Interim Forest Management Policy for High Conservation Value Forests

HCV: UPs14a – Dry Barrens Oak Savanna (Southern) Native Plant Community

Table 1. Key Statistics	Total Acreage	Acreage on HCVF (non-STL)	Acreage on HCVF (STL)
NPC Class			
UPs14 (Southern Dry Savanna)	8,176 ac	1,516 ac	94 ac
NPC Type			
UPs14a, UPs14a1, UPs14a2 (Dry Barrens Oak Savanna)*	5,370 ac	1,515 ac	94 ac
UPs14a, UPs14a1, UPs14a2 Condition Rank A – BC	2,177 ac	685 ac	21 ac
UPs14a, UPs14a1, UPs14a2 Condition Rank C-D	1,639 ac	541 ac	46 ac
UPs14a, UPs14a1, UPs14a2 Condition Rank not identified	1,555 ac	289 ac	27 ac
UPs14a, UPs14a1, UPs14a2 currently in pine**	n/a***	105 ac	26 ac

Source: DNR Native Plant Community polygon dataset (may include non-DNR admin lands)
*Likely includes some dry barrens oak savanna – data in this class isn't necessarily defined down to the type.
**Calculated by clipping DNR NPC polygon subset with Statewide FIM subset of pine covertypes.
***Not able to characterize cover type information for non-DNR lands.

Status: Globally Imperiled to Vulnerable (G2 or G3 rank)
State Critically Imperiled to Imperiled (S1 to S2 rank)
Noted in MFRC Site-level Guidelines as a "Sensitive Native Plant Community"

Location: Predominantly in Sherburne, Anoka, Isanti, Winona, Houston, Rice, and Wabasha counties, with additional acreage in adjacent counties.

Brief Description

Dry barrens oak savannas (southern) are sparsely treed graminoid-dominated communities on wind-reworked sands and other deep sands. Dune forms are typically evident, with small local blowouts present, and there is little or no soil formation. Black oak is the main tree in the Paleozoic Plateau, with bur oak and occasionally jack pine. Elsewhere, bur oak is the principal tree. Northern pin oak is sometimes present, perhaps only as a result of fire suppression. Vegetative cover is often less than 100%, with bare sand exposed among plants. UPs14a is divided into two subtypes, based on canopy composition: the jack pine subtype, in which jack pine is present in the canopy, and the oak subtype, where oak is present in the canopy and jack pine is absent.

Policy for Dry Barrens Oak Savanna (UPs14a) within High Conservation Value Forests (HCVFs)

The guidance below provide several management options for Dry barrens oak savanna (Southern) (UPs14a), developed with the understanding that site context matters and that the condition and quality of a site will dictate management options, likelihood of persistence or restoration potential. The policy uses a condition ranking assessment to determine the appropriate management approach to use on a given site.[1] Owing to the

[1]*Condition Ranks for native plant communities reflect the degree of ecological integrity of a specific occurrence of a native plant community. Condition Ranks are assigned by considering species composition, vegetation structure, ecological processes and functions, level of human disturbance, presence of exotic species, and other factors. Condition Ranks are*

global and state rarity of this NPC, recommended management actions restore, maintain, or enhance Dry Barrens Oak Savanna communities on the landscape.

Note: When this native plant community is found within the Sand Dunes State Forest HCVF, any management activities should follow the Operational Plan for Management of Sand Dunes State Forest in place of this policy.

Scenario #1: Pine stands have been planted in place of Dry Barrens Oak Savanna
Move towards a clear-cut harvest of all standing pine and species that are uncharacteristic of this NPC and thinning of characteristic species where canopy cover exceeds 50% (Table 2, Option 1). Depending on the age of the pine stand, and with interdisciplinary consensus, it may be appropriate to continue thinning the stand until final rotation age is met while retaining characteristic species during those pine thinning entries. Following harvest, a suite of management activities will likely be necessary to reconstruct or restore this community. Once restored, vegetation management activities (preferably prescribed fire) will be necessary to maintain or enhance this community's quality as defined by the Upland Prairie condition ranking guidelines. When appropriate, Fuelwood permits may be issued to remove uncharacteristic woody species or reduce canopy cover of characteristic woody species exceeding 50%.

