DEPARTMENT OF NATURAL RESOURCES

Hardwood Hills

Subsection Forest Resource Management Plan
Fiscal Years 2013-2022

2018 Mid-plan Monitoring Report

Minnesota Department of Natural Resources
Division of Forestry Planning Document
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This report and additional information about the DNR Subsection Forest Resources Management
Planning process can be found on the DNR Forest Management Planning website.

This information is available in alternate formats upon request.

Contents

Executive Summary

When the Hardwod Hills Subsection Forest Resource Management Plan (HH SFRMP) was implemented in 2012, the following goals for management were emphasized (in bold). A summary of findings based on analysis in this report are listed under each goal.

Move toward a balanced age-class distribution for even-aged cover types, particularly aspen and oak
- Management efforts are moving aspen and oak toward balanced age class distributions, but achieving this goal will take decades

Maintain adequate acres of young forest
- Young forest has increased slightly in the direction of plan goals

Identify and maintain old forest, including designating old growth forest
- The amount of old forest on the landscape is trending toward plan goals, except for low-site index red oak, which has an overabundance of acres over normal rotation age that will take decades to correct
- Old growth forest designation is complete, and polygon mapping is nearly complete
- Release of old growth candidate acres during the first half of the plan increased acres available for management, especially in northern and lowland hardwood cover types

Slightly increase timber productivity
- For three of five years, timber productivity (volume offered and sold) was slightly higher than before the plan

Increase and decrease specific cover types across the landscape, including increasing oak
- In line with plan goals, aspen has decreased and oak increased across the subsection. Increasing oak was one of the most common management objectives entered by foresters, indicating the intent to carry out this plan objective

Convert or restore specific Native Plant Communities (NPCs) and maintain wildlife habitat
- Additional Native Plant Community (NPC) and NPC condition data are available to inform management since plan implementation
- The state Endangered, Threatened, and Special Concern and Species of Greatest Conservation Need lists, which inform coordination and guide management activities, were updated since plan implementation, resulting in more listed species

Based on results of analysis in this report, the monitoring team made recommendations for continuing to successfully address the goals of the HH SFRMP during the second half of the plan:

- Because of good sell rates over the last four years in the subsection, look to offer a variety of species, including those considered less marketable, and a variety of sale designs.

- Staff are doing well at entering objective codes and the number entered could increase to capture additional valuable information. Entering as many objective codes as is appropriate is encouraged.
- Need better, more specific definitions for deferral codes and consistently use them to facilitate meaningful reporting and improvement.
- Reiterate definitions and importance of appraised, altered, and deferred acres to help support tracking efforts.
- Emphasize plan goals to increase average forest patch size by managing whole stands and grouping harvest treatments in this heavily fragmented landscape.
- Emphasize the importance of consistent, accurate data entry. Further, database system updates should be done in a way that facilitates long-term trend analysis, and added FIM fields for analysis and planning should be derived and named consistently over time.
- Apply appropriate silvicultural techniques to more effectively meet plan goals for oak age class distribution and contribution of oak to old forest on the landscape. Challenges include less stump sprouting success in larger diameter oak and deer browse.
- In future planning, consolidate oak cover type into fewer categories and do not split out by SI, especially for such small acre amounts.
- The northern hardwoods age class distribution is trending older, while the goal was to maintain the age class distribution. Current standard management practices may not achieve this goal; regeneration harvests should be considered. Encourage trying innovative techniques and adding results to the Great Lakes Silviculture Library.
- Open/brushland has increased across the landscape more than plan goals. While the reason is unclear, we recommend focusing on maintaining forest land in appropriate NPCs going forward.
- When prescribing management, be aware of issues around maintaining or enhancing rare and high quality NPCs and HCVFs.
- Apply management recommendations for state and federally listed species in cooperation with DNR partners.
- Continue to map NPCs on DNR lands to facilitate more detailed understanding and analysis of landscape patterns, including growth stage.
- Continue to monitor and treat invasives as funds are available.
- Goals for increasing or maintaining old forest in riparian areas rely on tools that have been rescinded (e.g. ERF, EILC), as well as OFMCs. Therefore, staff should look for innovative opportunities to accomplish this goal.
- Through this monitoring process we became aware the fish SGCNs list significantly changed, and current information resides in disparate databases. We encourage compiling these data into one database to facilitate planning and management going forward.

Introduction

The Hardwood Hills SFRMP recommends vegetation management for the state fiscal years 2013-2022 ([final plan documents are available on the Hardwood Hills SFRMP website](#)). Assembling available monitoring information through FY2017 provides an approximate mid-point review of plan implementation.

The Monitoring Process

Following internal guidance developed for monitoring SFRMP implementation and effectiveness, the Hardwood Hills (HH) SFRMP Core Team convened in 2018. The team reviewed and compared accomplishment data with the goals identified in the HH SFRMP. A variety of policies have changed over the course of this monitoring cycle, which affect plan implementation. The extended plan will include this document as an appendix.

Team members who contributed to this monitoring report include:

> **Division of Forestry**
> Walker Wearne, Team Leader, Timber & Development Program Forester, Camp Ripley
> Kyle Anderson, Timber Program Forester, Park Rapids
> Scott Burns, Northwest Regional Timber Specialist
> **Ecological and Water Resources**
> Becky Marty, Northwest Regional Ecologist
> **Fish and Wildlife**
> Mike North, Region 1 and 3 Forest Wildlife Coordinator

Information Sources, Data, and Data Analysis

The monitoring team used a variety of data sources (see list below) to assess trends and summarize data since plan implementation. These observations led to the recommended actions listed in this report. Detailed data used to develop these recommendations are available to the forestry and wildlife areas upon request.

Information Sources:

- Final HH SFRMP
- Forest Inventory Module (FIM) implementation data from HH SFRMP development
- FIM data from 2017
- Timber Sales Report System – reports of timber volumes sold FY13-FY17
- Silviculture and Roads Module (SRM) and Stand Exam Layer (SEL) data including planned and actual actions, site visits, and management objectives for FY13–FY17.

A Note Regarding Data Limitations

This monitoring effort used the best-available data sources to assess SFRMP implementation and effectiveness. However, due to inherent limitations in these datasets and the short timeframe of the monitoring period, analysis results may not always reflect effects of management work completed on the ground. Results of these analyses should be interpreted with an understanding that it will take decades to assess effectiveness of plan implementation for some goals. Further, landscape changes reported from FIM comparisons may be influenced by factors outside of plan implementation, such as small changes in stands considered in or out of the SFRMP boundary, changes to land administration, and changes resulting from inventory updates.

Implementation Monitoring – Management Actions

> **Key Points**
>
> - In most years, volume offered was close to plan estimates and sell rates were high.
> - Appraisal rates are low relative to state average.
> - Nearly half of total planned acres on the 10-year stand exam list have been visited.
> - Recorded management objectives indicate that foresters are applying plan goals to management decisions, including conversion, silvicultural, habitat, and ecological goals.

Monitoring Question

Are management actions on DNR forest lands in the Hardwood Hills subsection carried out in a manner consistent with the plan?

- Do metrics such as treatment levels, appraisal rates, management prescriptions, and management objectives reflect goals in the plan?

We compared implementation data, Timber Sales Module (TSM), Silviculture and Roads Module (SRM), and Stand Exam Layer (SEL) data to help answer these questions.

Results

Treatment Level: Volume Offered and Sold

The average estimated treatment level over the 10-year Hardwood Hills SFRMP was approximately 4,475 cords per year, compared to an estimated 3,959 cords per year during the decade preceding the planning period.

- Volume offered was 86% of estimated cords (19,328 cords compared to 22,375 estimated).
- Of cords offered, 17,154 were sold (89%, average of 3,431 cords per year) (Figure 1).
- For three of the last five years, volume offered and sold exceeded 4,000 cords, and for two of those years exceeded the estimated level in the SFRMP. Fewer cords were offered and sold in FY13 and FY17 (1,900 and 2,923 cords respectively).
- Fewer cords of aspen and oak, and to a lesser extent pine species, were offered than estimated in the plan (Appendix I).
- There may be several reasons for the variation in volume offered and sold between FY13-17:
    - In spring of 2012, an explosion at Verso Paper Corp. in Sartell may have impacted market demand, potentially contributing indirectly to the relatively low percentage of offered cords that were sold in 2013.

- o Smaller, more dispersed stands in this subsection may cause marketability to fluctuate over time.
- o Data from 2013 may represent a lag in when the plan came out and when stands were visited.
- o Cords offered and sold for 2014 are high relative to the number of appraised acres for this year (see Table 1). Appraisal data, particularly for 2013 and 2014, may not be complete due to migration to the new SEL database between 2013 and 2014. Further, changes to Forestry administrative areas during the same time period, including merger of Detroit Lakes with Park Rapids and closure of Alexandria's field station, may have affected data entry. Higher volumes offered and sold during 2014 and 2015 may also reflect reoffers from FY12 and FY13; however, this is difficult to assess because data were not entered consistently for reoffers in the Timber Sales Module system prior to 2014.

Figure 1. Volume in cord-equivalents offered and sold by fiscal year, with percent of offered volume sold over bars. Data contributing to total volume offered does not exclude reoffers.
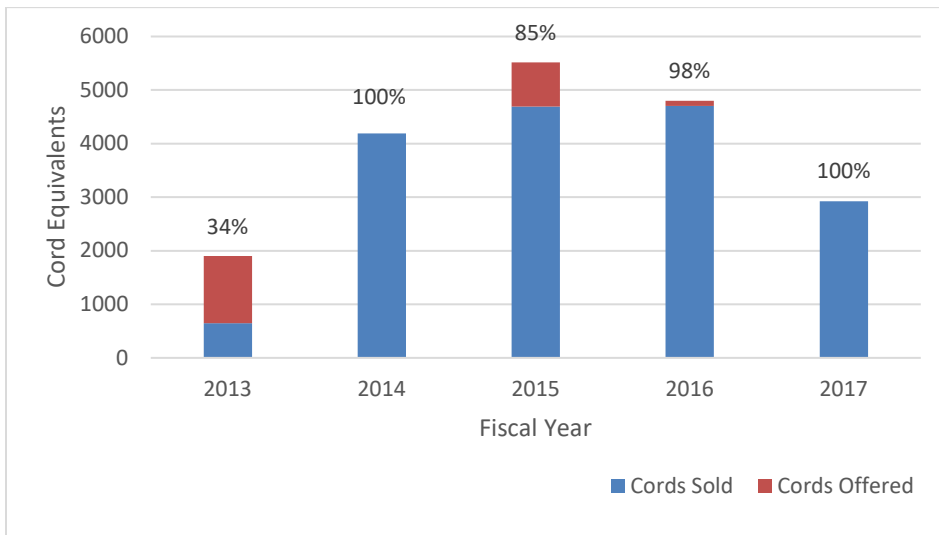
Appraisal

Overall, 80% of planned acres were visited during the monitoring period. This accounts for nearly half (48%) of the total acres on the original 10-year stand exam list (4,290 acres).

