Interim Forest Management Policy for High Conservation Value Forests

HCV: Jack pine woodland – FDc23

Table 1. Key Statistics	Total Acreage	Acreage on HCVF (non-STL)	Acreage on HCVF (STL)
NPC Class			
FDc23 (Central Dry Pine Woodland)*	6,705 ac	1,158 ac	8 ac
NPC Type			
FDc23a (Jack Pine – (Yarrow) Woodland)	1,506 ac	0 ac	82 ac

Source: DNR Native Plant Community polygon dataset (may include non-DNR admin lands)
*Likely includes some jack pine yarrow woodland. Data in the class isn't always defined down to the type.

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

Location: Predominantly Hubbard and Wadena Counties, with additional acreage in Becker, Beltrami, Clearwater, Mahnomen, Cass, Todd, Morrison, Crow wing and Pine Counties.

Brief Description

Jack pine woodlands (FDc23) are dry-mesic pine woodlands found on sandy, level to gently undulating outwash deposits. Crown fires and surface fires were common historically. Jack pine (yarrow) woodland is the only recognized community type in this class. It's divided into two subtypes: the ericaceous shrub subtype, in which the canopy is dominated by jack pine with occasional red pine and paper birch; and the bur oak-aspen subtype, in which the canopy is strongly dominated by jack pine with occasional quaking aspen, northern red oak and bur oak.

Policy for Jack Pine Woodland (FDc23) within High Conservation Value Forests

The guidance below provide several management options for Jack pine woodland (FDc23), developed with the understanding that site context matters and that the condition and quality of a site will dictate management options. Tables 2-4 on pages 3 - 9 contain descriptions and consequence assessments for these various activities and provide the basis for the following recommendations. More information on the management objectives for HCVF sites can be found on the MN DNR website.

Recognizing the need for staff to have flexibility in selecting management practices that are most appropriate for any individual site, given its current level of ecological integrity (or condition rank[1]), use the recommendations below to make management decisions on FDc23 NPC sites.

[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 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.*

Harvest

Harvest approaches that facilitate natural regeneration and improve structural diversity are preferable on HCVF sites for their ability to maintain the ecological characteristics of this community.

Use a condition ranking assessment to determine appropriate management strategies.

- Identify the condition rank of the FDc23 NPC present on site by referring to the condition rank field in the DNR Native Plant Community polygon shapefile in ArcGIS. If the NPC present does not have a condition rank assigned, refer to the process identified in Appendix A below.
- Where highly-ranked sites have been identified (condition rank A, AB, B, BC), use the lightest-impact options to maintain the site, determined by site conditions and community growth stage, with increased tolerance for lower-intensity harvest options.
    - These management options include 'large group selection' (Table 2, option 1) and 'variable density harvest' (Table 2, option 2), which are most likely to maintain and potentially enhance this native plant community as they favor local central floristic jack pine genetics and retain more intact ground layer habitat and overstory structure.
- Where sites condition ranking is C or lower more intensive options such as a seed tree with reserves (Table 2, option 3) or clearcut with reserves (Table 2, option 4) may be applied, as site conditions require.

	Table 2. Harvest approaches for managing FDc23 NPC sites within HCVFs
#	**Approach, description and consequences**
1	**Large group selection (1-5 ac patches).** A harvest approach utilized in several case studies that retains ~50% of the mature overstory as a seed source and intact habitat. Small-moderate size patches (1-5 acre) are harvested in the first entry to establish regeneration gaps. Seed tree matrix should be harvested in subsequent (or adjacent) entries, as initial harvest gaps regenerate. Consequences: • Increased economic risk of reduced revenue due to retained seed tree matrix areas lost to wind events relative to options 2, 3, and 4. • Retains and favors local jack pine genetics in subsequent natural regeneration. • Provides the greatest amount of intact groundlayer habitat. • Logistical challenges exist for return harvest plans, which will require additional planning.
2	**Variable density harvest (e.g. skips, gaps, logger select).** A harvest approach of which we have a limited number of examples. Utilizes scattered retention of clumped seed trees and desired legacy components. Seed tree 'skips' should be harvested in subsequent (or adjacent) entries, approximately every 15-20 years, or as harvest gaps regenerate. Consequences: • Increased economic risk of reduced revenue due to retained seed tree and legacy areas lost to wind events relative to options 3 and 4. • Provides greater additional intact ground layer habitat relative to options 3 and 4. • Retains and favors local jack pine genetics in subsequent natural regeneration. • Logistical challenges exist for return harvest plans, which will require additional planning.