A clear-cut harvest (Winter harvest restriction) should be implemented to remove all trees uncharacteristic of the NPC. Characteristic trees, if present, will be reserved as scattered individuals or in small clumps while maintaining tree canopy cover between 10 – 70%. The site would not be planted after harvest except where tree species characteristic of Dry Barrens Oak Savanna are absent. Seeding of native herbaceous species may be necessary where seed bank or adjacent lands are absent of native component.

Note: Depending on the age of the pine stand, and with interdisciplinary consensus, it may be appropriate to continue thinning the stand until final rotation age is met while retaining characteristic species during those pine thinning entries.

Following clearcutting, a biomass harvest may be necessary. Then, two alternative scenarios exist:

1. If fire refuge size oak (>10cm DBH) are present, apply NPC restoration Rx fire regime 1 or 2 (See Table 3).
2. Young oak (if present) should be given time to mature to fire refuge size. If young oak are not present, prescribed fire should be applied to prepare soil and target species should be subsequently planted. Once oak have matured to fire refuge size, implement NPC restoration regime 1 or 2 (See Table 3).

Total canopy cover should not exceed 50% across the site; however, canopy cover should vary on smaller scales within the site at between 10 – 70%.
Optional - Implement additional activities to enhance the quality of the NPC such as:

- Increase plant species diversity that are locally present and characteristic of the NPC, but may have been lost from previous management practices (e.g. "grazing decreasers": plant species that appear to decrease in abundance with persistent moderate to heavy grazing).

assigned on a scale of A to D. The majority of condition rank-assessed NPCs on MN DNR managed lands have been assigned by Minnesota Biological Survey staff.

- Review floral resources. Plant seed/plugs for absent larval or nectar plants required by invertebrate species present in the area.
- Remove barriers, such as trails or roads, within the site to improve connectivity for nongame species.
- Restore sand dune blowouts in areas known to have harbored open, loose sand dependent species.
- Monitor to track the status of rare species populations.

Scenario #2: Higher quality examples (Condition rank A, AB, B, and BC) of Dry Barrens Oak Savanna
Manage these communities through prescribed fire or other appropriate vegetation management strategies that maintain canopy cover between 10 and 50%. No timber harvest recommended. However, when appropriate, fuelwood permits may be issued to remove uncharacteristic woody species or reduce canopy cover of characteristic woody species exceeding 50%. Then, use vegetation management options to maintain or enhance the quality of this community as defined by the Upland Prairie condition ranking guidelines.

Preferentially, implement a maintenance prescription fire regime (see Table 3) to maintain high quality oak savanna characteristics and diversity. Vegetation management options will be implemented if site conditions change that would adversely impact the condition of the site (e.g. woody encroachment, invasive species, etc.). Grazing should be employed only as a last option to achieve desired NPC characteristics. Monitoring to track the status of rare species populations is critical.

Optional - Implement additional activities to enhance the quality of the NPC such as:

- Increase plant species diversity that are locally present and characteristic of the NPC, but may have been lost from previous management practices (e.g. grazing decreasers).
- Review floral resources. Plant seed/plugs for absent larval or nectar plants required by invertebrate species present in the area.
- Remove barriers, such as trails or roads, within the site to improve connectivity for nongame species.
- Restore and/or maintain sand dune blowouts in areas known to harbor or have harbored open, loose sand dependent species.
- Monitor to track the status of rare species populations.

Scenario #3: Moderate to lower quality examples (Condition rank C, CD and D) of Dry Barrens Oak Savanna
Succession to woodland/forest is likely progressing. Implement harvest, girdling, or NPC restoration Rx fire regime option 1 or 2 (see Table 3) to bring canopy cover levels of characteristic species to between 10 and 50%. Implement NPC restoration Rx fire regime 1 or 2, where possible, to bring structural features to levels that are characteristic of this community. Where Rx fire is not viable, implement other vegetation management options (Table 3). Transition to NPC maintenance Rx fire regime indefinitely (See Table 3). No further harvest is anticipated except to reduce the presence of uncharacteristic woody species or canopy cover of characteristic woody species exceeding 50%.

Enhancing the quality of these sites to higher condition ranks will likely require the use of many or all additional vegetation management options listed in Table 3.

Optional - Additional activities to enhance the quality of the NPC should be explored such as:

- Increase plant species diversity that are locally present and characteristic of the NPC, but may have been lost from previous management practices (e.g. grazing decreasers)
- Review floral resources. Plant seed/plugs for absent larval or nectar plants required by invertebrate species present in the area.
- Remove barriers, such as trails or roads, within the site to improve connectivity for nongame species.
- Restore sand dune blowouts in areas known to have harbored open, loose sand dependent species
- Monitoring to track the status of rare species populations is critical.

