Generic Desired Future Conditions for Major Forested Natural Communities within Biodiversity Stewardship Areas on DNRE-Administered Lands

Introduction:

This document contains Desired Future Conditions (DFCs) for forested natural community types that occur on DNRE-Administered lands within Biodiversity Stewardship Areas (BSAs). BSAs are being identified to establish a network of intact, functional examples of Michigan's native ecosystems. These DFCs are essentially vision statements for the desired future composition, structure, and function for a subset of forested natural communities that occur in BSAs. These DFCs are being developed for DNRE planning processes, where in conjunction with other documents (such as Regional State Forest Management Plans, and silvicultural guidelines for BSAs) they will provide direction to DNRE field staff for the sustainable management of forested natural communities in BSAs. It is important to keep in mind that BSAs throughout the State will not be comprised of a singular, homogenous community types, but rather will be complex associations of multiple community types with regionally variable structure, composition, and size configurations. For this reason, BSA-specific DFCs will need to be crafted to reflect the current regional-specific conditions (structure, composition, and size) of natural communities in each individual BSA.

BSAs are a planning designation, not a legal designation. It is also important to recognize a distinction between BSAs and Ecological Reference Areas (ERAs). While both are based upon the framework of the MNFI Natural Community Classification System, ERAs are focused on singular endangered, threatened or rare communities of the highest quality or reference condition, where maintaining that condition is the highest and exclusive priority. Conversely, BSAs rarely focus on a singular community type, but are most often complex associations of multiple community types. All BSAs (especially matrix level BSAs) will not necessarily be comprised of or even contain examples of reference condition communities, and while the conservation of biodiversity through maintenance or restoration of natural communities is a high priority value for management in BSAs, it is not intended to be the exclusive value or use. Historical or existing land uses found to be compatible and already in place will continue and "new" uses may be allowed if they will not detract from the ability to achieve desired future condition of the BSA (or identified natural communities within the BSA) but all uses will be assessed for their impacts and possible alternatives within DNRE planning processes. BSAs are proposed, vetted, and approved with the knowledge that some legacy uses, particularly existing public uses, will continue as long as they remain compatible and some other uses (such as timber and mineral management) may need to be modified, mitigated, or phased out over time to help achieve the desired future conditions. The natural community DFCs desribed in this document are intended to reflect this concept of use.

This is a technical document intended for use by professional DNRE staff, which contains terminology that is not in common societal use. To aid in understanding the content of this document, a limited glossary is located at the end to provide further definition of some key words and phrases.

DFC Components:

The following characteristics are used to describe DFCs for each community in this document:

1. Site Suitability (Kotar * or GLO records)
2. Vegetative composition, structure, and function
    - Dominant understory and overstory vegetative species (trees, groundcover)
    - Minor species of importance
    - Stand Structure:
        - Typical overstory tree size (dbh, crown position i.e., supercanopy trees etc.)
        - Standing dead and down woody debris (if only described qualitatively or relative to today's forests)
        - Stand age class structure (even, uneven aged, two aged, or multiple even aged cohorts)
    - Landscape Composition: Proportion of landscape by successional class and age (adaptation of LANDFIRE models)
    - Regeneration (full or partial stocking)
3. Disturbance form and frequency
    - High Intensity (catastrophic, stand replacing events)
    - Low Intensity (i.e. native/naturalized insect/disease caused mortality, windthrow single tree fall gaps, low intensity fire events)
4. Stressors/Threats (Major pest, invasives, etc.) – (These are framed as statements of desired absence, low populations, or minor/endemic impact.)

* The Kotar habitat classification has not been completed for wetland areas and the southern Lower Peninsula.