- For most years, 100% or nearly 100% of planned acres were visited. However, in 2013, and to a lesser extent in 2014, fewer acres were visited than planned, especially for aspen and oak cover types (Table 1).
- Data for 2013-2014 may be inaccurate due to changes in data entry systems.

- The timing of two areas' early fall auctions may have also contributed to low number of acres visited due to delayed stand selection for the first two years of the plan.

A similar proportion of visited acres were appraised, altered, and deferred. Appraisal rates were lower than the average across all SFRMPs in SEL for 2014-2017 (33% vs. 61% average). However, appraisal rates varied by cover type and year (Table 1):

- Appraisal rates were lowest in 2014 and 2016, and highest in 2013 and 2017
    - Deferral rate highest in 2016 in all cover types, especially northern hardwoods (NH) in Park Rapids
    - Altered rate highest in 2014, due to alteration of all planned NH acres in Bemidji (Appendix II)
    - In 2014, planned reinventory of 18 acres of Agriculture and 43 acres of Marsh cover type were deferred and altered respectively, contributing to the lower appraisal rate
- Appraisal rates varied by cover type:
    - Aspen: most years around 50%, 0% in 2014 and 73% in 2013
    - NH: ranged from 6-23%, except in 2017 (70%)
    - Oak: varied depending on year from 7-75%, except 2013 (0%)
- From FY2014-2017, 610 acres were deferred and deferral reasons were entered for 531 acres (87%) (Table 2).
    - Stands were most often deferred due to silvicultural reasons (54%), followed by habitat (28%) and ecological reasons (18%).
    - Oak and NH had the most acres deferred, with most NH acres (120 acres) deferred due to habitat reasons on one large stand and all oak acres deferred due to silvicultural reasons.

The sum of Annual Plan Addition (APA) acres from FY2014-FY2017 was 22% of deferred acres during that time period (Table 3). Annual Plan Addition acres from FY2014-FY2017 were approximately 6% of planned ASEL acres.

Table 1. Planned compared to visited acres that were appraised, altered, or deferred by year and cover type, not including Annual Plan Additions.

Fiscal Year	Cover Type	Planned ASEL Acres	Stand Exam Acres Completed						Visited Acres	% of planned
			Appraised		Altered		Deferred			
2013	Aspen	163	48	73%	18	27%	0	0%	66	40%
	Northern Hardwoods	110	18	23%	0	0%	62	78%	80	73%
	Oak	257	0	0%	0	0%	4	100%	4	2%
	Norway pine	27	27	100%	0	0%	0	0%	27	100%
	Jack Pine	15	7	100%	0	0%	0	0%	7	47%
	Balsam fir	28	0	0%	0	0%	19	100%	19	68%
2014	Aspen	94	0	0%	51	72%	20	28%	71	76%
	Northern hardwoods	257	37	14%	221	86%	0	0%	258	100%
	Oak	92	28	47%	12	20%	20	33%	60	65%
2015	Aspen	127	65	51%	20	16%	42	33%	127	100%
	Northern hardwoods	337	32	9%	245	72%	61	18%	338	100%
	Oak	182	137	75%	45	25%	0	0%	182	100%
2016	Aspen	190	81	49%	23	14%	61	37%	165	87%
	Northern hardwoods	139	8	6%	12	9%	120	86%	140	101%
	Oak	220	47	21%	32	15%	141	64%	220	100%
2017	Aspen	103	52	55%	30	32%	12	13%	94	91%
	Northern hardwoods	113	92	81%	22	19%	0	0%	114	101%
	Oak	94	7	7%	43	44%	48	49%	98	104%
Totals		**2548**	**686**	**33%**	**774**	**37%**	**610**	**29%**	**2070**	**81%**

Table 2. Deferral reason by cover type (data not available in SEL for 2013 deferral records, which included 62 acres of northern hardwoods and 19 acres of balsam fir in the Bemidji Area).

Fiscal Year	Cover Type	Number Stands	Total Acres	Deferral Reason					
				Silviculture		Ecology		Habitat	
2014	Aspen	7	20	20	100%	0	-	0	-
	Oak	4	20	20	100%	0	-	0	-
2015	Aspen	3	42	0	-	42	100%	0	-
	Northern Hardwoods	8	61	17	28%	44	73%	0	-
2016	Aspen	12	61	33	54%	9	15%	19	31%
	Northern Hardwoods	1	120	0	-	0	-	120	100%
	Oak	2	141	141	100%	0	-	0	-
2017	Aspen	7	12	0	-	0	-	12	100%
	Oak	6	48	48	100%	0	-	0	-
	White Pine	-	8	8	100%	0	-	0	-
	Total:		**531**	**286**	**54%**	**95**	**18%**	**150**	**28%**

Table 3. Annual Plan Addition acres by year, area, and cover type (2013 data are not available in SEL).

Fiscal Year	Area	Cover Type	Acres
2014	-	-	-
2015	Park Rapids	Northern Hardwoods	5
2016	Park Rapids	Norway Pine	9
		Oak	31
		Oak	14
		White Pine	10
2017	Bemidji	Aspen	30
	Park Rapids	White Pine	12
	Little Falls	White Pine	8
		Total:	**119**

Planned vs. Final Prescriptions

Final prescriptions were generally similar to preliminary prescriptions, and adjustments are within expectations (Appendix III). Examples in which the final prescription did not match the preliminary prescription over relatively many acres include:

- One large 162-acre stand in Park Rapids (Detroit Lakes Wildlife Area) was altered with a final prescription of Group Selection-w/Reserve, with uneven-age gap management prescribed for biodiversity and wildlife habitat.

- Across 14 stands, 304 acres of northern hardwoods planned for uneven-aged management were altered. Future stand conditions were either not entered (7 stands) or said something to the effect of "self-sustaining stand/protect NPC/healthy stand." Prescription reasons were similar, but sometimes gave additional information including that stands were small, were part of a High Conservation Value Forest (HCVF), or had minimal merchantable aspen.
- One large 137-acre stand of high SI red oak was changed from shelterwood to commercial thinning to achieve an uneven-age stand with higher quality trees by removing lower quality trees through thinning every 10-20 years.
- Across 14 stands, 84 acres of aspen were deferred for a variety of reasons including stand actually northern hardwoods or otherwise mistyped, or the stand was inaccessible

Management Objectives

- 41% of appraised stands with management objectives entered had more than one objective (Table 4)
- An objective addressing ecological or species issues was entered for ~16% of appraised acres with objectives and 24% of altered acres.
- Some objectives, including those aimed at maintaining or changing stand structure and composition, address multiple goals across ecological, wildlife, or silvicultural issues.
- Recorded management objectives are one of the only ways to assess work toward conversion goals at this stage of plan progress (see Appendix IV for objectives by cover type).
  - o **Aspen:** goal to reduce aspen by 196 acres over first 10 years of plan. Increase (red oak – 57 acres) or conversion (NH – 3 acres) were recorded as objectives for appraised aspen stands, which may contribute to conversion goal.
  - o **Oak:** the plan 10 and 50-year DFFCs were to increase red and bur oak. The most common objectives recorded for appraised oak stands were increase northern red oak, bur oak, American elm (in combination with red and bur oak), and maintain similar stand. Similarly the top three objectives for altered oak were maintain similar stand, increase northern red oak, and increase white oak.
  - o **NH:** The plan goal was to reduce NH by ~22 acres in the first 10 years of the plan and 144 acres as a 50-year DFFC. Most NH acres with objectives entered were altered, with objectives aimed at maintaining a similar stand or existing NPC composition and structure. For appraised acres, increasing aspen and oak were listed as objectives for 50 and 20 acres respectively.
  - o Working to expedite conversion of an 11 acre Scotch pine stand through an APA to address 50-year DFFC for this cover type and to buffer an old growth northern hardwood stand.

- Objectives across forestry areas:
  - 111: Objectives were entered for more acres that were altered than appraised, and the most common objectives were maintain similar stand and maintain existing NPC composition and structure.
  - 161: For appraised acres, the most common objectives were to increase aspen, northern red and bur oak, and American elm (in combination with oak species). The only objective entered for altered acres was to maintain a similar stand.
  - 312: Most common objectives for appraised acres were to change stand structure to multi-aged and increase aspen, northern red oak or bur oak. For altered acres, the most common objectives were to increase northern red oak or white oak, or maintain a similar stand.

Table 4. Stands and acres with one or more objectives assigned.

Preliminary			Appraised			Altered		
# Objectives	Stands	Acres	# Objectives	Stands	Acres	# Objectives	Stands	Acres
1	36	1522	1	35	436	1	47	673
2	8	159	2	14	208	2	1	1
-	-	-	3	6	57	3	1	45
4	1	26	4	4	108	-	-	-
5	1	5	-	-	-	-	-	-
Total:	**46**	**1712**	**Total:**	**59**	**809**	**Total:**	**49**	**719**

Recommended Actions

- Because of good sell rates over the last four years in the subsection, look to offer a variety of species, including those considered less marketable, and a variety of sale designs
- Staff are doing well at entering objective codes and the number entered could increase to capture additional valuable information. Entering as many objective codes as is appropriate is encouraged.
- Need better, more specific definitions for deferral codes and consistently use them to facilitate meaningful reporting and improvement.
- Reiterate definitions and importance of appraised, altered, and deferred acres to help support tracking efforts.
- Emphasize plan goals to increase average forest patch size by managing whole stands and grouping harvest treatments in this heavily fragmented landscape.
- Emphasize the importance of consistent, accurate data entry. Further, database system updates should be done in a way that facilitates long-term trend analysis, and added FIM fields for analysis and planning should be derived and named consistently over time.

