Interim Forest Management Policy for High Conservation Value Forests

HCV: MHn45 NPC – Northern mesic hardwood (cedar) forest

Table 1. Key Statistics	Total Acreage	Acreage on HCVF (non-STL)	Acreage on HCVF (STL)
NPC Class			
MHn45 (Northern Mesic Hardwood (Cedar) Forest*)	69,938 ac	531 ac	2,979 ac
NPC type			
MHn45a (Paper Birch – Sugar Maple Forest (N. Shore))	15,385 ac	104 ac	1,109 ac
MHn45b (White Cedar – Yellow Birch Forest)	5,913 ac	20 ac	153 ac
MHn45c (Sugar Maple Forest (N. Shore))	43,906 ac	406 ac	1,718 ac

Source: DNR Native Plant Community polygon dataset (may include non-DNR admin lands)
*Includes some undefined MHn45a/b/c acres not classified down to NPC type.

Status: Depends on NPC type
MHn45a: Apparently secure; uncommon but not rare (S4 rank)
MHn45b: Globally Critically Imperiled to Imperiled (G1 or G2 rank)/ State Critically Imperiled to Imperiled (S1 or S2 rank)/ Noted in MFRC Site-level Guidelines as a "Sensitive Native Plant Community"
MHn45c: Vulnerable to extirpation (S3)

Location: Predominantly in Cook, Lake, St. Louis counties.

Brief Description

Northern mesic hardwood (cedar) forests are mesic hardwood and hardwood-conifer forests on sandy-loam soils in fire-protected sites on rugged, scoured bedrock terrain.

Policy for Northern Mesic (Cedar) Hardwood (MHn45) within High Conservation Value Forests

The ranges of management options outlined in Table 2 below are not necessarily distinct options as much as they are different ranges on a management continuum. The MHn45 community types express themselves in multiple ways that require multiple approaches from a management standpoint, from even-age paper birch management, to uneven age single tree harvests.

To meet the goal of maintaining and enhancing high conservation values on HCVF sites, the management policy focuses on natural processes, community maintenance, and support for other conservation values that are found within these matrixes. The guidance for making management decisions depend on the community type with consideration of the current covertype and tree species composition. Rather than being based on a rotation age, this community should be managed with an uneven age prescription that develops or maintains at least three defined age cohorts. Formulating a long-term desired future condition will help inform a specific management choice.

Note: MHn45b is the G1/G2 HCV under consideration in this policy. However, MHn45a and MHn45c can also benefit from attention to quality and adherence to the true expression of the native plant community to lead to

the desired productivity, resiliency, and health of the forest. As such, we include a set of recommendations for optional use where MHn45a and MHn45c are found within HCVFs.

Guidance for white cedar-yellow birch forest (MHn45b):

No harvest should be planned for this NPC type (option 1 in Table 2). This is based on the rarity of the community type (G1/G2) and inability to regenerate the dominant community species.

	Table 2. Management approaches for MHn45b within HCVFs
#	**Approach, description, consequences**
1	**No harvest – No timber sale planned.** No harvest occurs within stand due to stand development or maintaining/enhancing HCVs. May allow for TSI projects that improve quality ranking within the community. **Consequences:** • Provides for no immediate economic return. • May optimize natural diversity attributes to occur or develop • Allows for direct control of TSI activities throughout stand

Optional recommendations for paper birch – sugar maple (MHn45a):

- **If the stand is in a paper birch covertype, apply option 1 in Table 3 below:** use large gap harvest and thinning (regenerate 10-15% of stand acres through gaps). This approach targets regen shade intermediates to shade intolerants.
- **If the stand is in a northern hardwood covertype, apply option 1 or option 2 in Table 3 below:** use large gap harvest and thinning (regenerate 10-15% of stand acres through gaps) or use small gap harvest and thinning (regenerate 10-15% with gaps and single tree selection). This approach targets regen shade intermediates to shade tolerants.
    - The decision between choosing gap sizes is also largely dependent on the advanced regeneration of the targeted species. When advanced regeneration is already present, smaller gap sizes may encourage recruitment of these trees into the canopy. Where advanced regeneration is not present, larger gaps may be needed to provide an appropriate environment for the regeneration and recruitment of desired species.
    - These options mimic natural stand conditions more often, can provide management for a range of covertypes or the desired goals of the stand relating to other HCVs (e.g. maintaining birch gaps (1) vs canopy closure for interior forest birds (2)).