	Table 2. Harvest approaches for managing FDc23 NPC sites within HCVFs
#	Approach, description and consequences
3	**Seed tree w/reserves (either strips or scattered clumps).** A harvest approach utilized in several case studies. It retains ~25% of the mature overstory as either strips or scattered clumps as a seed source to regenerate the adjacent harvested areas. Seed tree areas are harvested in subsequent (or adjacent) entries. Orientation and size of the retention areas should factor in prevailing summer wind direction to facilitate seed dispersal. **Consequences:** • Some economic risk of reduced revenue due to loss of retained seed tree areas to wind events. • Provides some additional intact groundlayer habitat relative to option 4. • Retains and favors local jack pine genetics in subsequent natural regeneration.
4	**Clearcut w/Reserves (5% reserves).** A wide-spread harvest approach that removes the majority of the currently mature overstory in one entry, retaining 5% as either clumped or scattered trees. Clumped reserve areas are largely preferred, as they offer more wind firmness and ground layer refugia areas*. **Consequences:** • Provides the highest economic return. • Potentially reduces the number and quality of ground layer refugia areas. • Potentially introduces increased herbivory pressure. • Natural regeneration is possible following this approach, it is less likely with a smaller amount of retained seed sources.

*Ground layer refugia areas (aka. lifeboats) are undisturbed locations within a harvest block that retain representative groundlayer vegetation.

Additional harvest considerations

- These harvest options have been evaluated for impacts to this NPC, and contributors agreed that modifying the canopy component of this disturbance-dependent community does not alone present a negative impact to representative plant diversity. Instead, ground layer vegetation likely shifts between later and earlier growth stages according to shade and moisture tolerance characteristics.
- All of these harvest approaches are used to regenerate the stand. Harvest options 1, 2, and 3 provide continual seed input, facilitating natural regeneration, while option 4 allows for a limited initial chance of natural regeneration but often requires additional inputs (e.g. planting).
- Outright harvest deferral generally does not provide a desirable outcome, considering the disturbance history of this community. Therefore, deferral was not evaluated as a viable harvest decision, but could be considered for other resource goals (canopy composition, rare species, habitat considerations, etc.).
- Diplodia shoot blight disease may be a consideration when pine reserves are left. Where present, risk of Diplodia infection increases as the amount of susceptible reserves increases.
- Two-entry harvest approaches (seed tree, variable-density, group selection, etc.) and intermediate treatments will require field staff to evaluate adjacent harvest plans to facilitate merchantability of previously retained areas (e.g., timing adjacent red pine thinning harvests with jack pine seed tree/group harvests).

- Associated slash management approaches should also reflect this NPC's characteristics. A lop and scatter approach may provide additional, short-lived, seed supply. A pile and burn, or biomass harvest, approach could reduce the amount of nutrient inputs to the site- potentially limiting hardwood competition (mesification) over time.

Site preparation

Use a condition ranking assessment to determine appropriate management strategy.

- Identify the condition rank of the FDc23 NPC present on site by referring to the condition rank field in the DNR Native Plant Community polygon shapefile in ArcGIS. If the NPC present does not have a condition rank assigned, refer to the process identified in Appendix A below.
- Where site condition ranking is A, AB, B, or BC use less intensive options including prescribed fire when possible, full-tree skidding, or mechanical site prep- both soil and vegetative, depending on site conditions. Lower intensity site preparation approaches (Table 3, options 1-4), are most conducive to maintaining and/or enhancing the ecological integrity of this native plant community. Fire is an integral aspect of this community's natural history and many of the plant species found in FDc23 are fire-adapted (jack pine included). Using this natural disturbance agent to prepare a site for regeneration includes the additional benefits of removing woody debris (which can lead to site enrichment and greater hardwood competition) and activating fire-dependent plant's seeds in the soil seed bank. Mechanical and harvest disturbance approaches also offer vegetation control and seed bed preparation, but avoid the possibility of unintended herbicide impacts (compositional shifts in plant and animal assemblages, off-site drift, etc.).
- Where sites condition ranking is C or lower, more intensive options including spot, band or broadcast application of herbicide may be used as site conditions require. Staff should refer to the MN DNR Op Order 59 on Pesticide Use for direction on herbicide use considerations, and apply an integrated pest management approach, where use of herbicides should only occur after all non-chemical treatment methods have been evaluated first.