Key Points

- Changes in cover type, young forest, and old forest align well with, or are generally moving in the direction of plan goals.
- Age class distributions for aspen and oak are moving toward plan goals, although not as quickly as planned.
- Old growth forest designations in progress during plan development are complete and map accuracy is being finalized.
- Number of rare species in the subsection has increased due to revisions of the statewide Endangered, Threatened, and Special Concern species and Species of Greatest Conservation Need lists since plan implementation.
- Native Plant Community has been classified on additional acres since plan implementation, and condition rank has been assigned to more NPC acres, increasing information available to inform management.

Monitoring Question

Are management actions on DNR forest lands in the Hardwood Hills subsection having the desired on-the-ground effect?

- Does the landscape composition of cover types, and age-class distributions within cover types, reflect a trend toward long-term goals?

We compared Forest Inventory Module (FIM) data from the implementation dataset used to develop the HH SFRMP and FIM data from 2017 to help answer these questions.

Results

Change in managed acres

During the first five years of the plan, DNR acres available for management increased (Table 5), primarily due to changes in the old growth designations in the subsection (see Old Growth section below and Table 9). Secondarily, changes are due to land acquisition, cover type changes, and subsection boundary adjustments.

Table 5. Change in managed acres by land administrator from 2011-2017 FIM data.

Managed Acres	2011			2017			Change
	Forestry	Wildlife	Total	Forestry	Wildlife	Total	
All	13,290 (31%)	30,220 (69%)	43,510	13,954 (31%)	31,620 (69%)	45,574	+5%
Forested	7,949 (48%)	8,522 (52%)	16,471	8,416 (49%)	8,910 (51%)	17,326	+5%

Change in young forest

This plan defines young forest as Aspen/Balm of Gilead cover types 0-30 years old. The 10-year DFFC for young forest in the Hardwood Hills Subsection is to increase the proportion of young aspen from 54% of the cover type to 60% (50-year DFFC: increase to 61%; Table 6).

During the first five years of the plan, the proportion of aspen considered young forest increased slightly, in line with plan DFFCs (Table 6, Fig 2).

Table 6. Percent of Aspen/Balm of Gilead managed acres that are young forest.

Cover Type	FIM 2011	FIM Data 2017	10-year DFFC	50-year DFFC	Trend	Trend matches goal?
Aspen/Balm of Gilead	54%	55%	60%	61%	↑	Y

Change in old forest

The Hardwood Hills SFRMP defines old forest as even-age managed stands that are over normal rotation age for their cover type. During the planning process, most even-aged cover types had an overabundance of old forest due to age class imbalances. These imbalances will take decades to correct, in some cases longer than the 50-year plan horizon; however, the SFRMP identifies goals for percent of cover type considered old forest for each of the next five decades.

During the first half of the planning period, the proportion of old forest in aspen/balm of Gilead and bur oak cover types decreased, in line with plan goals. Old forest increased for red oak overall, which was in line with goals for high SI red oak, but was not consistent with the goal for low SI red oak (Tables 7 and 8). When the plan was developed, red oak had many acres in the 71-80 year old age class, which likely contributed to the spike in red oak acres over normal rotation age. It will take a long time to distribute those acres to balance the oak age class distribution.

The major driver of this increase in old, low SI red oak is unknown. It does not appear to be due to acquisitions (there were no oak stands exclusively in the 2017 dataset), or changes in old growth designation since the acreages for old growth oak are similar between 2011 and 2017.

Re-inventory could change site index, influencing the shift in red oak acres. In addition, forest management issues, such as buckthorn competition, may be influencing active management for this cover type.

In addition, department policies and definitions surrounding old forest management have changed since plan implementation. Through this process, Extended Rotation Forest (ERF) and Ecologically Important Lowland Conifer (EILC) have been rescinded and Lowland Conifer Old Growth (LCOG) candidates have been selected, but are not yet designated.

Table 7. Percent of even-aged cover types over normal rotation age (NRA) compared to DFFCs over next five decades.

Cover Type	NRA	2011		2017		Change 2011-2017	% cover type over NRA DFFCs		Trend matches goal?
		Acres over NRA	% over NRA	Acres over NRA	% over NRA		10-year	50-year	
Aspen/Balm of Gilead	45	2022	38	1684	34	-5	19	17	Y
Red oak - SI 55+	80	391	21	807	51	30	64	40	Y
Red oak - SI <55	80	1163	73	1596	82	10	55	30	N
Bur oak	80	995	74	1171	73	-1	66	55	Y

Table 8. Cover type acres and percent of acres over normal rotation age (NRA) compared to DFFCs over next five decades by DNR land administrator.

Cover Type	NRA	2011		2017		% Change 2011-2017	% cover type over NRA DFFCs		Trend matches goal?
		Acres over NRA	% over NRA	Acres over NRA	% over NRA		10-year	50-year	
Wildlife									
Aspen/Balm of Gilead	45	1350	46	1163	43	-3	19	17	Y
Red oak - SI 55+	80	266	29	392	43	14	64	40	Y
Red oak - SI <55	80	621	77	617	80	3	55	30	N
Bur oak	80	672	71	751	70	-1	66	55	Y
Forestry									
Aspen/Balm of Gilead	45	672	28	521	23	-5	19	17	Y
Red oak - SI 55+	80	125	13	415	63	50	64	40	Y
Red oak - SI <55	80	541	68	979	84	16	55	30	N
Bur oak	80	323	82	420	79	-3	66	55	Y

Old Growth

During plan development, old growth forest designations in the subsection were not yet complete. Since, they have been finalized and polygon mapping is close to completion. The goals listed in Table 9 for old growth acres were rough estimates of likely old growth using the best data available at the time (e.g. remotely sensed data), but were not based on field-collected or verified data. These were not meant to be firm acre targets for old growth, and designated old growth in 2017 may be greater or less than the 1994 goal based on evaluation, including field data.

Since 2011, many acres of candidate old growth, especially NH and LH cover types, were released into the management pool, increasing pool acres in 2017 datasets.

Table 9. Comparison of old growth candidate and designated acres between 2011 FIM implementation dataset (based on acres deferred from management pool due to pending or designated old growth status) and 2017 FIM dataset (based on old growth status field) by cover type.

Cover Type	1994 Acres Goal	Acres 2011			Acres 2017		
		Candidate*	Designated	Total	Candidate	Designated	Total
BA/LH	135	36	221	257	11	-	11
NH	395	1151	680	1830	28	983	1011
Oak	160	348	62	410	361	34	395
Total	**690**	**1535**	**963**	**2497**	**400**	**1017**	**1417**

*Pending old growth in 2011

Change in managed acres by cover type

The HH plan called for increasing oak through conversion of hardwood stands, decreasing aspen (including some conversion to northern hardwoods), and a slight decrease in northern hardwoods. During the first 5 years of the plan, oak has increased and aspen decreased as planned (Table 10).

Increase in northern hardwood pool acres is primarily due to changes in old growth designation over the planning period rather than management (see Old Growth section above). Without release of candidate old growth acres since 2011, northern and lowland hardwood cover types would have decreased slightly across the landscape. Some change between these cover types also reflects results of field assessments.

Table 10. Change in total managed acres by cover type compared to plan goals. Note that cover type change may reflect succession, inventory, changes in stand boundaries, and changes in land administration in addition to effects of management. Note that percent change is large for some cover types within the subsection that have very small acreages.

Cover Type	FIM 2011	FIM 2017		10-year DFFCs		50-year DFFCs			Trend matches goal?
	2011 Acres	2017 Acres	% Change 2011-2017	Acres	% Change from 2011	Acres	% Change from 2011	Long-term Goal	
Aspen/Balm of Gilead	5277	4979	-6	5078	-4	4964	-6	↓	Y
Ash/Lowland Hardwoods	457	476	4	457	0	438	-4	↓	Y*
Northern Hardwoods	4529	5250	16	4507	-1	4385	-3	↓	Y*
Oak	4994	5423	9	4936	-1	5207	4	↑	Y
Tamarack	739	778	5	739	0	739	0	–	Y
Birch	12	38	209	12	0	12	0	–	NA[†]
Black Spruce - Upland and Lowland	21	13	-37	21	0	21	0	–	NA[†]
White Pine	38	38	0	38	0	38	0	–	NA[†]
Red Pine	153	167	9	153	0	153	0	–	NA[†]
Jack Pine	52	48	-7	52	0	40	-23	↓	NA[†]
White Spruce	131	135	3	131	0	131	0	–	NA[†]
Balsam Fir	57	55	-2	57	0	57	0	–	NA[†]

*Note: Management planned and executed on available NH acres met management goals. Increase in acres available for management for northern and lowland hardwood cover types is due to an influx of acres from release of candidate old growth acres when they were added back into the management pool since 2011.

[†] NA = not applicable. Acreages for non-modeled cover types in the plan are too small to adequately assess management goals.

Change in age class distributions

The Hardwood Hills SFRMP includes long-term goals to move the aspen/balm of Gilead and combined oak cover types toward balanced age class distributions, and to maintain the age class distribution in northern hardwoods.

- The aspen cover type is moving toward balanced age class distribution, but perhaps not as quickly as plan goal (Figure 2). In particular the 71-80 year age class has many acres, most of which are not under development.
- For oak, an increase in the 1-10 age class is consistent with plan goals to move toward a balanced age class distribution (Figure 3).
- The combined oak cover type had a relatively large decrease of acres in the 71-80 age class, with a large increase of acres in the 111-120 age class. This may be due to inventory updates. It is not likely due to changes in old growth designation, since the number of acres of candidate and designated old growth for oak are very similar between 2011 and 2017. This is also likely not due to acquisitions, since there were no oak stands exclusively in the 2017 dataset.
- Large increases in acres of northern hardwoods in the 81-90 and 101-110 age classes (Figure 4) may be partially explained by changes in old growth status between 2011 and 2017 (see Old Growth section). In addition, approximately 300 acres classified as aspen in 2011 were classified as northern hardwoods in 2017.