Optional recommendations for sugar maple forest (MHn45c):

For all covertypes in this native plant community type, apply options 1 - 3 in Table 3. This community type is typically older, with more shade tolerant species than shade intolerants. The amount of desirable open canopy will be based on other HCVs in the forest (e.g. large block forest, salamanders, and rare species) and current species composition.

- **Option 1:** Utilized conservatively, large gap harvests may mimic a serious wind event and be appropriate for increasing conifer components, encouraging forest health & quality, or as part of maintenance for a neighboring HCV community (i.e. Cliff Talus).
    - This option may increase species diversity within a stand, address forest health issues, and be appropriate to maintain an intermediate growth stage forest. However, this option may be detrimental to specialist species requiring closed canopy conditions.
- **Option 2:** Small gap harvests are a flexible approach to maintain large block habitat while still encouraging new recruitment of mid-tolerant species like white pine and yellow birch.
    - This option mimics single tree mortality and is appropriate for maintaining the spectrum of mature forest structures.
- **Option 3:** The reverse-J approach is meant to maximize the growing space within the forest stand. It is also one of the best methods for stand improvement and quality, by systematically addressing diameter and species distribution across the stand. Implementation of the reverse-J approach allows for deliberate marking and management to maintain forest interior/late successional species and features.
    - The reverse J is a standard silvicultural approach to managing a regulated hardwood forest based on a natural distribution curve. Here it can be most effective in maintaining sites where shade tolerant hardwoods are species desired for the primary future condition.

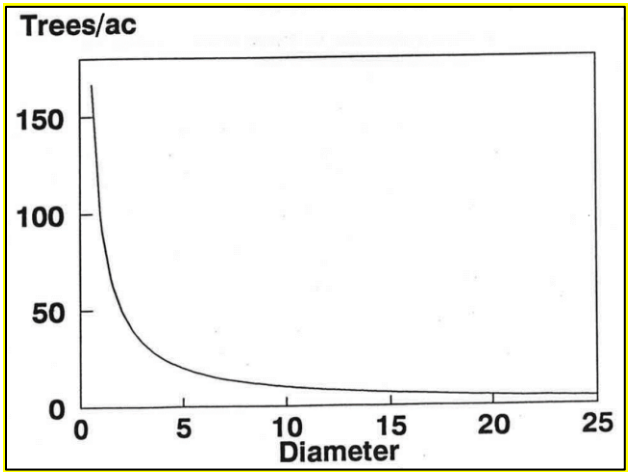

Figure 1. Reverse J showing tree density and diameter distribution.

	Table 3. Optional recommended management approaches for MHn45a and MHn45c within HCVFs
#	**Management Approach, description and consequences**
1	**Large Gap Harvest and Thinning (regenerate 10-15% of stand acres through gaps): Targets regen shade intermediates to shade intolerants.** A harvest approach that removes the current overstory in gaps varying in sizes (.5 to 4 acres) on a rotation of 15-20 years or upon a BA of 120 sq ft. Thinning of the remaining overstory may occur to encourage composition, health and vigor, but should not drop crown closure below 80-90% in remainder of stand. Favor frozen ground operations; scarify if regen is limited. Natural regeneration is expected. **Consequences:** • Provides for uncertain marketable/operable sale.