Following restoration of community (as described above), fuelwood permits may be issued to remove uncharacteristic woody species or reduce canopy cover of characteristic woody species to between 10 and 50%.

Additional considerations:

- Higher frequency and greater intensity restoration measures will be necessary to enhance D-ranked vs. C-ranked oak savanna communities to a higher condition rank.
- D-ranked sites include communities dominated by grasses without a forbs or native shrub component due to repeated herbicide use, but also communities where overall native species richness is low and the site is dominated by non-native invasive species. These sites should not be treated equally. After several years without herbicide, communities in the first case may see forb cover reemerge from the seed bank. Recoverability of the second case may be more challenging due to the persistence and competitiveness of many non-native invasive species.

	Table 2. Harvest approaches for managing UPs14a NPC sites within HCVFs
#	**Approach, description and consequences**
1	**Clear-cut/ Restoration harvest.** A clear-cut harvest should be implemented to remove all trees uncharacteristic of the NPC, and reduce appropriate tree canopy to between 10-50%. Trees will be reserved as scattered individuals or in small clumps. The site would not be planted after harvest. Could be used in either the jack pine or oak subtype depending on stand conditions prior to harvest. **Consequences:** • Best possible one-time economic return for this NPC. • Lack of any characteristic tree species on site may necessitate plantings and management to ensure survival/growth • A large economic loss is not anticipated because the tree species of this community are typically poor quality and of low value (cordwood, fuelwood). • Quickest method for bringing stand back to native savanna. • Open canopy allows sunlight to reach the ground and provides adequate light levels for prairie understory species. • Reserved trees may be susceptible to wind damage.
2	**Variable density thinning.** Thinning method where the stand, rather than being methodically thinned, is harvested non-uniformly. Some areas are thinned quite heavily, actually creating small gaps in the canopy up to an acre in size. Other areas aren't thinned at all. Creates a stand with a highly variable basal area throughout. **Consequences:**

	Table 2. Harvest approaches for managing UPs14a NPC sites within HCVFs
#	**Approach, description and consequences**
	• Standard economic benefit from a pine harvest. • Could benefit the future establishment of a savanna. • Oaks could be planted within the small harvest gaps and allowed to get a head start in growth before the savanna is fully established. • Stand will be thinned 1-2 more times before final harvest.
3	**Small gap harvest.** Somewhat similar to variable density thinning in that small gaps are created. Stand is methodically harvested creating small 1-2 acre gaps in the canopy uniformly throughout the stand. **Consequences:** • Similar to Variable density, standard economic benefit from a pine harvest. • Would also allow oaks to get established well before a fully restored savanna. • Stand will be thinned 1-2 more times prior to final harvest.
4	**Standard thinning.** Pine stands are thinned every 10-15 years. Final harvest eventually completed once trees reaches maturity. **Consequences:** • Consistent economic benefit every 10-15 years. • Stand essentially remains a pine stand until final harvest. • Longest method for converting back to a dry barrens oak savanna, and may prohibit restoration if the community is too far removed from its original state or a considerable amount of time (seed bank is no longer viable, soil has changed, etc).

Additional considerations:

- Local site managers and cooperators should use their discretion in determining slash management based on site conditions and plans. This could include piling and burning of logging debris or lopping and scattering of slash for future prescribed fire activities.

	Table 3. Restoration approaches for managing UPs14a NPC sites within HCVFs
#	**Approach, description and consequences**
	Prescribed Fire Options
1	**NPC Restoration Rx fire regime option 1 -** Application of a high-intensity fire followed in successive years with lower intensity, but high frequency (Every 1-3 years) fire regime. If an understory component is lacking and adjacent seed source is absent, a native seeding and/or planting may be needed to facilitate understory development. After reaching target condition ranking for plant community, begin implementing Maintenance Rx fire regime. **Consequences:** • Regime option 1 may achieve reestablishment of oak savanna characteristics more rapidly than restricting fire management regime option 2. • High-intensity burns could result in loss of some or all residual oaks. This may be desirable in maximum conservation scenario, less so when maximizing economic gain. • High-intensity fire may damage wood products, lowering value. • High frequency fires will exclude woody recruitment and preference grass growth, encouraging fine fuel development.