Natural Communities Addressed:
DFCs for the following forested natural communities are listed in alphabetic order in the section that follows:

- Boreal Forest
- Bur Oak Plains (Extirpated) **
- Dry-mesic Northern Forest
- Dry-mesic Southern Forest **
- Dry Northern Forest (Jack Pine/Jack Pine-Hardwood Variant)
- Dry Northern Forest (Red Pine Variant)
- Dry Southern Forest **
- Floodplain Forest
- Great Lakes Barrens **
- Hardwood Conifer Swamp
- Lakeplain Oak Openings **
- Mesic Northern Forest
- Mesic Southern Forest **
- Northern and Southern Hardwood Swamp
- N. Wet Meadow-Shrub Thicket/Poor Fen/Poor Conifer Swamp/Muskeg/Bog (Weakly Minerotrophic to Ombrotrophic peatlands)
- Oak Barrens **
- Oak Openings **
- Oak Pine Barrens
- Pine Barrens
- Rich Conifer Swamp
- Rich Tamarack Swamp **
- Wet-mesic Flatwoods **
- Wooded Dune and Swale Complex

** Not yet completed.

Desired Future Conditions (DFCs) for Forested BSA Natural Communities:

Boreal Forest

1. Site Suitability: Stands are located on sand dunes, glacial lakeplains, and on thin soil over bedrock and cobble along the shores of the Great Lakes and on Great Lakes islands. Found locally inland on moderately to poorly drained lakeplain and outwash deposits.

2. Vegetative composition, structure, and function:
   - Dominant Species: Balsam fir (on wetter sites), northern white cedar (on wetter sites and on dunes and bedrock), white spruce (on drier sites), paper birch and trembling aspen.
   - Minor species: White pine, balsam poplar, hemlock, and less frequently black spruce, red pine, jack pine, red maple and yellow birch. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Multiple even aged cohorts in mosaics of early to mid-successional stands. Late successional stands are uneven-aged, with gap-phase dynamics creating a complex structure characterized by small to medium canopy gaps, coarse woody debris and snags in all stages of decomposition.
   - Successional classes: The following natural community structure (by seral state) is suggested from LANDFIRE modeling in matrix or large patch landscapes. Due to frequent disturbance patterns, this successional model does not apply to small patch BSAs, which tend to be linear occurrences along Great Lake and inland lake shorelines.

     Early successional stands comprise about 30% of the BSA, with 5% resulting from larger scale disturbance and dominated trembling aspen and paper birch seedling/saplings (<30 years), and 25% resulting from small-scale disturbance and being dominated by balsam fir, white spruce and cedar. Mid-successional stands comprise 35% of the BSA, with 10% dominated by an aspen-birch overstory and a white spruce, balsam fir and cedar understory (40-100 years), and 25% dominated by balsam fir, white spruce and cedar (40-100 years). Aspen-birch components are declining species in mid-successional stands, with recruitment of white spruce, balsam fir and cedar in progress. Late successional, uneven-aged stands comprise 35% of the BSA, with 25% dominated by white spruce, balsam fir, cedar, and white pine (100-200 years), and 10% of stands >200 years.
   - Regeneration: Natural regeneration of aspen and birch is occurring after large-scale disturbance, and recruitment of shade tolerant conifer species is continually occurring on tip-up mounds, exposed mineral soil and on nurse logs associated with small-scale disturbance. Cedar regeneration can occur via layering after wind throw events.

3. Disturbance form and frequency:
   - Low Intensity: Frequent individual tree or small group wind throw (0.05 acre or 52 foot diameter gaps) naturally occurs and enables regeneration of shade-tolerant conifers in the understory. Naturally occurring wind events also cause snap-off of tree tops and are a source of CWD.
   - High Intensity: Less frequent, larger gaps result from naturally occurring wind throw and group mortality from spruce budworm infestations (which often occur in 25-35 year intervals). Catastrophic disturbance (predominantly stand replacing fire, occasionally preceded by large-scale wind throw or disease or insect-caused mortality) naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest with a return interval of 500 years.

4. Stressors/Threats: High threat invasive species populations are low or absent. The incidence of spruce budworm is below epidemic thresholds. Populations of deer do not significantly inhibit cedar regeneration or cause dominance by browse tolerant tree species (aspen and red maple).

Dry-mesic Northern Forest

1. Site Suitability: Stands are located on coarse- to medium-textured sand or loamy sand soils (NLP Kotar habitat types PArVHa and PArVVb; EUP Kotar habitat type PArVAa; WUP Kotar habitat types PArVAa[w], PArV-Co, AVVb, AVb, and PArVAa).