	Table 3. Site prep approaches for managing FDc23 NPC sites
#	**Approach, description and consequences**
1	**Harvest scarification only- full tree skidding.** Uses harvest techniques to prepare the proper seedbed needed for seedlings to survive. Consequences: • No direct cost because cost is incorporated into the timber sale. Least costly of all site-prep options. • Highly variable outcomes due to harvest season and slash management, and least effective of the options in creating proper seedbed conditions consistently across entire site. • Initial plant diversity is likely maintained; there is generally less soil exposure, the groundlayer is left mostly intact. • Potential for non-native species invasion is lower than in options 2, 4, 5, and 6
2	**Mechanical – soil exposure.** Uses various equipment other than that which is used during harvest to prepare the proper seedbed for seedlings to survive (anchor chain, brakke, disc trencher, patch scarifier etc.) Consequences:

	Table 3. Site prep approaches for managing FDc23 NPC sites
#	**Approach, description and consequences**
	• Moderately expensive depending upon contract size. Similar in cost with all other options, other than possibly prescribed fire in option 4. • Initially more expensive than #1 and may be used in combination with #5 or #6. • Higher effectiveness in preparing conducive crop tree seedbed conditions consistently across entire site than options 1 and 4. • Initial plant diversity is likely maintained but more area might be impacted by this form of site prep. • There is likely greater ground layer disturbance, and risk of invasives from soil exposure than in option 1, but more localized effects.
3	**Mechanical – vegetation control.** Uses various equipment to reduce vegetative competition and creating optimum growing conditions for newly established seedlings (roller chopper, brush saw, mowing, etc.). Consequences: • Moderately expensive depending upon contract size. Similar in cost with all other options, other than possibly option 4. • May be used in combination with options 2, 4 and 5. • Initial plant diversity is likely maintained; generally less soil disturbance than options 1 or 2. • Reduces shrub competition in the short term. • Higher effectiveness in preparing conducive crop tree seedbed conditions consistently across an entire site than options 1 and 2. • Risk from invasive/competitive species is lowest when compared to the other options.
4	**Prescribed fire.** Using prescribed fire to prepare the proper seedbed needed for seedlings to survive. Consequences: • Can be more expensive than all other options depending on complexity and size of burn unit. • Limited ability to apply this approach each year due to funding, staffing, weather, terrain, and the urban interface. • Mixed effectiveness in preparing the seedbed, controlling competition and promoting germination due to weather, slash, timing etc. • Plant diversity is maintained; fire-dependent species likely to be favored. • Potential for positive community response, including from fire-dependent species stored in the seed bank. • Risk from invasive/competitive species is moderate initially, but is reduced as fire-dependent species take hold.
5	**Herbicide (spot/band).** Apply species-selective herbicide on targeted competing vegetation over a low percent of the site to reduce competition. This technique temporarily sets back competing vegetation and creates more optimal growing conditions for newly established seedlings (back pack, band application). Consequences: • Moderately expensive depending upon contract size. Typically more expensive than options 2 and 3. • High effectiveness in reducing vegetative competition on a micro site level. • Less vegetative control over entire site than option 6.