	Table 3. Restoration approaches for managing UPs14a NPC sites within HCVFs
#	**Approach, description and consequences**
	• Cost ($50-200/acre/burn). NPC Restoration regime option 1 likely to require fewer burns to achieve desired savanna characteristics then NPC Restoration Regime Option 2.
2	**NPC Restoration Rx fire regime option 2** – No initial high-intensity fire used. Lower intensity, but higher frequency fire regime (Every 1-3 years) is used from the outset of restoration. After reaching target condition ranking for plant community, begin implementing Maintenance Rx fire regime. **Consequences:** • High frequency fires will exclude woody recruitment and preference grass growth, encouraging fine fuel development. • Cost ($50-200/acre/burn). NPC Restoration regime option 1 likely to require fewer burns to achieve desired savanna characteristics then NPC Restoration Regime Option 2. • Lower intensity burns are more manageable with smaller crew (Lowered cost). • Fire rapidly removes duff/slash to prepare soils and initiate understory development.
3	**Maintenance Rx fire Regime** - Burn frequency of 3-8 years. Implement periodic fire cessation to allow recruitment of target species to fire refuge size to replace mature tree mortality that will occur over time. **Consequences:** • Once desired savanna characteristics are achieved, fewer burns and therefore less cost is required to maintain those features.
	Mechanical – Species removal options
4	**Fuelwood permit** – Use sale of fuelwood permits to encourage removal of uncharacteristic species. **Consequences:** • On sites where merchantability is questionable, fuelwood permits may provide minimal income generation and aid in reducing excessive canopy cover.
5	**Forestry Mowing -** Forestry mowing can be used in place of, or as a follow-up treatment to fire to help set back woody competition. Typically done with a skid steer with a forestry mulching head attachment. Mows entire area, mulching all young woody vegetation. **Consequences:** • Good option if prescribed fire cannot be used. • May be cheaper than grazing on sites with minimal to moderate amounts of brush. • Less feasible on steep hillsides. • $200-$400 per acre, depending on the site. • Repeated treatments are likely necessary to kill target plants. • Most effective in late summer to fall, but before vegetation sends its resources below ground.
6	**Grazing -** Rotational grazing typically done with goats. Animals are fenced off in small acreage parcels and allowed to feed on all existing woody vegetation. Once target vegetation is consumed, the goats are moved to an adjacent parcel. **Consequences:** • May be cheaper than forestry mowing if the brush coverage is extensive. • Time intensive process that requires consistent monitoring to ensure animals needs are met and overgrazing of non-target species doesn't take place. • Overgrazing can cause soil disturbance, opening areas for weeds to establish.

	Table 3. Restoration approaches for managing UPs14a NPC sites within HCVFs
#	**Approach, description and consequences**
	• Grazing can result in some plant species sensitive to grazing to decline or even disappear from the grazed areas. • Contractors may not be available in all counties.
	Chemical – Species removal
7	**Stem injection or cutting combined w/stump treatment of herbicide** – Strategy to kill undesirable mature trees and reduce canopy cover of stands targeted for restoration to savanna. **Consequences:** • Species of overgrown savanna are prone to stump sprouting; herbicide applications improve the success of this treatment thereby reducing costs. • Standing snags provide important wildlife habitat as they decay. • Costs varies greatly depending on density of individuals to be treated.
	Biomass Harvest
8	Removal of excess slash left after timber harvest. **Consequences:** • Opens up understory to allow seed bank to germinate. • No cost. • Biomass harvest may not be an option outside of large cities.
	Native seeding/planting
9	Native seeding or planting plugs can enhance native plant diversity and facilitate restoration of oak savanna, especially in areas that have been degraded for a long period of time or that do not have a native assemblage of species adjacent to the site to seed in. **Consequences:** Costs vary, depends on size of site to be seeded/planted, local availability, and the diversity of species desired. Where adjacent lands are devoid of native savanna species, this method can rapidly improve native site diversity.
	Seed collection
10	Seed collection internally to DNR or leasing of lands through a certified farming agreement for the purposes of collecting native prairie/savanna seed. **Consequences:** • Could provide revenue consistently and annually. • This option of revenue generation is largely unexplored, but shows promise. • Management actions would be necessary to maintain or enhance this NPC at a condition ranking that would make seed collection within the site desirable to leasee's or State entities. • Monitoring results of seed collecting will be critical to ensure maintenance of the NPC occurring at the site. Degradation of the site condition, including the composition and distribution of floral resources required by nongame species, will indicate the need to reassess this option, with the intent of applying adaptive management principles. Seed collection specifications will need to be reviewed and agreed upon by regional EWR specialists.