Figure 2. a) Aspen/balm of gilead age class distributions by acres from 2011 and 2017 FIM data, including acres under development across administration status, **b)** administered by Forestry, **c)** administered by Wildlife.

a.
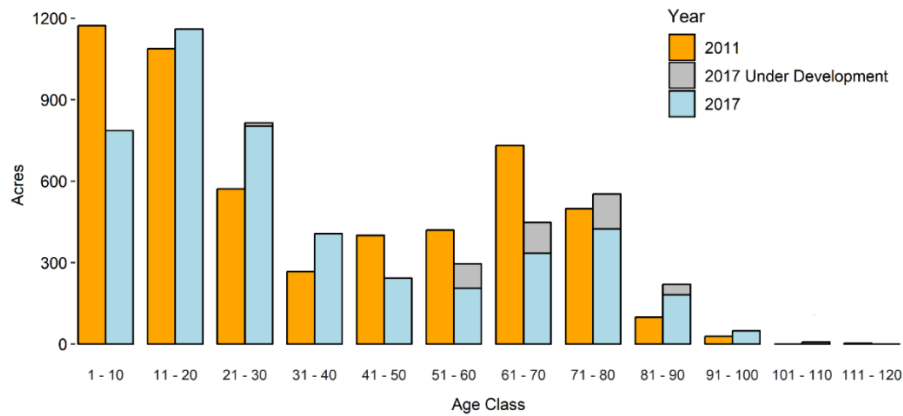
b.
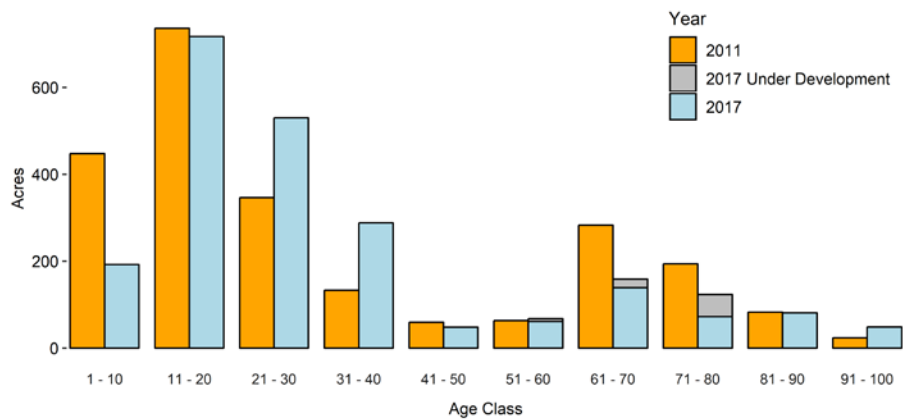
c.
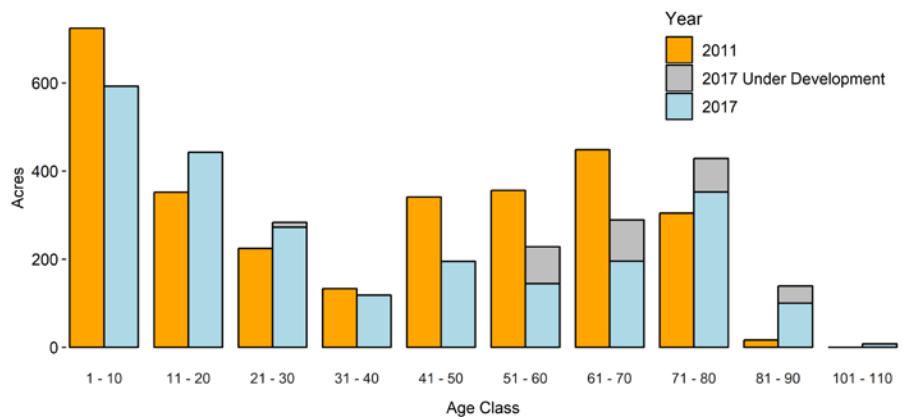
Figure 3. Combined oak age class distributions by acres from 2011 and 2017 FIM data.
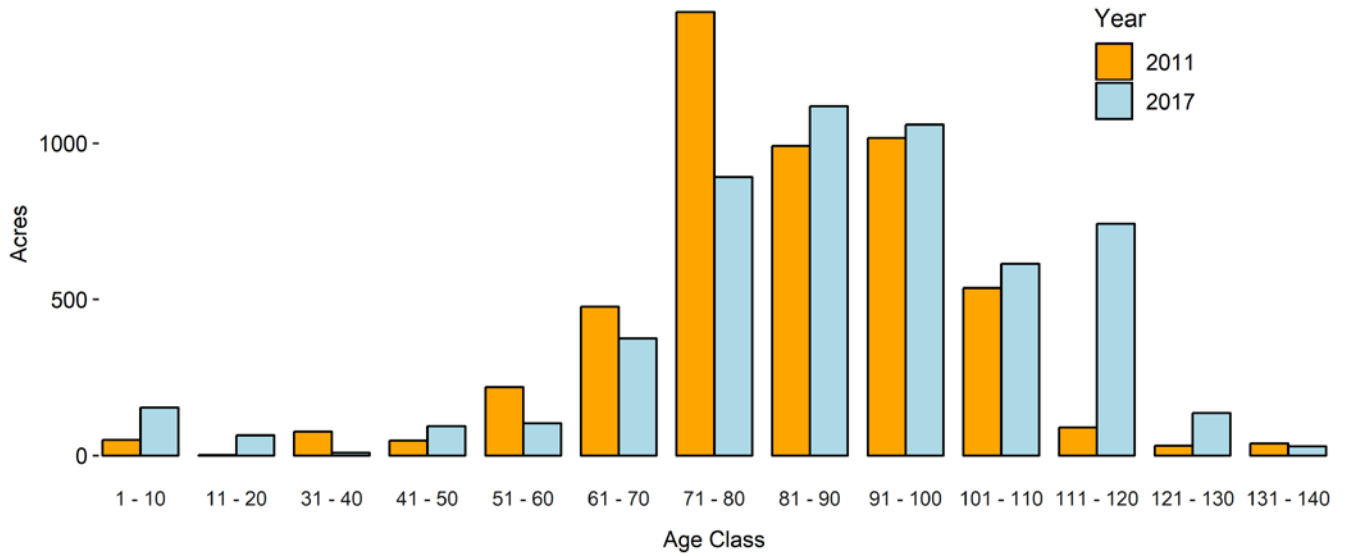
Figure 4. Northern hardwoods age class distributions by acres from 2011 and 2017 FIM data.
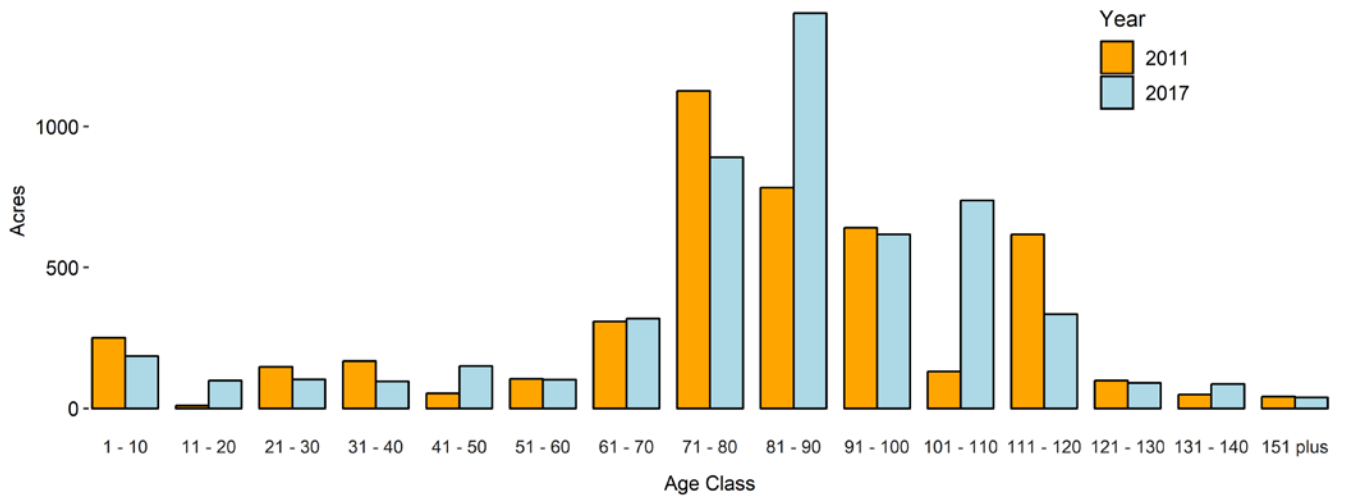
Open/Brushland

Eleven of 22 Land Type Associations (LTAs) in the Hardwoods Hills Subsection have a LTA Priority Open Landscape Area designation, mostly classified as Brushlands. In addition, four Special Management Areas (SMAs) have been identified including a Wild Turkey area, a Ruffed Grouse-Woodcock area, and two smaller Brushland Priority Open Landscape Areas.

The plan called for small (< 1%) increases in grassland and brushland in Hardwood Hills, which was met and exceeded during the first half of the planning period (Table 10). It is unclear whether this increase is due to acquisitions, although the 2017 dataset did not have more acres of non-forest cover types that were exclusive to that dataset compared to 2011. Another possible explanation for the increase is inventory updates. For example, over 200 acres classified as aspen cover type in 2011 were classified as non-forest in 2017.

Table 10. Change in open and brushland in Hardwood Hills compared to SFRMP goals.

| Cover Type | FIM 2011 | FIM Data 2017 | | 10-year DFFCs | | 50-year DFFCs | | | |
	2011 Acres	2017 Acres	% Change 2011-2017	Acres	% Change from 2011	Acres	% Change from 2011	Long-term Goal	Current Trend in Direction of Goal
Brushland and Openland	11305	12165	8	11305	0	11386	1	↑	Y

Native Plant Communities and Sites of Biodiversity Significance

The HH SFRMP lists classifying native plant communities (NPC) as a strategy for General Direction Statement (GDS) 1A. Since this plan was approved, these classifications now go through a rigorous certification process by experts from all three divisions. As of 2011, 16,760 acres in the Hardwood Hills subsection had a certified NPC classification, and 1,860 acres have been certified since. An additional 5,212 acres are classified by NPC, but not yet certified, 3,620 of which were classified after 2011.

Some NPCs in the Hardwood Hills have Status Ranks that indicate they are imperiled (S1 or S2, Table 11; For more information on NPC Status Ranks, see _Conservation Status Ranks for Native Plant Community Types and Subtypes_). Strategies for GDS-3G in the Hardwood Hills SFRMP recommend managing these communities to maintain their ecological integrity by protecting, maintaining or enhancing them.

In addition to status ranks, we have more information on NPC quality (Condition Rank) today than we did when the plan was developed. NPCs of the highest quality condition (ranks C and above) are rare in the Hardwood Hills and make up 14% of identified forested NPCs with condition ranks (Table 12).