2. Vegetative composition, structure, and function:
   - Dominant Species: Supercanopy of white pine and/or red pine.
   - Minor species: Subcanopy dominated or co-dominated by red maple, American beech, paper birch, bigtooth and quaking aspen, white, red and black and northern pin oak, and hemlock, on a regional-specific basis. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Two-tiered or occasional all-age structure with a less dense even-aged supercanopy of white and/or red pine over a subcanopy of co-dominant trees. Dead snags and coarse woody debris (CWD), with a diversity of species and diameter classes, are common and in various stages of decomposition.
   - Successional classes: In lieu of catastrophic, stand replacing wildfire in matix or large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model does not apply to small patch BSAs, such as upland ridges in large wetland complexes or moraine features in large outwash plains.

     Early successional stands comprise about 15% of the BSA and are dominated by pine, oak, aspen, or birch seedling/saplings (<30 years). Mid-successional stands comprise 60% of the BSA and are dominated by mixed red pine-jack pine-oak stands (30-75 years) with a mature bigtooth and trembling aspen-birch component, or young red pine-white pine stands (30-75 years). Aspen-birch components are declining species in mid-successional stands, with recruitment of pine, oak and other hardwoods in progress. Late successional stands comprise 25% of the BSA, are multi-aged with even-aged cohorts >75 year old, and are dominated by supercanopy white pine and/or red pine (100-300 years) with a site specific hardwood subcanopy.
   - Regeneration: Natural regeneration and recruitment of tree species (as listed in the MNFI community abstract) is continually occurring, supplemented by planting as needed to restore specific species (e.g. mesic conifers).

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire (frequently associated with events on more combustible adjacent landscapes) occurs naturally or is prescribed with a variable return interval of 5-20 years. Naturally occurring wind events top the largest supercanopy trees and are a source of coarse woody debris.
   - High Intensity: Catastrophic disturbance [predominantly stand replacing fire, but occasionally is preceded by infrequent windthrow (1,200 year return interval),

disease or insect-caused mortality] naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest with a return interval of 120-300 years. Landscape context drives variable but relatively large patch configuration of disturbance, with multiple cohorts often being completely replaced.

4. Stressors/Threats: High threat invasive species populations are low or absent. The incidence of oak wilt mortality is below epidemic thresholds.

Dry-mesic Southern Forest

1. Site Suitability: Stands are located on well-drained to somewhat excessively drained soils, and south-westerly facing slopes.

2. Vegetative composition, structure, and function:
   - Dominant Species: Overstory of white oak, northern red oak, and black oak.
   - Minor species: Red maple, pignut hickory, shagbark hickory, white ash, black cherry and sassafras, with hop-hornbeam restricted to the subcanopy. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Open stand structure with a mature overstory and a thin understory. Overstory ranges from 121-249 stems/ac, basal area is 113-179 ft^2/ac, and diameters of oak trees ranging from 4-35 inch dbh).
   - Successional classes: In lieu of catastrophic, stand replacing wildfire in matix or large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model applies to a shifting continuum of oak forest, woodlands, savannahs and prairie. It does not apply to small patch features, such as upland ridges in large wetland complexes or moraine features in large outwash plains.

     Two percent of the BSA is grassland prairie dominated by big and little bluestem. Ten percent of the BSA is mid-successional forest with early regeneration of white and black oak and sassafras (6-50 years old), with 10-60% canopy cover, and that succeeds into oak-hickory forest. Twenty-five percent of the BSA is mid-successional forest (>50 years) that develops into and is maintained by fire as oak-hickory savannah and woodland. 61% of the BSA is late-successional open-canopy oak hickory forest, dominated by white, black and red oak and pignut and shagbark hickory (50-200+ years old), with 60-80% canopy cover. In the prolonged absence of fire (100-200 years), 2% of the BSA is late-successional closed-canopy maple forest dominated by red and some sugar maple, basswood and white oak (50-200+ years old), with 80-100% canopy cover.
   - Regeneration: Natural regeneration and recruitment of tree species (as listed in the MNFI community abstract) is continually occurring. Where the seedbank is depleted, herbaceous prairie species may need to be re-introduced. Small-scale windthrow allows recruitment of suppressed oak saplings to the overstory.