Native Plant Community Description

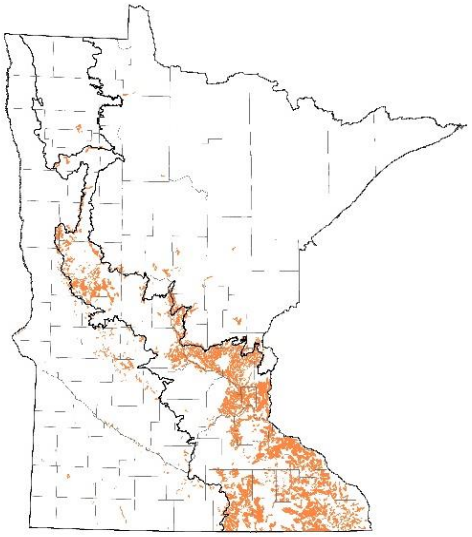

Figure 1. Historic distribution of Oak Savanna (UPs14)
in Minnesota (Marschner 1974, Texler & Lee 2017)

Dry Barrens Oak Savanna (UPs14a) is a sparsely treed native plant community (NPC) with grass-dominated herbaceous groundlayer on nearly level to steeply sloping sites with droughty soils. Trees occur as scattered individuals or in small to large clumps, with a total cover across the community greater than 5%, but less than 70% (typically ranging between 25 and 50%). Bur oak is the most common tree species in this community, but northern pin oak, black oak and jack pine can also be found on these sites. Vegetative cover is often less than 100%, with bare sand exposed among plants, and dune with blowouts typically evident. Little bluestem and porcupine grass are generally dominant, and big bluestem, Indian grass, and Pennsylvania sedge are usually present and often common with distinctive species including sand dropseed, sand reedgrass, hairy grama, slender nutsedge, hairy puccoon, silky prairie clover, and, rarely, wild lupine. Forbs, vines, and shrub species are often patchy, including species such as ray goldenrod, hairy and hoary puccoon, leadplant, prairie rose, chokecherry, American hazelnut, and smooth sumac. Historically, savannas occurred within a habitat mosaic consisting of grass-dominated prairies and oak woodlands and represented a compositional and structural transition between these community types. This continuum of habitats was modified, in part, through grazing and browsing; however, fire was the primary abiotic driver of structural and species composition. Structural and compositional variability within and between these communities was governed by the frequency, intensity, and severity of fire behavior that resulted from local site factors including soils, hydrology, geology, topography, and climate. Evidence suggests that oak savanna requires irregularity in its fire regime to maintain the characteristic grass-dominated openness, while providing infrequent, but necessary recruitment of woody species to the canopy.

Since early settlement, most oak savannas have been plowed under for agricultural purposes, developed, or allowed to succeed to closed-canopy forest via fire suppression. As a result, savanna is estimated to comprise less than 0.02% of its former range in the Midwestern United States today. Statewide, it is estimated that

approximately 0.2% (9,800 to 11,100 acres) of the State's original extent of Oak Savanna (all subtypes) remains. Dry Barrens Oak Savanna in Minnesota is even rarer, with acreage totaling less than 5400 acres. Owing to its' rarity, Dry barrens oak savanna has been ranked as Critically Imperiled (S1) or Critically Imperiled to Imperiled (S1S2) at the State level and 'Imperiled' at a global level (G2). Oak savanna is mostly limited to smaller, degraded remnants and high-quality savanna is extremely rare with the majority of the oak savanna communities having been ranked B-C to D (scale of A, excellent, to D, poor). In consideration of this communities' extreme rarity, protection and management of high-quality examples (A-B) is imperative, while restoration of BC – C-ranked examples that continue to display good to fair ecological integrity and have potential for recovery should be a high priority.