Table 11. DNR NPC acres classified through 2011 and since 2011 with Status Ranks. Rare or potentially rare NPCs are in bold. A range in rank (e.g. _S1S2_) indicates the status falls within the given range, but is uncertain. Multiple status ranks are given (e.g. _S1 or S2_) for NPC classes that have subtypes with different status ranks.

Forested NPC	Status Rank	Acres Identified Through 2011	Acres Identified After 2011	Non-forested NPC	Status Rank	Acres Identified Through 2011	Acres Identified After 2011
AFP_CX		4	0	APn91a	S5	8	0
FDc24	**S1 or S3**	**130**	**0**	BW_CX		36	0
FDc34	**S2 or S3**	**233**	**6**	**LKi32b**	**S2**	**2**	**0**
FDc34b	S3	92	0	MHs38c	S3	0	0
FDs36	S3S4	275	22	MMS_CX		680	0
FDs36a	S3S4	1000	0	MOW_CX		14	0
FDs37a	S4	11	0	**MRn83**	**S2**	**528**	**131**
FDs37b	S3	1468	0	**MRn83a**	**S2**	**16**	**0**
FDw44	*S3 or S4	4	0	**MRn83b**	**S2**	**104**	**0**
FF		28	0	MRn93a	S3	15	0
FPn73	S5	41	4	**MRn93b**	**S2**	**2**	**0**
FPn73a	S5	228	0	**MRp83a**	**S1**	**70**	**0**
FPn82	S4	0	8	OPn81	S5	3	710
FPn82b	S4	27	0	OPn81a	S5	111	0
FPs63	**S2S3**	**0**	**9**	**OPn91**	**S2, S3 or S4**	**28**	**0**

Table 11 continued.

Forested NPC	Status Rank	Acres Identified Through 2011	Acres Identified After 2011	Non-forested NPC	Status Rank	Acres Identified Through 2011	Acres Identified After 2011
FPs63a	**S2S3**	**618**	**0**	OPn92	S4	28	34
FW_CX		551	0	OPn92a	S4	57	0
MHc26	S4	449	231	OPn92b	S4	26	0
MHc36	S4	174	0	**OPp91c**	**S1**	**115**	**0**
MHc36a	S4	497	0	PWL_CX		95	0
MHc36b	S4	97	0	SS_CX		3	0
MHc37	S4	1712	262	**UPn12b**	**S2**	**23**	**0**
MHc37a	S4	328	0	**UPn23a**	**S2**	**59**	**0**
MHc37b	S4	2387	30	**UPn23b**	**S2**	**435**	**0**
MHc47a	S3	33	0	**UPs14a**	**S1 or S1S2**	**0**	**0**
MHF_CX		80	0	**UPs14b**	**S1S2**	**0**	**0**
MHn35	S4	647	166	**UPs23a**	**S2**	**0**	**2**
MHn35a	S4	375	0	WMn82	S4 or S5	93	188
MHn35b	S4	64	0	WMn82a	S5	788	9
MHn44	**S2, S3 or S4**	**57**	**0**	WMn82b	S4 or S5	1370	0
MHn44d	S3	32	0	WMn82b1	S5	113	0
MHn46	S4	16	10	WMn82b4	S5	1	0
MHn47	S3	18	0	**WMs83a**	**S2 or S3**	**87**	**0**
MHs38b	S3	0	9				
WFn55	S3 or S4	9	29				
WFn55b	S3	5	0				
WFn64	S4	5	0				
WFn64c	S4	20	0				
WFn74	S3	2	0				
WFs55a	S4	72	0				
WFs57a	**S1S2**	**61**	**0**				

Table 12. Managed acres with condition ranks assigned. Rare or potentially rare communities (Status Ranks S1-S2, or S1S2) are in bold.

Forested NPC		Condition Rank						
	Status Rank	AB	B	BC	C	CD	D	NR
APn91a	S5	3			2			2
FDc24	**S1 or S3**			**37**	**19**			
FDs36a	S3S4							17
FDs37a	S4		1					
FDs37b	S3			1077	160	33		10
FPn73a			0	25				1
FPn82b	S4				27			
FPs63a	**S2S3**		**13**	**20**	**5**			**39**
MHc26	S4		125		30			
MHc36a	S4		14	345	0			54
MHc37	S4			80				
MHc37b	S4	265	28	279	404			
MHs38b	S3				9			
MHs38c	S3				0			
WFn55b	S3			2				3
WFn74	S3							2
WFs55a	S4				16			25
WFs57a	**S1S2**			**61**				
	Total	268	181	1928	672	33	0	153
	Percent	8	6	60	21	1	0	5
Non-Forested NPC	**Status Rank**	**AB**	**B**	**BC**	**C**	**CD**	**D**	**NR**
AFP_CX								4
BW_CX								27
LKi32b	**S2**		**2**					
MMS_CX					456		79	53
MOW_CX								14
MRn83a	**S2**							**1**
MRn93a	S3							15
MRn93b	**S2**							**2**
OPn81	S5			3				
OPn91	**S2, S3 or S4**	**25**			**2**			
OPn92	S4			20				4
OPn92a	S4			4	5			
OPn92b	S4		1		3			
OPp91c	**S1**	**115**						
SS_CX								3
UPn12b	**S2**				**23**			
UPn23b	**S2**			**382**	**50**			

Table 12 continued.

Non-Forested NPC	Status Rank	AB	B	BC	C	CD	D	NR
UPs13b	S2						0	
UPs14a	S1 or S1S2			0				
UPs14b	S1S2				0			
UPs23a	S2						2	
WMn82	S4 or S5			56				37
WMn82a	S5				28			55
WMn82b	S4 or S5	108		35	14			89
WMn82b1	S5	102						6
WMn82b4	S5		1					
WMs83a	S2 or S3			42				
	Total	350	3	543	581	0	81	309
	Percent	19	0	29	31	0	4	17

GDS-3J calls for representation of each NPC growth stage that historically occurred in the subsection, but does not set acreage goals for growth stages. Currently, estimated percent of Fire Dependent (FD) and Mesic Hardwood (MH) communities in various growth stages is roughly similar compared to presettlement conditions (Table 13). However, there is more forest in a young growth stage across systems, and less mature growth stage FD forest and transitional growth stage MH forest, than there was historically.

Table 13. Derived growth stages by forested ecological system with percent of landscape pre-European settlement and today in each stage.

	Growth Stage					
	Young		**Transition**		**Mature**	
Fire Dependent	**0-75**		**-**		**75+**	
	Presettlement*	**Today**	**Presettlement**	**Today**	**Presettlement**	**Today**
	79%	86%	-	-	21%	14%
Mesic Hardwood	**0-35**		**35-85**		**85+**	
	Presettlement*	**Today**	**Presettlement**	**Today**	**Presettlement**	**Today**
	7%	18%	55%	41%	38%	43%

*Note: Presettlement percentages represent the average across the most widespread NPCs in the subsection by system, according to the Native Plant Communities of MN field guide, as reported in DNR ECS Silvicultural Interpretations. In HH, the most widespread FD NPC is FDs38 and the most widespread MH NPCs are MHc36 and MHs38. Calculations based on modeled NPC data in MBG_FIM_1F dataset from 2017.

Candidate HCVFs were proposed for designation on FSC-certified State forestry and wildlife administered lands by Regional Interdisciplinary HCVF Teams in early 2013. Minnesota Biological Survey Sites of outstanding or high biodiversity were used as the basis for HCVF designation. There are 4 designated HCVF sites in the subsection (Table 14, Figure 5). In addition to high and outstanding sites of biodiversity significance, there are 68 'moderate' sites totaling 14,079 acres.

Table 14. Sites of outstanding and high biodiversity significance in the Hardwood Hills subsection, including HCVF designation.

Site Name	Site Number	Biodiversity Significance	HCVF Designation	Acres
Burleene WMA North	93	Outstanding		466
Oakland Woods	100	Outstanding	Designated HCVF HCVF on School Trust	3110
Big Birch Lake SW	125	High		447
Clearwater 26	10	High		189
Dorr WMA plus	66	High	Designated HCVF	146
Eagle Mountain - Hill Lake	32	High		78
Folden Woods	242	High		299
Hart Lake NW Woods	99	High		208
Higgins Long Lake	39	High		239
Lake George-Jessie Woods	75	High		1099
Lakeview 36	112	High	HCVF on School Trust	446
Long Prairie River- Long Prairie WMA	49	High		751
Maple Grove 31	26	High		41
Oak Ridge WMA	30	High		484
Rat Lakes	132	High		200
Spruce Creek	45	High	Designated HCVF	272
Vanose WMA	55	High		1428
Washington Lake Meadow N	117	High		214
Washington Lake Meadow S	116	High		132
Zager Lake - Grey Eagle WMA South	38	High		387