	Table 3. Site prep approaches for managing FDc23 NPC sites
#	**Approach, description and consequences**
	• Species-selective herbicides may reduce collateral damage; areas of untreated/non-targeted species are generally intact. • Plant diversity is likely maintained, localized impacts potentially offset by unaffected areas. • Risk from invasive/competitive species is low to moderate initially because impacts are localized.
6	**Herbicide (broadcast).** Use aerial or ground equipment to apply herbicide widely across the site to reduce competition. This technique temporarily sets back competing vegetation and creates more optimal growing conditions for newly established seedlings. **Consequences:** • Moderately expensive depending upon contract size. Typically more expensive than options 2 and 3. • Higher effectiveness in preparing crop tree seedbed conditions than option 5. Often used in tandem with options 2 and 3. • Species-selective herbicides may reduce collateral damage. • Plant diversity maintenance is uncertain. Short-term direct groundlayer mortality/impacts across larger treated area; herbicide selection may create localized effects. • Risk from invasive/competitive species is moderately high due to amount of area treated.

Additional site prep considerations

- The site preparation options are directly correlated to the harvest options used, the initial regeneration methods planned/used and the specific site conditions.
- Many of these same considerations/consequences can apply to release treatments once seedlings are established, but for this guidance we only considered these options as site preparation treatments.
- Various factors limit the availability and potential success of several site-prep options, especially prescribed fire and herbicide spot treatments. Key factors include available credentialed contractors and timing of when they can do the work.
- While uncertain, there is potential for herbivores to be attracted to any activity that disturbs and exposes soil or introduces chemical scents. When operating in high browse areas, it may be worth considering site prep approaches that reduce the amount of exposed soil to avoid deer attention.

Regeneration

Use a condition ranking assessment to determine appropriate management strategy.

- Identify the condition rank of the FDc23 NPC present on site by referring to the condition rank field in the DNR Native Plant Community polygon shapefile in ArcGIS. If the NPC present does not have a condition rank assigned, refer to the process identified in Appendix A below.
- Where highly-ranked sites have been identified (condition rank A, AB, B, BC), use practices that reflect or emulate natural regeneration processes as much as possible.
    - Natural seeding (Table 4, option 1), which maintains the local jack pine genetics of a site, is the preferred reforestation practice for jack pine woodlands on HCVF sites.

    - Other approaches that reflect or emulate natural regeneration processes include artificial seeding (Table 4, option 2), a combination of seeding and planting (Table 3, option 3), or lower density planting (Table 4, option 4) to regenerate the site may also used.
    - When using artificial seeding, a combination of seeding and planting, or lower density planting, ensure seed sources are from the central floristic region.
- Where sites condition ranking is C or lower, higher density planting may also be considered as a reforestation option (see table 4 below for more information).
- In general, reforestation plans should reflect the Native Plant Community Tree Suitability Table for FDc23 NPC, with emphasis on regenerating jack pine from the central floristic region (southern Beltrami, Cass, Hubbard, Wadena, Crow Wing counties).

General: The highest ranked sites may also be places where we target restoration dollars to enhance the "high conservation value", as resources are available (examples include intermediate treatments, native groundlayer companion seeding, etc.).

	Table 4. Regeneration approaches for managing FDc23 NPC sites within HCVFs
#	**Approach, description and consequences**
1	**Natural seeding**. Relying on residual trees on a site to provide adequate seed to restock the stand over time. This is dependent upon reserves within the harvest area or adjacent stands/trees. Consequences • Lowest economic cost as there are no direct costs for planting, seeding or labor costs. • Moderate-high uncertainty of achieving eventual stocking goals. • There is more uncertainty with natural seeding than artificial seeding related to seed distribution across a site, however natural seeding allows for a longer period of seed release from retained seed trees. • If the seed trees are central floristic native trees, this is the only management approach where jack pine (and red pine) genetic integrity is guaranteed and maintained. • Good natural seed years vary by species and are predictable generally only in the short term. • Germination rates from natural seeding will vary each year and are generally unpredictable due to weather, rodent populations, seed bed characteristics etc. • This is commonly used as a first prescription followed by planting or seeding where needed. This is dependent upon harvest timing and methods used and must be part of the sale planning.
2	**Artificial seeding.** Seeding either by aerial or ground application in fall or spring. Aerial contracts tend to be larger statewide projects and ground seeding is done on a smaller case by case scale. **Consequences:** • Incurs slightly lower initial economic cost than the seedlings and labor costs of option 4. • Seed germination is generally viable for up to 3 to 5 years. • Moderate uncertainty of achieving eventual stocking goals; less uncertainty than with natural seeding due to frequency of seed availability. • May require additional seeding or interplanting if survival is low. • Currently used over multiple types of seed bed preparation with mixed results.