Figure 2. Expressions of UPs14a (Dry Barrens Savanna - Southern) across subsections

Section	*Landscape Expression*
Paleozoic Plateau (The Blufflands and Rochester Plateau)	• *UPs14 occurs primarily on deep, occasionally wind-reworked stream terrace sands on valley floors* • *Black oak is the main tree, with some bur oak and occasionally mixed with jack pine. In rare situations, jack pine is the dominant tree (UPs14a1)* • *Jack pine subtype (UPs14a1) only documented in the Paleozoic Plateau*
Anoka Sandplain and Oak Savanna	• *Most frequently occurs on sand deposits on terraces along the Mississippi River and on outwash and lacustrine deposits in the Anoka Sand Plain.* • *Bur oak is dominant tree with some pin oak*

Conservation Needs

Fragmentation and active fire suppression have all but eliminated the natural disturbance regime of this community. Active, intentional vegetation management is critical to maintain oak savannas indefinitely. High quality examples of Dry Barrens Oak Savanna (southern) communities often contain Endangered, Threatened, or Special Concern species that will require consideration when identifying the size and extent of burn units and timing for prescribed vegetation management activities.

Constraints/Challenges

- Public perception that pines are natural in areas where they historically did not occur can influence the ability of land managers to apply sound natural resource conservation and management principles.
- Managing fire dependent systems such as Dry Barrens Oak Savanna using prescribed fire may be challenging in areas with significant residential or commercial development.
- Habitat structure and species composition can vary greatly between high-quality savanna communities. A one-size fits all management prescription for Dry Barrens Oak Savanna may reduce overall habitat complexity of this community across the landscape
- Frequent, but regular fire intervals over long periods will shift oak savanna communities towards grass-dominated prairie. Longer, but regular fire return intervals will result in savanna communities shifting towards oak woodland. Applying fire returns at variable intervals over long time periods is challenging, but necessary to maintain site characteristics reflective of savanna communities

- Marketability of timber sales is questionable given the quality and volume of wood available in this Native Plant Community
- Climate change will alter local climates in ways we cannot anticipate. Management of savanna will require awareness of these changes to adapt management and fire regimes to account for shifts in local growing conditions.

Management Considerations Used in Policy Development

Prescribed burning

- Plan for burn unit sizes & rotations that leave adequate patches of unburned habitat for ETS species
- Timing, intensity, and frequency of prescribed burns should take into account life histories and susceptibility to fire damage of animals and plants
- Prescribed burn units should be planned in partnership with listed-species experts to determine size of refugia patches. Consider the distribution of resources across your burn unit and collaborate with listed-species staff to determine if resources required by nongame species are present in refugia.
- Maintaining tree cover above 50% inhibits domination of native grasses and therefore limits fine fuels development. Prescribed burning may be limited as an option under these circumstances and necessitate other forms of vegetation management to control woody competition.
- Successful implementation of prescribed fire can be challenging. Burning too frequently can cause significant oak mortality in the red oak family, either from the fire itself or the introduction of oak wilt or two lined chestnut borer on stressed trees. Burning too intensely can easily kill trees as well. Conversely, burning too lightly can fail to reduce woody competition and burning too infrequently can allow woody competition to take over the understory of a site. Weather also a plays a large factor in how a burn regime functions. Prescribed fire is the most effective tool in maintaining a healthy savanna but can be the hardest to get right at times.
- Where conversion from pine stand to oak savanna is possible and desirable, locally-sourced native prairie seed should be interspersed following prescribed burns to supplement low diversity/lower condition ranked communities.
- Other vegetation management tools may be applied to manage undesirable woody vegetation or to simulate fire in areas where prescribed fire is not feasible.

Timber harvest

- The establishment of new pine plantations in oak savanna habitat should not occur. Re-establishment of pine plantations in areas where an existing pine plantation was harvested (within the original range of oak savanna) should be strongly discouraged, especially in instances where a native component of oak savanna is apparent.
- Chemically treat stumps post-harvest to prevent resprouts.
- To reduce soil and groundlayer impacts in this rare community, the preferred timber harvest season is during frozen ground conditions.
- If no market exists for oak pulpwood or bolts, consider making the site a fuelwood cutting area. Reserve trees may be marked and fire wood permits may be subsequently issued to allow harvest of the rest.
- Opening up an oak woodland that has been a woodland for decades can be tricky. Ideally you want to create enough canopy opening to allow native savanna species to flourish. Opening up the stand and

removing a good deal of basal area leaves the residual oaks very prone to wind damage. Scattered trees can be left but small clumps may be a better option.