	Table 3. Optional recommended management approaches for MHn45a and MHn45c within HCVFs
#	**Management Approach, description and consequences**
	• Encourages and maintains structural, species, abiotic diversity – keeps canopy closure higher throughout the stand. • Minimizes impact to microtopography due to increased ability to direct and distribute activities. • Mimics natural disturbance regime. • Allows for management of shade intolerant species such as paper birch.
2	**Small Gap Harvest and Thinning (regenerate 10-15% of stand acres through gaps): Targets regen shade intermediates to shade tolerants.** A harvest approach that removes the current overstory in gaps varying in sizes (.1 to .5 acres) on a rotation of 15-20 years or upon a BA of 120 sq ft. Thinning of the remaining overstory may occur to encourage composition health and vigor, but should not drop crown closure below 80-90% in remainder of stand. Favor frozen ground operations; scarification not appropriate. Natural regeneration is expected. Localized plant and TSI if regen fails. **Consequences:** • Provides for uncertain marketable/operable sale • Stand is closer to natural structural, species, abiotic diversity – keeps canopy closure higher throughout the stand • Minimized impact to microtopography • More ability to direct and distribute activities • Mimics Natural Disturbance Regime • Allows for management of shade intermediate species such as yellow birch, northern red oak, and white pine.
3	**Reverse "J" Harvest – Tree diameters are managed to maintain a natural distribution (see Fig. 1 above).** A harvest approach that removes the trees in the current overstory to meet the desired diameter at breast height (DBH) and species distribution on a rotation of 15-20 years or upon a BA of 120 sq ft. Spatial distribution or gaps created based on application of diameters and species removed. Favor frozen ground operations; scarification not appropriate. Natural regeneration is expected. Localized plant and TSI if regen fails. **Consequences:** • Provides for time-consuming sale setup and administration with an uncertainty in marketable/operability • Ideally mimics the natural structural, species, abiotic diversity • May keep canopy closure higher throughout the stand • Variable impact to microtopography • Some ability to direct and distribute activities through entire stand. • Mimics single tree mortality • Best for management of shade tolerant species such as sugar maple, basswood, and white spruce; but can apply to intermediates

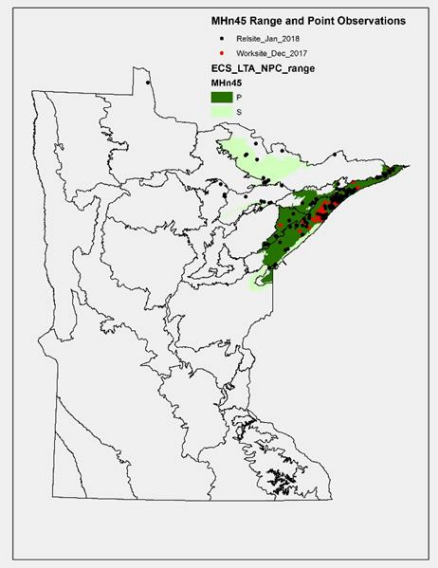

Figure 2. MHn45 range and point observations, Almendinger, 2018.

Native Plant Community Description

MHn45 are mesic hardwood and hardwood-conifer forests on sandy-loam soils in fire-protected sites on rugged, scoured bedrock terrain. This class of Native Plant Community (NPC) is currently subdivided into 3 types:

- MNn45a: Paper Birch – Sugar Maple Forest (North Shore) – S4 NPC
- MHn45b: White Cedar – Yellow birch Forest -- G1/G2 & S1/S2 NPC
- MHn45c: Sugar Maple Forest (North Shore) – S3 NPC

Within Minnesota, this NPC is primarily concentrated along the shore of Lake Superior (Figure 2). Viable MHn45 communities are typically patches of old forest providing habitat for forest interior species. Complete stand replacement disturbance occurred infrequently, on the scale of multiple thousands of years between re-initiation events. Due to this factor, quality MHn45 forests are self-sustaining.