	Table 4. Regeneration approaches for managing FDc23 NPC sites within HCVFs
#	Approach, description and consequences
3	**Combination: plant and seed.** Planting and seeding combination. This may be done when there are not enough well-spaced residual trees of the desired species or a species mix is desired. **Consequences:** • If planting and using natural seeding then this would have the same initial cost as if just planting (option 4). • If planting and using artificial seeding, this would have the highest initial economic cost. • Low-moderate uncertainty in achieving eventual stocking goals. It provides more certainty for success. • Not a widespread practice, but favored in some work areas; currently used to diversify regen options, with mixed results. • If using natural seed, there is potential for some central floristic jack pine genetic integrity to be guaranteed. • If using natural seed, success is dependent upon harvest timing and methods used, and must be part of the sale planning. • Representative plant diversity may be reduced due to competition for growing space in the initial 5-10 years depending upon species. It may be lost for a longer period depending upon site prep method. • Animal diversity may be reduced due to loss of habitat quality for the initial 5-10 years depending upon the species.
4	**Planting (lower density, 500-600 tpa).** Hand-planting closer to the central floristic regeneration standard (300-500 tpa at year 1) to address uncertain losses as well as NPC woodland characteristics. **Consequences:** • High initial economic cost for seedlings and labor, but less than #5. • Moderate-low uncertainty of achieving eventual stocking goals when planting lower densities. • May require additional interplanting if survival is low. • Currently limited to sites without high deer browse issues or with less emphasis on timber production.
5	**Planting (higher density, 800-1000 trees per acre, tpa).** Hand-planting above the central floristic region regeneration standard (300-500 tpa at year 1) to compensate for uncertain losses from drought, deer browse, and mortality. **Consequences:** • High initial economic cost for seedlings and labor. • Least uncertainty of achieving eventual stocking goals. • May require follow-up pre-commerical thinning if seedling survival (or additional recruitment) is high or additional interplanting if survival is low. • Representative plant diversity may be reduced due to competition for growing space in the initial 5-10 years, depending upon species and may be lost for longer depending upon site prep. • Animal diversity may be reduced due to loss of habitat quality for the initial 5-10 years, depending upon the species. • Commonly used in predicted high deer browse areas.

Additional regeneration considerations

- Germination and seedling survival are dependent upon weather, seedling planting technique, seedbed quality, and deer browse pressure, so there is a moderate amount of uncertainty with all of these treatments.
- Area staff generally do not have control over the timing of aerial seeding depending on the contract season.
- Regeneration surveys currently take place each year to assess reforestation efforts. Based upon these assessments, subsequent interplanting/seeding may be needed for any of these approaches.
- Using alternative known woodland species for reforestation may be beneficial to address browse and diversity considerations.
- All artificial seeding or planting approaches should utilize central floristic, semi-serotinous cone jack pine.
- There may be a potential for increased deer browse if there is a higher nutrient content of nursery-sourced seedlings utilized for regeneration.

Effects on the long-term representative native plant and animal diversity are not well documented. Monitoring needs to be completed relative to this for all of these management approaches.

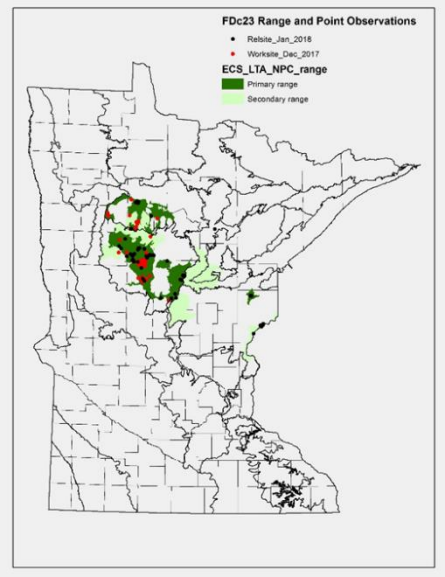

Figure 1. FDc23 Range and point observations, Almendinger 2018.