Figure 5. Outstanding and high biodiversity significance sites by site number (see Table 14) in the northern (left) and southern (right) Hardwood Hills subsection. Sites with an asterisk are also High Conservation Value Forests.
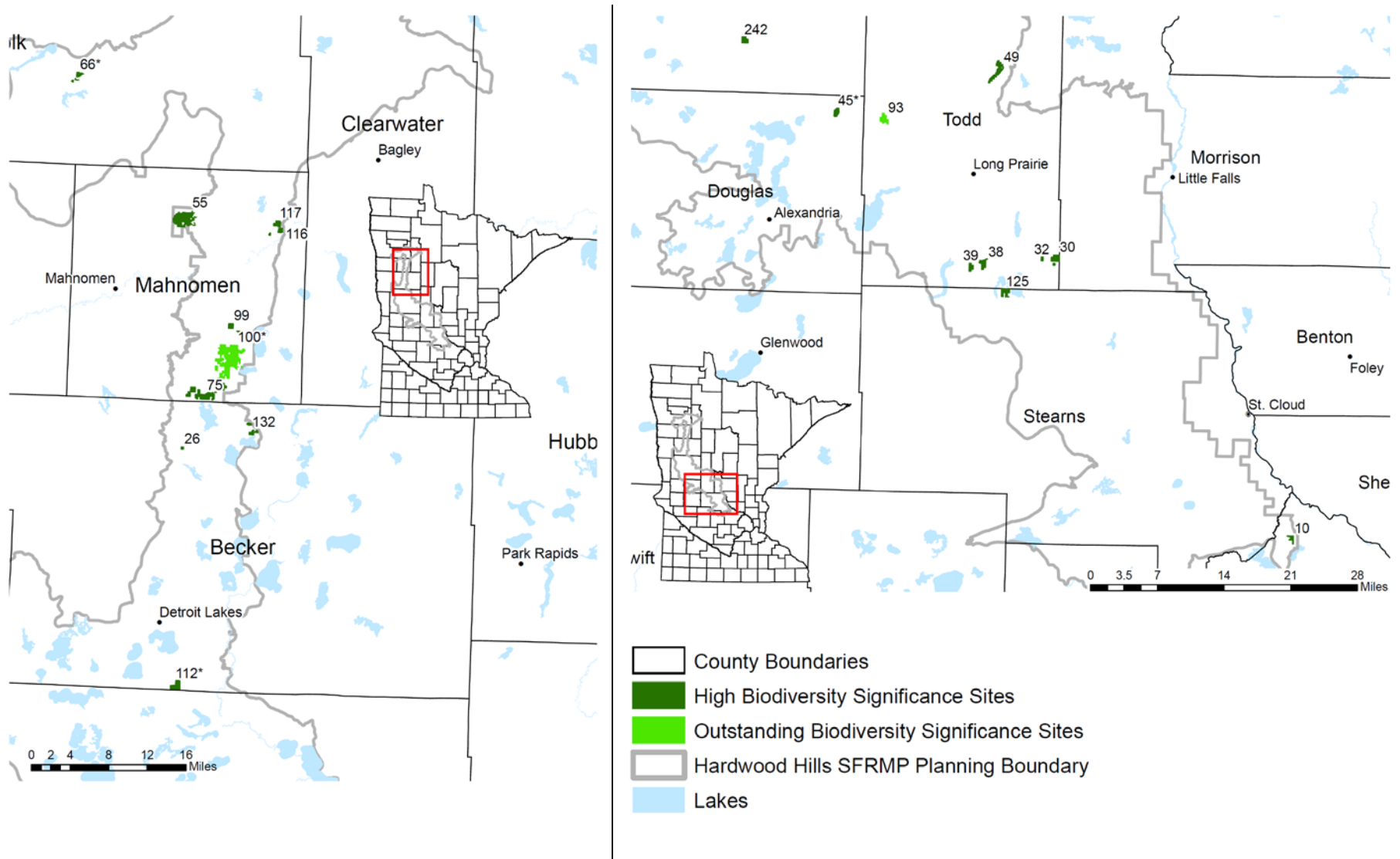
Rare Species

In 2013, the DNR officially updated the [state list of endangered, threatened, and special concern species](#) (ETS) for the first time since 1996. Minnesota's list of Species in Greatest Conservation Need (SGCN) was also updated in 2015 and is referenced in [Minnesota's 2015-2025 Wildlife Action Plan](#). Here we report updates and summaries for rare species data for the Hardwood Hills subsection.

Since 2011:

- 43 animals have been added to the state list of endangered, threatened, and special concern species, or were put on the watch list, while the conservation status of two species (trumpeter swan and bald eagle) was reduced. Seven of these species are associated with forested habitats.
- 13 animal species were added to the state list of Species in Greatest Conservation Need
- 3 animal species were added to the federal endangered species list including rusty-patched bumble bee, Poweshiek skipperling, and northern long-eared bat.
- 23 plants changed status, with 16 species added to the state ETS list and four increasing in conservation status. Six of these species are associated with forested habitats. One fungus changed state status from endangered to special concern.
- Five new records were added to the [Natural Heritage Information System](#) (NHIS), all for mudpuppy.

For further details and tables listing all species, see Appendix V.

Recommended Actions

- Apply appropriate silvicultural techniques to more effectively meet plan goals for oak age class distribution and contribution of oak to old forest on the landscape. Challenges include less stump sprouting success in larger diameter oak and deer browse.
- In future planning, consolidate oak cover type into fewer categories and do not split out by SI, especially for such small acre amounts.
- The northern hardwoods age class distribution is trending older, while the goal was to maintain the age class distribution. Current standard management practices may not achieve this goal; regeneration harvests should be considered. Encourage trying innovative techniques and adding results to the Great Lakes Silviculture Library.
- Open/brushland has increased across the landscape more than plan goals. While the reason is unclear, we recommend focusing on maintaining forest land in appropriate NPCs going forward.
- When prescribing management, be aware of issues around maintaining or enhancing rare and high quality NPCs and HCVFs.
- Apply management recommendations for state and federally listed species in cooperation with DNR partners.
- Continue to map NPCs on DNR lands to facilitate more detailed understanding and analysis of landscape patterns, including growth stage.
- Continue to monitor and treat invasives as funds are available.
- Goals for increasing or maintaining old forest in riparian areas rely on tools that have been rescinded (e.g. ERF, EILC), as well as OFMCs. Therefore, staff should look for innovative opportunities to accomplish this goal.
- Through this monitoring process we became aware the fish SGCNs list significantly changed, and current information resides in disparate databases. We encourage compiling these data into one database to facilitate planning and management going forward.

Appendix I.

Table I-1. Cord equivalents offered and sold during first five fiscal years of Hardwood Hills SFRMP by species.

Species	2013 Offered	Sold	2014 Offered	Sold	2015 Offered	Sold	2016 Offered	Sold	2017 Offered	Sold	Total Offered	Sold
American Elm	-	-	12	12	-	-	-	-	-	-	12	12
Ash	39	25	212	212	26	-	-	-	60	60	337	297
Green Ash	-	-	5	5	-	-	-	-	-	-	5	5
Aspen Species	473	-	833	833	310	310	550	470	300	300	2466	1913
Trembling Aspen	288	288	1066	1066	2214	1679	1665	1665	1515	1515	6748	6213
Lowland Hardwoods	-	-	40	40	-	-	-	-	-	-	40	40
Mixed Hardwoods	-	-	-	-	123	123	-	-	65	65	188	188
Northern Hardwoods	85	-	85	85	2344	2344	2157	2140	132	132	4803	4701
Maple Species	26	-	26	26	-	-	-	-	-	-	52	26
Red Maple	-	-	7	7	6	6	-	-	5	5	18	18
Sugar Maple	20	20	90	90	-	-	-	-	-	-	110	110
Basswood	320	123	601	601	110	-	-	-	265	265	1296	989
Paper Birch	101	75	140	140	136	66	-	-	5	5	382	286
Oak Species	-	-	115	115	110	110	-	-	485	485	710	710
Bur Oak	31	-	146	146	-	-	-	-	-	-	177	146
Red Oak	432	33	810	810	55	55	-	-	91	91	1388	989
Balsam Fir	85	85	-	-	85	-	-	-	-	-	170	85
Black Spruce	-	-	-	-	-	-	3	3	-	-	3	3
Pine Species	-	-	-	-	-	-	150	150	-	-	150	150
Spruce-Balsam	-	-	-	-	-	-	270	270	-	-	270	270
Tamarack	-	-	-	-	-	-	3	3	-	-	3	3
Totals	**1900**	**649**	**4188**	**4188**	**5519**	**4693**	**4798**	**4701**	**2923**	**2923**	**19328**	**17154**

Appendix II.

Table II-1. Planned compared to visited acres that were appraised, altered, or deferred by area.

Year	Forestry Area	Planned ASEL Acres	Appraised		Altered		Deferred		Total Visited	% of Planned
					Stand Exam Acres Completed					
2013	111 Bemidji	160	74	47%	4	3%	81	51%	159	100%
	161 Park Rapids	364	26	65%	14	35%	0	0%	40	11%
	312 Little Falls	45	0	0%	0	0%	4	100%	4	9%
	351 Cambridge	31	0	-	0	-	0	-	0	0%
2014	111 Bemidji	229	0	0%	230	100%	0	0%	230	100%
	161 Park Rapids	189	65	41%	54	34%	40	25%	159	100%
	312 Little Falls	26	0	-	0	-	0	-	0	0%
2015	111 Bemidji	180	0	0%	87	48%	93	52%	180	100%
	161 Park Rapids	411	234	57%	178	43%	0	0%	412	100%
	312 Little Falls	55	0	0%	45	82%	10	18%	55	101%
2016	111 Bemidji	100	28	28%	53	53%	19	19%	100	100%
	161 Park Rapids	285	50	17%	0	0%	236	83%	286	100%
	312 Little Falls	163	58	42%	13	9%	67	49%	138	85%
2017	111 Bemidji	164	73	47%	82	53%	0	0%	155	94%
	161 Park Rapids	147	78	52%	13	9%	60	40%	151	103%
Totals		**2548**	**686**	**33%**	**773**	**37%**	**610**	**29%**	**2069**	**81%**

Appendix III.

Table III-1. Preliminary compared to final prescriptions by cover type and appraisal status.

Preliminary Prescription	Final Prescription	Appraised Acres	Altered Acres	Deferred Acres
Aspen/BG				
Clearcut- with Reserves	Blank	8.4	-	-
Clearcut- with Reserves	Clear-cut (Aspen)	10.3	-	-
Clearcut- with Reserves	Clear-cut- with Reserves	106.2	16	0
Clearcut- with Reserves	Clear-cut- with Reserves (Aspen)	7	-	-
Clearcut- with Reserves	Clear-cut-Sprouting	9.4	-	-
Clearcut- with Reserves	Clear-cut-w/Rsrv - Sprouting (Aspen)	47.5	16.3	10
Clearcut- with Reserves	Group Selection	8.5	-	18.6
Clearcut- with Reserves	No harvest action	0	53.2	84.3
Clearcut- with Reserves	Regeneration Harvest General (Aspen)	3.9	-	0.9
Clearcut- with Reserves	Selective Thinning-Commercial	3.4	-	-
Clearcut- with Reserves	Shelterwood-with Reserves	6.2	-	-
Manage for Understory	No harvest action	0	32.7	11.5
Re-Inventory	No harvest action	0	6	0
SFRMP On-site Visit	Reserve, Designated Stand	-	-	9.1
Burr Oak				
Shelterwood-With Reserves	No harvest action	-	21.3	20
Shelterwood-With Reserves	Clear-cut-w/Rsrv - Sprouting (Aspen)	6	31.4	-
Northern Hardwoods				
SFRMP On-site Visit	Clear-cut- with Reserves	23.2	0	119.8
SFRMP On-site Visit	Commercial Thinning	37	0	0
SFRMP On-site Visit	Group Selection-w/Reserve	31.7	161.7	-
SFRMP On-site Visit	No harvest action	0	0	9.9
SFRMP On-site Visit	Regeneration Harvest General (Aspen)	34.9	-	-

Table III-1 continued.