- Slash management approach should be based on local site manager discretion in collaboration with their cooperators. Management approaches could include pile and burn, or lop and scatter for future prescribed fire activities.

Grazing

- Is not a standalone management technique and work best when combined with other management techniques.
- Prescribed grazing must be done rotationally (in most cases), and for more than one season to achieve lasting reductions in brush densities.
- Goat grazing is more appropriate for a savanna, but there may be instances where rotational grazing with cows may provide management benefits. A grazing specialist should be consulted before allowing cattle grazing on a savanna site, particularly if it is a Rank A or B quality.

Mowing

- On sites with sensitive species/features, forestry mowing should be done on frozen ground to limit soil disturbance and compaction.
- Mowing should be limited to time periods when ETS species are inactive. Consultation with listed species experts should occur to avoid incidental take.
- Entrance to a site for mechanical seed harvest should be limited to a time when the highest diversity of species will be harvested rather than having multiple entrances with mechanized seed harvesters.

Seeding or seed collection

- Follow guidance provided by Op Order 124 "Plant Material Standards for Native Plant Community Restoration."
- Use appropriate species mixes.
- Collection of vegetative material (seed or cutting) from state listed plant species is not allowed by Minnesota statute without a permit. If the collection is of benefit to the species and has a high likelihood of success, a permit can be issued for collection.

Additional considerations

- Oaks will die over time. Some may be lost to fire damage, especially pin oak and black oak. Some will perish naturally. New oak recruitment is needed to replace dying/dead trees. Oak recruitment can be complicated with a fairly heavy, consistent use of prescribed fire to maintain the savanna. In this case, the use of fire may have to be suspended for a period to allow new trees to develop. Another option is to protect desirable young oaks from fire damage during a burn.
- Due to the limited opportunities for revenue generation, sale of these lands from the school trust portfolio to a conservation focused entity could be considered (public or private)
- Potential issue with slash on the site following a commercial or fuelwood harvest. If slash is piled next to residual trees it could cause tree mortality when fire is introduced and the slash piles burn. Slash piles should be burned on frozen ground to minimize scarring. Additionally, seek to create several smaller

piles for burning rather than one large pile to minimize burn scar depth, thus minimizing recovery time of these areas. Brush/slash piles are made, they should be placed on lower quality portions of the site (e.g. from where it was just cut), rather than placed on high quality prairie or next to leave trees.Overall costs for restoration appear to be quite high in the long term. Multiple stand entries to control woody vegetation is inevitable in the long term, no matter which management strategy or combination is used.

- Restoring and sustaining oak savanna requires repeated and purposeful management. Management actions; aside from timber harvest, fuelwood permits, and possibly biomass harvest; requires investment of capital
- The overall cost of management activities needed to maintain viable examples of Dry Barrens Oak Savanna is likely to exceed the revenue generated through extraction of wood products.
- While no funding source is currently identified to pay for the implementation of this policy, the DNR is encouraged to support funding initiatives for a dedicated prescribed fire crew.
- With only 0.2% of the original oak savanna in Minnesota remaining, each occurrence is significant.
- C-ranked oak savanna occurrences display evidence of degradation, but have fair ecological integrity, are still dominated by native/characteristic species of the community, and have potential to recover to a higher quality rank when appropriate management is applied
- Management of sites displaying significant recruitment of oak into the canopy may necessitate special management prescriptions that consider oak wilt and the potential repercussions of harvest to residual oaks intended to be retained in the canopy.
- Restoration prospects for degraded Dry Barrens Oak Savanna (Pine plantations and/or Condition Rank D) is dependent on the landscape context (e.g. Presence of high quality savanna/prairie in lands adjacent to State lands would improve prospects) and potential for natural processes to facilitate successful restoration projects.
- The establishment of new pine plantations in oak savanna habitat should not occur. Re-establishment of pine plantations in areas where an existing pine plantation was harvested (within the original range of oak savanna) should be strongly discouraged, especially in instances where a native component of oak savanna is apparent.

Next steps and additional needs

- Training programs will need to be developed and implemented in order for DNR staff to understand how to implement the management options outlined in this policy (e.g. NPC condition ranking, invasive species management, fire ecology and applications).
- Phase 2 of the HCVF project includes development of monitoring approaches. Explicit monitoring efforts should be aimed at increasing understanding of community responses to various management approaches and in cases where rare species are present.

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