Native Plant Community Description

The jack pine woodland native plant community (NPC), FDc23, is a dry-mesic pine woodland on sandy, level to gently rolling outwash deposits. The canopy is interrupted to continuous (50-100%) and strongly dominated by jack pine. Common understory species include Lindley's aster, mountain rice grass, yarrow, and broad-leaved evergreen species such as wintergreen, pipsissewa, and bearberry. High-quality sites support a significant component of prairie species in openings (e.g. big bluestem, hoary puccoon), carpets of mosses, patchy

distribution of low shrubs (e.g. blueberry), and low to patchy distribution of taller shrubs (e.g. American hazel). Further information on the FDc23 NPC can be found on the MN DNR website.

This community was historically maintained by crown and surface fires, with a return interval of approximately 22 years, and is not viable long-term if fire is excluded. Due to the lack of fire for the past ~100 years, the documented condition of most of the remaining sites with this community are ranked as B to BC quality (scale of A, excellent, to D, poor), which suggests that most of the known sites with this community are losing their ecological integrity and viability. There are currently fewer than 8,000 acres of these woodlands left on MN DNR-managed lands and they are ranked as 'Critically Imperiled to Imperiled' at the state level (S1S2) and 'Imperiled' at the global level (G2), reflecting their restricted range, limited number of occurrences, and risks from resource management activities.

This woodland community has four growth stages: young – from age 0 – 55 years, dominated by jack pine with a minor component of red pine; transition – from age 55 – 75 years, where there is a partial decline in overstory jack pine and increases in red pine; mature – from 75 – 155 years, where the woodland is dominated by jack pine mixed with red pine; and old – from age 155 years and older, where the woodland is dominated by jack pine of several age classes mixed with both red and white pine. Currently almost all known occurrences of this community are in the young or transition growth stages.

As a woodland community, the overstory tree density is relatively variable, falling between a savanna and forest in terms of overstory stocking. Recent research has confirmed that the jack pine component of this community may initiate through several successional pathways. One route is the gradual invasion of a relatively open site over time, with several age classes of jack pine present. Another route is the rapid, dense regeneration of jack pine following a stand-replacing disturbance event on a site previously occupied by mature jack pine trees.

Naturally-occurring jack pine trees in Minnesota can exhibit different physiological traits depending on their location relative to Minnesota's glacial history and selective pressures from the resulting disturbance regimes. Jack pine in the northern portion of the state (northern floristic region) have developed as forests since glacial retreat (10,000 years ago), and these trees exhibit specific silvic characteristics including: closed-cone ecotype: predominantly serotinous, dense stocking, self-pruning, and thin bark. Jack pine in central Minnesota (central floristic region) are the result of a gradual afforestation from initial prairies/woodlands following deglaciation, and exhibit characteristics such as: open-cone ecotype (semi-serotinous), sparse stocking, persistent branches, and thicker bark. These central floristic/open-cone traits are the predominant jack pine ecotype present in FDc23 communities.

Following guidance in the 2009 MN DNR Chippewa Plains-Pine Moraine and Outwash Plains (CPPMOP) Subsection Forest Resource Management Plan (SFRMP), where most of the FDc23 NPC is located, these woodlands have been managed as opportunities exist for more open conditions (25-100% canopy closure), often with prairie grass-dominated openings, lower stocking levels than forests, and a longer establishment period (5 to 30 years). Typical management focuses on early growth stages (normal rotation ages) to maintain a woodland dominated mostly by jack pine with red pine, aspen, bur oak, birch, and/or white pine.

Multiple issues exist that often make managing FDc23 NPC sites as described in the above-mentioned MN DNR plans challenging. Some of the most significant include deer browse, prescribed fire limitations, unpredictable

weather, jack pine genetic material mixing, competition from other woody species and non-native invasive plant species, timing of management activities, and different targets for management success.