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire (frequently associated with events on more combustible adjacent landscapes) occurs naturally or is prescribed with a return interval of about 10 years. Small-scale windthrow and stem breakage from ice storms are frequent and naturally occurring.

- High Intensity: Higher intensity fire (but also disease or insect-caused mortality) naturally occurs (as limited by legal fire suppression requirements), or may be mimicked by shelterwood-cut timber harvest with a return interval of 100-200 years. Catastrophic stand replacing fire is rare with a 500-700 year return interval, and due to fire suppression policy may also be mimicked by timber harvest. Infrequent insect and disease disturbance can be expected to occur naturally.

4. Stressors/Threats: Herbivory and high threat invasive species populations are low or absent. The incidence of oak wilt mortality is below epidemic thresholds.

Dry Northern Forest (Jack Pine/Jack Pine-Hardwood Variant) – Note: This DFC applies to areas where pine barrens are not currently present and where restoration of pine barrens is not feasible or desired.

1. Site Suitability: Pine stands are located on coarse-textured, well-sorted, excessively dry sand soils (NLP Kotar habitat type PVCd; EUP Kotar habitat types PVE, PArV, and PArV-Ao; WUP Kotar habitat types PVDc, PVCx, PQE and PArV).

2. Vegetative composition, structure, and function:
   - Dominant Species: Jack pine, northern pin oak, red pine.
   - Minor species: Paper birch, white pine, aspen, and many of the other characteristic native plant species as described in the MNFI abstract.
   - Stand structure: Two-tiered structure with dense even-aged jack pine stands and a scattered super-canopy of red and/or white pine, located on dry sandy outwash plains.
   - Successional classes: In lieu of catastrophic, stand replacing wildfire in matix or large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model does not apply to small patch BSAs, such as upland ridges in large wetland complexes.

     Early-successional stands comprise approximately 5% of the BSA and are dominated by sedge and grass species with jack pine regeneration (0-5 years). Mid-successional stands comprise approximately 10% of the BSA and are dominated by dense jack pine seedlings or saplings (6-15 years), with scattered northern pin oak and aspen-birch saplings and supercanopy red pine that survive catastrophic fire events. Eighty-five percent are late-successional stands dominated by jack pine (15-70 years old, with variable 70-100% canopy cover), with scattered individuals and groves of red and white pine (>100 years) and occasional northern pin oak (50-120 years old).
   - Regeneration: Natural regeneration and recruitment of tree species is occurring, with supplemental planting as needed for reintroduction of specific species where natural seed sources are lacking.

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire is relatively rare but naturally occurs or is initiated with prescribed fire.
   - High Intensity: Catastrophic disturbance of jack pine (predominantly stand replacing fire, but occasionally is preceded by less frequent windthrow, disease or insect-caused mortality) naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest with a return interval of about 60 years. Landscape

context drives variable but relatively large patch configuration of fires, with patches of mature, super-canopy red and white pine cohorts remaining in the overstory for several rotations of jack pine.

4. Stressors/Threats: High threat invasive species populations are low or absent. The incidence of naturally occurring jack pine budworm mortality is below epidemic thresholds.

Dry Northern Forest (Red Pine Variant)

1. Site Suitability: Pine stands are located on inland dune ridges within peatland complexes and on ice-contact island ridges within outwash plains (NLP Kotar habitat type PArVHa; WUP Kotar habitat type PArV[w}).

2. Vegetative composition, structure, and function:
   - Dominant Species: Red pine
   - Minor species: White pine, jack pine, and many of the characteristic native plant species described in the MNFI abstract.
   - Stand structure: Less dense even-aged (single cohort) structure.
   - Successional classes: In lieu of catastrophic, stand replacing wildfire in matrix or large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model does not apply to small patch BSAs, such as upland ridges in large wetland complexes.