Preliminary Prescription	Final Prescription	Appraised Acres	Altered Acres	Deferred Acres
Northern Hardwoods				
Uneven-Aged Harvest	Clear-cut-w/Rsrv - Sprouting	31.7	10	0
Uneven-Aged Harvest	Clear-cut-w/Rsrv - Sprouting (Aspen)	10	12.1	0
Uneven-Aged Harvest	Manage for Understory	-	11.5	-
Uneven-Aged Harvest	No harvest action	0	304.1	50.9
Uneven-Aged Harvest	Shelterwood-with Reserves	32	26.5	4
*Uneven-Aged Harvest	Uneven Age Regen Harvest	-	-	62
Red Oak SI < 55				
Commercial Thinning	Clear-cut- with Reserves	8.3	-	-
Manage for Understory	No harvest action	0	3	0
Shelterwood-With Reserves	Group Selection	28	0	0
Shelterwood-With Reserves	Group Selection-w/Reserve	6.5	-	3.5
Shelterwood-With Reserves	Intermediate Treatment	-	-	17.4
Shelterwood-With Reserves	No harvest action	0	75.3	27.1
Red Oak SI 5+				
Re-Inventory	Shelterwood-with Reserves	14.1	0.3	-
Shelterwood-With Reserves	Clear-cut-w/Rsrv - Sprouting	9.6	-	78.4
Shelterwood-With Reserves	Shelterwood	8.5	-	-
Shelterwood-With Reserves	Commercial Thinning	136.9	0	0
Shelterwood-With Reserves	No harvest action	-	-	62.2
Jack Pine				
*Clearcut- with Reserves	Clear-cut- with Reserves	7	-	-
Red Pine				
*Clearcut- with Reserves	Clear-cut- with Reserves	7	-	-
Totals		609	578	427

*Data from 2013 SRM records

Appendix IV.

Table IV-1. Planned and implemented management objectives by cover type

Preliminary			Appraised			Altered		
Cover Type	Objective	Acres	Cover Type	Objective	Acres	Cover Type	Objective	Acres
Agriculture	Retain NPC older growth stage components	18	Aspen	Change stand structure Multi-aged	42	Agricultural	Maintain similar stand	18
Agriculture	Convert cover type UG	18	Aspen	Change stand structure Even-aged	6	Aspen	Change stand structure Multi-aged	21
Aspen	Protect rare plant or animal location	31	Aspen	Change stand structure Retain legacy patches	52	Aspen	Change stand structure Even-aged	6
Aspen	Special management consideration for species or habitat	146	Aspen	Maintain existing NPC composition and structure	33	Aspen	Maintain existing NPC composition and structure	21
Aspen	Protect a known rare native plant community	15	Aspen	Protect a known rare native plant community	30	Aspen	Retain NPC older growth stage components	1
Aspen	Use prescribed fire	31	Aspen	Convert cover type NH	3	Aspen	Maintain similar stand	109
Aspen	Retain NPC older growth stage components	31	Aspen	Increase Aspen	100	Aspen	Manage for smaller patches	1
Jack Pine	Increase JP	7	Aspen	Increase Northern Red Oak	57	Marsh	Maintain similar stand	43
Marsh	Retain NPC older growth stage components	23	Aspen	Maintain similar stand	73	NH	Maintain existing NPC composition and structure	89
NH	Special management consideration for species or habitat	187	NH	Change stand structure Multi-aged	10	NH	Special management consideration for species or habitat	15
NH	Increase Oak	436	NH	Change stand structure Even-aged	32	NH	Retain NPC older growth stage components	31
NH	Increase Northern Red Oak	352	NH	Increase Aspen	50	NH	Increase Aspen	12

Table IV-1 continued.

Preliminary			Appraised			Altered		
Cover Type	Objective	Acres	Cover Type	Objective	Acres	Cover Type	Objective	Acres
NH	Increase NP	62	NH	Increase Northern Red Oak	10	NH	Maintain similar stand	191
Norway Pine	Increase NP	27	NH	Increase Bur Oak	10	Oak	Change stand structure Uneven-aged	31
Oak Burr	Special management consideration for species or habitat	52	NH	Maintain similar stand	45	Oak	Maintain existing NPC composition and structure	16
Oak Burr	Maintain similar stand	59	Norway Pine	Increase NP	8	Oak	Increase Basswood	21
Oak Red +55	Special management consideration for species or habitat	199	Oak	Change stand structure Multi-aged	42	Oak	Increase Northern Red Oak	45
Oak Red -55	Special management consideration for species or habitat	237	Oak	Change stand structure Uneven-aged	6	Oak	Increase White Oak	45
Oak Red -55	Maintain similar stand	25	Oak	Use prescribed fire	18	Oak	Maintain similar stand	94
Tamarack	Special management consideration for species or habitat	7	Oak	Convert cover type Oak	18			
Tamarack	Protect a known rare native plant community	7	Oak	Increase American Elm	108			
			Oak	Increase Aspen	100			
			Oak	Increase Northern Red Oak	249			
			Oak	Increase Bur Oak	150			
			Oak	Increase NP	8			
			Oak	Maintain similar stand	143			
			White Pine	Increase Northern Red Oak	20			
			White Pine	Increase WP	20			
			White Pine	Maintain similar stand	12			
	Total	**1969**		**Total**	**1455**		**Total**	**810**

Appendix V.

Since 2011, the following changes have been made to the state Endangered, Threatened, and Special Concern and state Species in Greatest Conservation Need (SGCN) lists. Updates to the federal Endangered species list are found separately at the bottom of this list.

- Amphibians: two species added as special concern and SGCN (great plains toad and mudpuppy), one species (bullfrog) no longer listed as SGCN, but now on watchlist
- Arachnids: three species listed as special concern, two of which are now also SGCN
- Birds: burrowing owl added as endangered, common tern added as threatened (trumpeter swan downgraded from threatened to special concern), 9 species added as special concern (northern goshawk, lark sparrow, Nelson's sparrow, purple martin, cerulean warbler, hooded warbler, Forster's tern, greater prairie-chicken, Bell's vireo), and 5 species added as watchlist species (western grebe, sandhill crane, upland sandpiper, American bittern, double-crested cormorant). Five species were added to the SGCN list (western grebe, burrowing owl, lark sparrow, purple martin, Bel's vireo) and two that were on the list in 2011 no longer were in 2015 (bald eagle and sand hill crane). The status of bald eagle dropped from special concern to watchlist.
- Insects: one species listed as state endangered (Poweshiek skipperling), two species listed as state threatened, 8 as special concern, one as a watch list species (rusty patched bumble bee), and 9 as SGCN that were not listed in 2011.
- Mammals: four species added as special concern (northern long-eared bat, prairie vole, least weasel, plains pocket mouse)
- Mollusks: two species added as threatened and two as special concern.
- Reptiles: Blanding's turtle added as threatened, and eastern hognose snake added to watchlist.
- Plants: two species added to endangered, 8 species as threatened, 10 species as special concern, and 4 species as watchlist (Table V-2). Of these species, goblin fern, rock sandwort, and clustered broomrape were upgraded from special concern to threatened, pale moonwort and St. Lawrence grapefern were downgraded from endangered and threatened respectively to special concern, and tubercled rein orchid was downgraded from endangered to threatened. One plant, *Carex woodii*, was listed as special concern in 2011, but has been removed from the list.
- Fish: three additional species not listed in HH Assessment document. One of them (northern sunfish) is now listed as special concern, one (slender madtom) is listed as endangered, and all three are listed as SGCN (including weed shiner).
- Five new records were added to NHIS since 2011, all for mudpuppy.
- Federal Endangered Species list updates include two insect species added as federally endangered: rusty-patched bumble bee and Poweshiek skipperling, and northern long-eared bat listed as threatened in 2015.

Table V-1. Potential rare fish species in the Hardwood Hills SFRMP area.*

Scientific Name	Common Name	Current State Status				Status in 2011
		Greatest Conservation Need (SGCN)	Endangered (E)	Threatened (T)	Special Concern (SPC)	
Acipenser fulvescens	lake sturgeon	X			X	SGCN, SPC
Etheostoma microperca	least darter	X			X	SGCN, SPC
Lepomis peltastes	northern sunfish	X			X	
Moxostoma valenciennesi	greater redhorse	X				SGCN
Notropis anogenus	pugnose shiner	X		X		SGCN, SPC
Notropis texanus	weed shiner	X				
Noturus exilis	slender madtom	X	X			

*Data compiled from multiple sources including Fishes of MN Mapper, state NHIS data, and Fish species found GIS layer (available in QuickLayers) by Heather Baird

Table V-2. Updates to rare species data since 2011. Each species represents at least one record in the DNR NHIS database. Current federal and state status are compared to status in 2011. Species in bold have updated statuses since 2011.

Scientific Name	Common Name	Taxa Group	Federal Status	State Status					State Status 2011
				SGCN	END	THR	SPC	Watch	
Anaxyrus cognatus	**Great Plains Toad**	**Amphibian**		X			X		
Lithobates catesbeianus	**Bullfrog**	**Amphibian**						X	**SGCN**
Necturus maculosus	**Mudpuppy**	**Amphibian**		X			X		
Habronattus viridipes	**A Jumping Spider**	**Arachnid**		X			X		
Marpissa formosa	**A jumping spider**	**Arachnid**		X			X		
Paradamoetas fontanus	**A Jumping Spider**	**Arachnid**		X			X		SGCN
Accipiter gentilis	**Northern Goshawk**	**Bird**		X			X		SGCN
Aechmophorus occidentalis	**Western Grebe**	**Bird**		X				X	
Ammodramus henslowii	Henslow's Sparrow	Bird		X	X				END, SGCN
Ammodramus nelsoni	**Nelson's Sparrow**	**Bird**		X			X		SGCN
Antigone canadensis	**Sandhill Crane**	**Bird**						X	SGCN
Athene cunicularia	**Burrowing Owl**	**Bird**		X	X				
Bartramia longicauda	**Upland Sandpiper**	**Bird**		X				X	**SGCN**
Botaurus lentiginosus	**American Bittern**	**Bird**		X				X	**SGCN**
Buteo lineatus	Red-shouldered Hawk	Bird		X			X		SPC, SGCN
Calcarius ornatus	Chestnut-collared Longspur	Bird		X	X				END, SGCN
Chondestes grammacus	**Lark Sparrow**	**Bird**		X			X		
Coturnicops noveboracensis	Yellow Rail	Bird		X			X		SPC, SGCN
Cygnus buccinator	**Trumpeter Swan**	**Bird**		X			X		**THR, SGCN**
Haliaeetus leucocephalus	**Bald Eagle**	**Bird**						X	**SPC, SGCN**
Lanius ludovicianus	Loggerhead Shrike	Bird		X	X				THR, SGCN

Table V-2 continued.

