix G) are recommending reductions in aspen within both landscapes that include the Chippewa and Superior NFs. The amount and extent of this projected reduction in young aspen/birch forest on other land ownerships is largely unknown at this time. Non-industrial private forestland owners will likely provide high amounts of grouse habitat and heavily influence landscape level conditions (Wolter and White 2002).

Chapter 3.2.1 and Appendix B show the vegetation conditions predicted to occur when the landscapes that include the Chippewa and Superior NFs were functioning within the range of natural variability (RNV). By theory, it is anticipated that managing vegetation to more closely approach the conditions that occurred under RNV should provide sustainable amounts of habitat and population numbers within both forests.

Cumulative actions under any of the alternatives would likely provide suitable habitat for ruffed grouse viability.

Alternatives A and C provide the most grouse habitat, of highest quality, but in the context of similar conditions on other ownerships may perpetuate a boom and bust pattern of habitat availability, and therefore, to grouse populations beyond the normal cyclic patterns. Alternatives B and D would provide forest disturbance at rates lower than that found under the natural range, and among alternatives would provide the least amount grouse habitat. Base rates of disturbance would continue to provide at least minimal young forest habitat on federal land additive to more than ample habitat within the planning area. Alternatives Modified E, F and G would provide habitat amounts at least as high as those expected under the natural range, but when combined with trends, some aspects of grouse habitat among all ownerships may be over-represented. Providing relatively high amount of habitat additive with other ownerships may contribute to a boom and bust in grouse habitat and accentuate the highs and lows of the normal population cycle of the grouse. Landscape level goals could help to coordinate harvest levels and provide sustainable levels of habitat in the long term. The effect of non-industrial private forest land management may be problematic in achieving this end.

Figure WRG-1: Harvest Treatment (Chippewa National Forest)

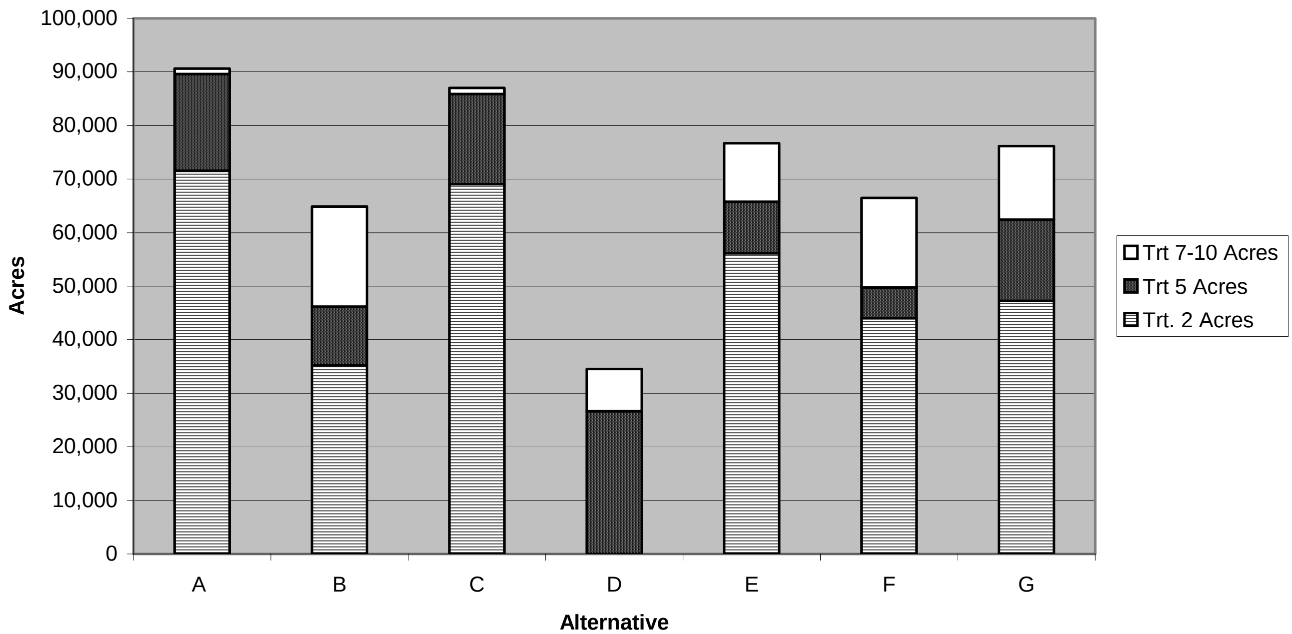


Figure WRG-2: Harvest Treatment (Superior National Forest)