- Deer damage to tree seedlings is variable but seems to have increased over the years, including in some locations where deer densities are not known to be high. While field staff attempt to assess the potential for deer damage prior to regeneration operations, the resources needed to annually protect seedlings from deer browse can be significant. Further, annual budcapping does not necessarily ensure success (i.e., a free-to-grow stand of jack pine). Funding necessary to protect investments in this community needs to be stable until the trees are above deer browse height and free-to-grow, a process that can take anywhere from 5 to 10 years.
- The prescribed fires that occur today do not fully replicate the extent of historical wildfires, nor their timing, intensity, or severity. Limited staff availability and funding, in addition to increasingly common conflict in the wildland-urban interface, restrict fire activity for many jack pine woodland sites.
- This community exists on sites susceptible to weather extremes (precipitation and wind events), which are becoming more common. Successful tree regeneration is dependent upon rain at the right time for germination and seedling survival. The logistics of monitoring and planning regeneration operations for these changing conditions can be difficult.
- There is currently an inability to ensure jack pine seed and seedlings are coming from central floristic region, semi-serotinous stock. Planting closed-cone ecotype jack pines outside of the northern floristic region has reduced the opportunity for managers to naturally regenerate open-cone jack pine through seed tree approaches. Mixing northern and central floristic region jack pine genetics results in more serotiny and less resistance to pine-oak gall rust in the FDc region. The gene for serotiny is likely carried by pollen, so the presence of non-native (northern) jack pines in FDc23 communities may threaten the genetics of the native population.
- Expansive colonies of tall shrubs and other tree species (e.g. hazel and aspen), as well as invasive plant species (e.g. Kentucky bluegrass, Canada thistle) often compete with jack pine seedlings for soil moisture and growing space, further challenging successful regeneration. Sites with abundant competition are often the product of either fire suppression or other past management practices, and often require higher intensity site preparation practices to establish a jack pine cohort.
- It can be challenging to apply some management activities at the most opportune time for regeneration success. For example, aerial seed application timing may not coincide with ideal local weather conditions, and timing of harvest entry may not be ideal to maximize natural regeneration goals.
- Additionally, programs within MN DNR continue to be challenged by different definitions of success when managing FDc23 (e.g. full stocking, representative groundlayer, habitat characteristics).

Figure 2. FDc23 community at Lyons State Forest.

Management considerations that informed guidance development

The following list of considerations and recommendations are relevant for overall decision-making in this community:

- Management plans should be based upon site-specific conditions and community growth stage, while also recognizing site objectives from approved plans (e.g. SFRMP, Wildlife Management Areas, etc.).
- Maintain a presence of big bluestem and other prairie species within FDc23 sites to facilitate jack pine regeneration and provide an alternative to non-native species when the climate becomes inhospitable to the existence of woodlands on these sites.
- Use prescribed fire when possible to provide a proper seedbed, reduce competition, and aid in germination of jack pine and other ground layer species.
- Several plant and animal species are closely associated with this dry, sandy, pine woodland at growth stages when it either has a more open canopy or is more structurally or compositionally-diverse (i.e., the early, mature, and old growth stages). These species include: three-toothed cinquefoil, ram's head orchid, Hill's thistle, slender ladies'-tresses, eastern towhee, whip-poor-will, pine warbler, American badger, and others. Some of these species may be common elsewhere, but this habitat is critical for them in this geographic region. When present on a site, the habitat needs of these species should be considered during site-level planning, as management activities may have the potential for adverse impacts.
- Favor sourcing jack pine from known semi-serotinous sites of the central floristic region (e.g. Hubbard, Wadena counties). A consequence of losing central floristic region jack pine genetics is the loss of a semi-serotinous seed source in this community. This loss could hamper or completely eliminate the option of naturally regenerating FDc23 using on-site seed.
- Refer to the Pine Regeneration Decision Key at the beginning of any planning effort for these sites. Where deer browse concerns exist, protection measures may be a requirement until the terminal leader is beyond browse height.
- Conduct annual regeneration surveys until trees on pine-dominated sites are considered free to grow, following regeneration monitoring protocols to help clarify any failures and successes. The 2016 MN DNR Regeneration Monitoring Procedure and Standards document contains updated stocking objectives for jack pine woodlands.
- Select and design reserve areas to meet multiple objectives, including seed sources for tree regeneration and refugia habitat for pine woodland species.