     Early successional stands comprise about 15% of ice-contact features and 10% of peatland dune ridges and are dominated by red pine seedling/saplings (<30 years). Mid-successional stands comprise 60% of ice-contact features and 20% of peatland dune ridges, and are dominated by young red pine stands (30-75 years). Twenty-five percent of ice-contact features and 70% of peatland dune ridges are late-successional stands of closed canopy red pine forest (75-300 years old, with variable 25-70% canopy cover).
   - Regeneration: Natural regeneration and recruitment of tree species is occurring, with supplemental planting as needed for reintroduction of specific species where natural seed sources are lacking.

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire (frequently associated with fire events in the adjacent landscapes) naturally occurs naturally or is prescribed with a return interval of 30-70 years on ice-contact features.
   - High Intensity: Catastrophic disturbance [predominantly stand replacing fire, but occasionally is preceded by less frequent and naturally occurring windthrow (1,200 year return interval), disease or insect-caused mortality] naturally occurs (as limited by legal fire suppression requirements), or can be mimicked by timber harvest on ice-contact features. Timber harvest in peatlands mimick fire only where existing access is present. Even-aged cohorts on individual dune ridges are often completely replaced. Return intervals for ice contact features range from 100-200 years. Return intervals for dune ridges in forested peatlands are highly variable, and range from

100-300 years in fire-prone landscapes from 300 to over a thousand years in fire-protected landscapes.

4. Stressors/Threats: High threat invasive species populations are low or absent.

Dry Southern Forest

1. Site Suitability: Stands are located on well-drained to somewhat excessively drained sandy soils on glacial outwash and south-westerly facing slopes of sand dunes and coarse-textured moraines.

2. Vegetative composition, structure, and function:
   - Dominant Species: Overstory of white oak and black oak.
   - Minor species: Red maple, pignut hickory, black cherry and sassafras, with northern pin oak on the driest sites close to the climatic tension zone. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Open stand structure with a mature overstory and a thin understory. Overstory ranges from 121-249 stems/ac, basal area is 113-179 ft^2/ac, and diameters of oak trees ranging from 4-35 inch dbh).
   - Successional classes: In lieu of catastrophic, stand replacing wildfire in matix or large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model applies to a shifting continuum of oak forest, woodlands, savannahs and prairie. It does not apply to small patch features, such as upland ridges in large wetland complexes or moraine features in large outwash plains.

     Two percent of the BSA is grassland prairie dominated by big and little bluestem. Eight percent of the BSA is mid-successional forest with early regeneration of white, black and northern pin oak, pignut hickory, and sassafras (6-50 years old), with 10-60% canopy cover, and that succeeds into oak-hickory forest. Forty percent of the BSA is mid-successional forest (>50 years) that develops into and is maintained by fire as oak-hickory savannah and woodland. Forty-eight percent of the BSA is late-successional open oak hickory forest, dominated by 50-200+ years old white and black oak and pignut hickory and shorter-lived northern pin oak, with 60-80% canopy cover. In the prolonged absence of fire (100-200 years), 2% of the BSA is late-successional closed maple forest dominated by red and some sugar maple, basswood and white oak (50-200+ years old), with 80-100% canopy cover.
   - Regeneration: Natural regeneration and recruitment of tree species (as listed in the MNFI community abstract) is continually occurring. Where the seedbank is depleted, herbaceous prairie species may need to be re-introduced. Small-scale windthrow allows recruitment of suppressed oak saplings to the overstory.

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire (frequently associated with events on more combustible adjacent landscapes) occurs naturally or is prescribed with a return

interval of about 10 years. Small-scale windthrow and stem breakage from ice storms are frequent and naturally occurring.

- High Intensity: Higher intensity fire (but also disease or insect-caused mortality) naturally occurs (as limited by legal fire suppression requirements), or may be mimicked by shelterwood-cut timber harvest with a return interval of 100-200 years. Catastrophic stand replacing fire is rare with a 500-700 year return interval, and due to fire suppression policy may also be mimicked by timber harvest. Infrequent insect and disease disturbance can be expected to occur naturally.