High quality MHn45 forests are characterized by near continuous tree canopy cover with filtered light, patchy shrub cover, and variable ground cover. Old-growth stage forests are often dominated by sugar maple, white cedar, or yellow birch, but may include other co-dominants such as white spruce or heart-leaved birch. Advanced regeneration, seed trees, and organic seedbeds are always present as forest legacy. Specialist species (Figure 3) in both the canopy and the ground layer require fine-scale abiotic conditions -- tip-up mounds/pits, well-decayed woody debris (nurse logs), shallow-to-bedrock soils, wet-mesic drains and depressions, freeze-thaw micro-disturbances of mineral soil, wetland edges – to regenerate and recruit. MHn45 communities are critical habitat for a number of rare plant and animal species, including but not limited to uncommon ferns, spring ephemerals, forest interior birds, and spotted salamanders. The forest matrix often contains inclusions of other small patch communities, including vernal pools, rock outcrops, drainages and depressions, and areas of freeze-thaw micro disturbances.

Forest legacies including pit and mound topography, snags, and coarse woody debris (CWD) play key roles in the health and function of MHn45 communities. Often, these features provide important micro-niche habitat for plants and animal species. Young growth stages of MHn45 communities should have legacies of various sized snags and downed logs. Downed logs often act as nurse trees, allowing species such as white cedar and yellow birch to establish amidst a sea of sugar maple. As the stand ages, the amount of snags and CWD decreases and the level of decay increases. The community transitions into the older-growth stage with scattered but ever present advanced regeneration, CWD, and snags as patchy windthrow and individual tree mortality occur.

Figure 4. Expressions of MHn45b (White Cedar- Yellow Birch Forest) across subsections

Subsection/Community location	*Landscape Position*
North Shore Highlands **Small to medium patches within MHn45 matrix**	• *Lower/toe slopes between MHn45 and bodies of water* • *Adjacent to riparian or lowland forest classes* • *Small wet-mesic swales, first order drainages where micro-disturbance prevents sugar maple dominance*
Laurentian Uplands **Toimi Uplands** **Small to medium patches within FDn43 matrix**	• *Undulating terrain between FDn43 or lowland forest classes* • *Silt loam soils*
Nashwauk Uplands **Small patches**	• *Lower/toe slopes between MHn35 and wet cedar (WFn53)* • *Mid-slope on north aspects of MHn35 with noticeable subsurface water movement*
Littlefork Vermillion Uplands **Border Lakes** **Islands in peatlands or lakes**	• *All mid-low slope positions- dropping out of upper slopes as bedrock is exposed* • *May occur in other settings, not sufficiently documented*

Ecologically distinct, differences between the native plant community types MHn45b and MHn45c exist, and lack of recognition of separate communities often lead to poor management decisions. MHn45c has abundant sugar maple in all growth stages, which MHn45b usually lacks, or contains in reduced amounts when found within the MHn45c matrix. MHn45b has multiple expressions across subsections (Figure 4), although is typically characterized by large yellow birch with canopy co-dominants of any of the following – white spruce, white cedar, heart-leaved birch, white birch, and balsam fir. Super canopy white pine or white spruce are occasionally present, although frequently have been reduced due to past management.

Indicator plant species found in MHn45 communities

Specialists - Species that require a narrow range of habitat conditions to grow and reproduce:

- White cedar
- Yellow birch
- Eastern hemlock
- Var. Botrychium species
- Carolina spring beauty
- Braun's holly fern
- Green-leaved rattlesnake plantain

Generalists - Species that commonly occur and do not have exacting habitat requirements:

- Sugar maples
- Basswood
- Large-leaf aster
- Beaked hazelnut
- Canada mayflower
- Blue-bead lily
- False Solomon's seal

Conservation Needs

MHn45 plant communities persist indefinitely in unmanaged states. Management of these forests for wood products requires emulation of fine-scale tree mortality and replacement, maintenance of the "reverse-J" diameter distribution, and careful attention during harvest procedures to reduce additional unwanted disturbance. There is nothing to suggest that stand-replacement disturbance applies to this community, or is applicable in silvicultural system approaches. Silvicultural tactics in MHn45 communities should tend to resemble stand improvement harvests, and tending desirable advanced regeneration into the canopy.