Scientific Name	Common Name	Taxa Group	Federal Status	SGCN	END	THR	SPC	Watch	State Status 2011
Leucophaeus pipixcan	Franklin's Gull	Bird		X			X		SPC, SGCN
Limosa fedoa	Marbled Godwit	Bird		X			X		SPC, SGCN
Phalacrocorax auritus	**Double-crested Cormorant**	**Bird**						X	
Phalaropus tricolor	Wilson's Phalarope	Bird		X		X			THR, SGCN
Progne subis	**Purple Martin**	**Bird**		X			X		
Setophaga cerulea	**Cerulean Warbler**	**Bird**		X			X		SGCN
Setophaga citrina	**Hooded Warbler**	**Bird**		X			X		SGCN
Sterna forsteri	**Forster's Tern**	**Bird**		X			X		SGCN
Sterna hirundo	**Common Tern**	**Bird**		X		X			SGCN
Tympanuchus cupido	**Greater Prairie-chicken**	**Bird**		X			X		SGCN
Vireo bellii	**Bell's Vireo**	**Bird**		X			X		
Buellia nigra	**A Species of Lichen**	**Fungus**					X		END
Anabolia ozburni	**A Caddisfly**	**Insect**		X			X		
Bombus affinis	**Rusty-patched Bumble Bee**	**Insect**	END	X				X	
Catocala whitneyi	**Whitney's Underwing**	**Insect**		X			X		
Cicindela limbata nympha	**Sandy Tiger Beetle**	**Insect**		X		X			
Cicindela patruela patruela	**Northern Barrens Tiger Beetle**	**Insect**		X			X		
Hesperia leonardus pawnee	**Pawnee Skipper**	**Insect**		X			X		
Oarisma poweshiek	**Poweshiek Skipperling**	**Insect**	END	X	X				
Oxyethira ecornuta	**A Caddisfly**	**Insect**		X		X			SGCN
Oxyethira itascae	**A Caddisfly**	**Insect**		X			X		SGCN
Protoptila erotica	**A Caddisfly**	**Insect**		X			X		
Schinia lucens	**Leadplant Flower Moth**	**Insect**		X			X		
Speyeria idalia	**Regal Fritillary**	**Insect**		X			X		SGCN
Microtus ochrogaster	**Prairie Vole**	**Mammal**		X			X		SGCN
Mustela nivalis	**Least Weasel**	**Mammal**		X			X		SGCN
Myotis septentrionalis	**Northern Long-eared Bat**	**Mammal**	THR	X			X		

Table V-2 continued.

Scientific Name	Common Name	Taxa Group	Federal Status	State Status SGCN	END	THR	SPC	Watch	State Status 2011
Perognathus flavescens	**Plains Pocket Mouse**	**Mammal**		X			X		**SGCN**
Actinonaias ligamentina	**Mucket**	**Mollusk**		X		X			**SGCN**
Lasmigona compressa	**Creek Heelsplitter**	**Mollusk**		X			X		**SGCN**
Lasmigona costata	**Fluted-shell**	**Mollusk**		X		X			**SGCN**
Ligumia recta	**Black Sandshell**	**Mollusk**		X			X		**SGCN**
*Emydoidea blandingii	**Blanding's Turtle**	**Reptile**		X		X			**SGCN**
Heterodon platirhinos	**Eastern Hognose Snake**	**Reptile**		X				X	**SGCN**
Achnatherum hymenoides	Indian Ricegrass	Vascular Plant			X				END
Alisma gramineum	Narrow-leaved Water Plantain	Vascular Plant					X		
Antennaria parvifolia	**Small-leaved Pussytoes**	**Vascular Plant**					X		
Aristida purpurea var. longiseta	Red Three-awn	Vascular Plant					X		SPC
Avenula hookeri	**Spike Oat**	**Vascular Plant**					X		
Botrychium campestre	Prairie Moonwort	Vascular Plant					X		SPC
*Botrychium mormo	**Goblin Fern**	**Vascular Plant**			X				**SPC**
*Botrychium pallidum	**Pale Moonwort**	**Vascular Plant**					X		**END**
*Botrychium rugulosum	**St. Lawrence Grapefern**	**Vascular Plant**					X		**THR**
*Botrychium simplex	Least Moonwort	Vascular Plant					X		SPC
*Carex capillaris	**Hair-like Sedge**	**Vascular Plant**						X	
*Carex formosa	Handsome Sedge	Vascular Plant			X				END
Carex obtusata	Blunt Sedge	Vascular Plant					X		SPC
Carex scirpoidea	**Northern Single-spike Sedge**	**Vascular Plant**					X		
Carex sterilis	Sterile Sedge	Vascular Plant				X			THR
Chamaerhodos nuttallii	**Nutall's Ground-rose**	**Vascular Plant**						X	
Chamaesyce missurica	Missouri Spurge	Vascular Plant					X		SPC
*Cirsium pumilum var. hillii	Hill's Thistle	Vascular Plant					X		SPC
Cladium mariscoides	Twig Rush	Vascular Plant					X		SPC
*Cypripedium arietinum	Ram's Head Orchid	Vascular Plant				X			THR
Cypripedium candidum	Small White Lady's-slipper	Vascular Plant					X		SPC
Drosera anglica	English Sundew	Vascular Plant					X		SPC

Table V-2 continued.

Scientific Name	Common Name	Taxa Group	Federal Status	State Status SGCN	State Status END	State Status THR	State Status SPC	State Status Watch	State Status 2011
Eleocharis quinqueflora	Few-flowered Spikerush	Vascular Plant					X		SPC
Eleocharis rostellata	Beaked Spikerush	Vascular Plant				X			THR
Floerkea proserpinacoides	**False Mermaid**	**Vascular Plant**			**X**				
Gaillardia aristata	Blanketflower	Vascular Plant					X		SPC
Hieracium longipilum	**Long-bearded Hawkweed**	**Vascular Plant**						**X**	
Juniperus horizontalis	Creeping Juniper	Vascular Plant					X		SPC
Malaxis monophyllos var. brachypoda	White Adder's Mouth	Vascular Plant					X		SPC
Minuartia dawsonensis	**Rock Sandwort**	**Vascular Plant**			**X**				**SPC**
Najas guadalupensis ssp. olivacea	**Olive-colored Southern Naiad**	**Vascular Plant**			**X**				
Najas marina	Sea Naiad	Vascular Plant					X		SPC
Orobanche fasciculata	**Clustered Broomrape**	**Vascular Plant**			**X**				**SPC**
Packera cana	Gray Ragwort	Vascular Plant		X					END
Panax quinquefolius	American Ginseng	Vascular Plant					X		SPC
Platanthera flava var. herbiola	**Tubercled Rein Orchid**	**Vascular Plant**			**X**				**END**
Rhynchospora capillacea	Hair-like Beak Rush	Vascular Plant				X			THR
Rubus fulleri	**a bristle-berry**	**Vascular Plant**			**X**				
Rubus semisetosus	**Swamp Blackberry**	**Vascular Plant**			**X**				
Rubus wheeleri		**Vascular Plant**						**X**	
Ruppia cirrhosa	**Spiral Ditchgrass**	**Vascular Plant**					**X**		
Sagittaria brevirostra	**Short-beaked Arrowhead**	**Vascular Plant**		**X**					
Salix maccalliana	**McCalla's Willow**	**Vascular Plant**					**X**		
Sanicula trifoliata	Beaked Snakeroot	Vascular Plant					X		SPC
Shinnersoseris rostrata	Annual Skeletonweed	Vascular Plant				X			THR
Silene drummondii ssp. drummondii	**Drummond's Campion**	**Vascular Plant**					**X**		
Stellaria longipes ssp. longipes	Long-stalked Chickweed	Vascular Plant					X		SPC
Stuckenia vaginata	**Sheathed Pondweed**	**Vascular Plant**		**X**					**SPC**
Torreyochloa pallida	**Torrey's Mannagrass**	**Vascular Plant**					**X**		
Trillium nivale	Snow Trillium	Vascular Plant					X		SPC

*Species associated with forest or woodland habitats. For additional details on habitat, see the MN DNR Rare Species Guide.

Table V-3. Breeding SGCN birds confirmed in the Hardwood Hills from Minnesota Breeding Bird Atlas that are not recorded in NHIS. Species with an * are on the updated 2015 list, but were not listed as SGCN in 2011.

Species	Breeding habitat
*American kestrel	Open, but requires nest cavities (usually created by flickers or pileated woodpeckers) in larger trees
American woodcock	Mix of open brushy and forested areas
*belted kingfisher	Earthen banks near water
black tern	Wetlands
black-billed cuckoo	Varied, including deciduous and mixed forests, especially aspen and birch
bobolink	Open
brown thrasher	Early successional forest or brush
*chimney swift	Old growth or mature forest with hollow trees or cavities; now relies on developed areas
common loon	Lakes
*common merganser	Lakes
common nighthawk	Variable habitats with patches of bare ground, often cutover areas
dickcissel	Grasslands
eastern meadowlark	Grasslands and other open habitats
field sparrow	Edges of oak woodlands, upland grasslands
grasshopper sparrow	Grasslands
northern harrier	Open upland and wetland
northern rough-winged swallow	Usually open cutbanks, but also variable open habitat
*purple finch	Mixed forest, bogs, coniferous forest, pine-oak barrens, lowland coniferous forest
red-headed woodpecker	Deciduous woodlands with open canopy and dead trees, oak savanna, ash (WF) wetlands
red-necked grebe	Wetlands
sedge wren	Open upland and wetland
veery	Variety of forest habitats
Virginia rail	Wetlands
*western kingbird	Open and riparian habitats
*western meadowlark	Open
*yellow-billed cuckoo	Shrubby habitats
*yellow-headed blackbird	Wetlands