- Central-floristic jack pine matures at a young age, so retaining wind firm clumps of younger trees can provide a viable seed source while minimizing impact to economic return.
- When identifying reserves, consider wind-firmness, seed sources and genetics, groundlayer plant community complexity, etc.
- In certain cases, some of the more intensive harvest, site prep and regeneration efforts might be the only cost-effective options available to successfully regenerate a jack pine component in an acceptable timeline to meet certain management objectives (i.e. heavy brush competition, high deer browse risk, northern floristic jack pine present).
- When applying more intensive site-preparation techniques, incorporate intentional "skip" areas avoided by treatments to maintain groundlayer diversity through the subsequent stand establishment period.

Next steps and additional needs

- Complete the condition ranking process for sites that have not yet been ranked (85% of sites have not yet been ranked). See Appendix A for related condition ranking plan.
- Define floristic-region seed zones for jack pine to increase the likelihood that genetically appropriate semi-serotinous jack pine are present on site for seed production and regeneration. Work with the state forest nursery to provide central floristic region jack pine stock for planting and/or seeding on these sites. Avoid planting jack pine stock from the northern floristic region as the presence of non-native (northern) jack pines in FDc23 communities may threaten the genetics of the native population.
- Encourage a multi-divisional approach to utilizing prescribed fire and greater commitment of staff and funding to increase the potential for more widespread prescribed fire applications.
- There is a need for deliberate monitoring efforts aimed at increasing understanding of the FDc23 community responses to various silvicultural approaches (e.g. case studies, supplemental regen survey info). When planting for regeneration, staff are encouraged to use less than full stocking to better attain a jack pine woodland type. Some individual species responses are fairly well understood, but community related responses are not well documented. The effort to complete this monitoring needs to be a Department-wide priority applied through shared resource allocation (staff, time, funding), and using a standardized, agreed-upon approach.
- Pursue community-specific field days/tours to foster shared understanding of the management options, and issues and challenges associated with this native plant community.

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Appendix A. Native Plant Community Condition Ranking Process

Summary

Project teams for school trust land forest management guidance and high conservation value forest (HCVF) forest management guidance have proposed using a native plant community condition ranking to guide forest management for certain rare and/or sensitive native plant communities, such as jack pine woodlands (FDc23). In some instances, the condition ranking for native plant communities is complete. However, for jack pine woodlands only 15% of this native plant community currently mapped has an assigned condition ranking. Below, we propose a plan to complete the condition ranking for this native plant community so we can implement this forest management policy.

Plan

1. EWR - MBS staff will translate, as necessary, the Condition Ranking protocols into plain language.
2. EWR - MBS staff and/or Regional Ecologists to train Forestry staff (Area and Regional Ecological Classification Staff (ECS) program staff) and Fish and Wildlife staff (Area managers, Regional Forest Wildlife coordinators) in assessing and assigning condition ranks for jack pine woodland sites.
3. At the end of each 10-year stand selection process, before implementation begins, Forestry staff will identify stands that include this NPC, but have not been ranked (referring to "condition rank" field in DNR NPC polygon GIS layer). These stands should be deferred during the first 2-3 years of the 10 year planning process to allow for the condition ranking process to occur prior to harvest.
    a. Limit condition ranking to school trust land and HCVF acres
    b. Prioritize the Park Rapids Area, where most jack pine woodland acres are located
4. Trained staff will conduct condition ranking for those identified stands during the growing season months (June-August).
5. Following the field assessment, staff will update the corresponding NPC polygon in ArcGIS to include the condition ranking score, using a similar process as the NPC polygon database mapping (Regional ECS program or MBS program staff review/approval).
6. Site managers will use the condition ranks to guide forest management activities on these stands, as identified in the corresponding topic guidance materials.

Forestry Admin Area	FDc23 DNR admin acres (% of total)	FDc23 DNR admin Unranked acres (% of Area)
Backus	69 ac (1.0)	1 ac (1.4)
Bemidji	981 ac (14.4)	977 ac (99.6)
Little Falls	26 ac (0.4)	26 ac (100)
Park Rapids	5,702 ac (83.9)	5,184 ac (90.9)
Sandstone	19 ac (0.3)	19 ac (100)
Total	6,796 ac	6,207 ac (91.3)