The greatest potential consequences of management are altered hydrology from soil compaction or rutting, altered forest floor moisture, humidity, temperature, and light conditions due to canopy removal, and the introduction of invasive/generalist species.

Management and silvicultural considerations that informed policy development

- Management for wood products can occur while maintaining a viable MHn45 community
- Community naturally self-sustains so no active management is required
- Management should strive to emulate fine-scale disturbance with selective harvesting
    - Small, single tree openings or gaps most closely emulate single tree mortality
    - Canopy gaps should be kept to the smallest size necessary for regeneration goals
        - Maintain filtered light conditions and humidity for specialist species
        - Results of too much canopy removal may result in the creation of conditions conducive to introducing invasives or generalists to the detriment of sensitive species
        - Ensure successful regeneration of openings/gaps as desired for community type
- Focus on using or manipulating existing advance regeneration before removing canopy trees
    - Make sure that the resulting light regime will favor the desired species
    - Ensure advanced regeneration is in good condition (health and vigor) and will respond to release
    - Pay attention to regeneration needs not met by just the correct light regime:
        - Seed availability among residuals (or consider seeding or release of seed tree crowns)
        - Seedbed requirements (legacy organics or consider scarification)
        - Recruitment needs (reducing root competition, cleaning, release)

- Conserve fine scale abiotic conditions
    - Conserve soil organics and nutrients, particularly coarse debris in an advanced state of decomposition
    - Frozen soil conditions are preferential for harvest operations
        - Minimize soil compaction, which may lead to run off, erosion, and reduced productivity
        - Scarification may be needed to encourage regeneration of species like yellow birch. Soils and organics, should be taken into consideration along with the size of the disturbance, to reduce potential negative impacts.
    - Avoid altering existing micro-topography
    - Conserve or create complex structure (e.g. large diameter nurse logs)
- Focus on high-quality, valuable species
    - Be willing to allow for or cull non-merchantable species where they serve the purpose of shelter, training boles of valuable trees, or can serve as future coarse substrate.
    - Management is an iterative process over time optimizing past efforts toward maintaining/enhancing viable community types
- Practice "come-clean, go-clean" strategies
- Minimize roads and skid trails
    - Plan out for long-term management use for multiple entries

Constraints/Challenges

- Continuing health and vigor issues (i.e loss of upland cedar, birch and maple decline)
- High white-tailed deer populations (currently 18.5 deer/km^2)
- Marketability of sale
- The inherently small size of communities may be problematic for management
- Maintaining or enhancing species diversity is difficult
    - Simplification risk, particularly maple overtaking
- Management experience/expertise can be limited
- Climate change affects future composition
    - Optimize community resiliency

Threats to viable MHn45 communities

- Failure in silviculture approach
    - Failure to recognize MHn45b as its own community (see Class Profile in Additional Sources)
    - Over simplification of silviculture application
    - Lack of follow through and investments in development projects
    - Management that favors short term goals over long term goals (i.e. wood vs. quality)
- Invasive native and non-native organisms
    - European earthworms disrupt duff layer simplifying plant community
    - Generalist native species can out-compete specialists
- Erosion and compaction of silt or finer-based soils
- Continuing health and vigor issues (i.e. loss of upland cedar, birch and maple decline)
- High white-tailed deer populations (<8 deer/km^2 threshold is needed for successful recruitment)

- Climate change affects future composition
    - Optimize community resiliency

Next steps and additional needs

Phase 2 of the HCVF project includes development of monitoring approaches. In this phase, explicit monitoring efforts should be aimed at increasing understanding of community responses to various silvicultural approaches. Provide NPC and type-specific training with field days/tours to foster shared understanding of issues and challenges. Continue this education to improve and apply best hardwood silvicultural practices to meet the community type objectives. Encourage adaptive management projects to learn more about cedar and yellow birch regeneration in hardwood forests outside of HCVFs.

Additional Sources

Wisconsin DNR Silviculture Handbook
Michigan DNR Silvics and Management Guidance Manual
Argonne Experimental Forest
MHn45 Class Profile

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