4. Stressors/Threats: Herbivory and high threat invasive species populations are low or absent. The incidence of oak wilt mortality is below epidemic thresholds.

Floodplain Forest

1. Site Suitability: Not applicable – the community is restricted in occurrence adjacent to third order or greater streams and rivers, most frequently occurring within former glacial meltwater (outwash) channels.

2. Vegetative composition, structure, and function:
   - Dominant Species: The vegetative species of floodplains are variable from southern to northern parts of Michigan, and are diverse across a typical gradient of a levee, first bottom, back swamp, and second bottom, as described in the MNFI abstract.
   - Minor species: The vegetative species of floodplains are variable from southern to northern parts of Michigan, and are diverse across a typical gradient of a levee, first bottom, back swamp, and second bottom, as described in the MNFI abstract.
   - Stand structure: All-aged, closed canopy forest, with scour and fluvial depositional processes creating substrate for regeneration, and the presence of coarse and fine woody debris. Scour of canopy trees by ice and debris lead to the development of multiple-stemmed canopy trees
   - Successional classes: Due to frequent disturbance patterns, this successional model may not apply to small patch BSAs, which tend to be linear occurrences along inland stream systems.

     15% of early successonal floodplain is dominated by cottonwood and willow shrubs south of the transition zone and speckled alder to the north (0-9 years). 25% of the BSA is open canopy mid-successional forest, with willow species, cottonwood and sycamore south of the transition zone and willow species, green and black ash and balsam poplar to the north (10-30 years). 45% of the BSA is closed canopy mid-successional forest, with the additional presence of hemlock, white cedar and white pine to the north of the transition zone (30-150 years). 15% of the BSA is late-successional closed canopy forest, with the additional presence of hackberry, redbud, black walnut, butternut, black maple, shagbark and bitternut hickory, Kentucky coffee-tree, and tulip poplar south of the transition zone, and with the additional presence of yellow birch to the north (>150 years).
   - Regeneration: Natural regeneration and recruitment of tree species (as listed in the MNFI community abstract) is continually occurring on disturbed substrates.

3. Disturbance form and frequency:

- Low Intensity: Low intensity seasonal flooding occurs with a return interval of 5 years, and maintains a relatively high native plant species density and diversity in the understory. Treefall frequently occurs from eroded banks or windthrow in saturated soils.
- High Intensity: Major flooding naturally occurs with a return interval of 50-200 years. Widespread treefall occurs from more extensive eroded banks or windthrow in saturated soils.

4. Stressors/Threats: High threat invasive species populations (i.e. emerald ash borer) are low or absent. The incidence of Dutch elm disease currently restricts American elm to a mid-canopy status. Incidence of butternut canker is low or absent.

Hardwood Conifer Swamp There are northern and southern variants of this community, based upon the climatic tension zone.

1. Site Suitability: Typically associated with headwater streams or shallow kettle depressions in poorly drained outwash channels or in depressions in outwash plains, medium- to coarse-textured end moraines, and glacial lake plains, with thin layers of organic soil (saturated, highly decomposed, neutral pH sapric peat) over poorly-drained, often acidic mineral substrate, and may be correlated with circa-1800 records.

2. Vegetative composition, structure, and function:
   - Dominant Species: In northern Michigan canopy dominance by hemlock, yellow birch, red maple and white pine. In southern Michigan canopy dominance by red maple, black ash, yellow birch and white pine.
   - Minor species: In northern Michigan balsam fir, black ash, northern white cedar, tamarack, white spruce, and black spruce. Paper birch, trembling aspen and balsam poplar are common after disturbance. In southern Michigan American elm, basswood, northern white cedar, hemlock, and tamarack. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: All-aged structure, with an emphasis on representation of larger diameter trees. Mid to late successional stands have >70% canopy cover. Exhibit the full range of gap phase dynamics, and the presence of dead snags (>10 per acre), stumps, tip-up mounds, and coarse woody debris.
   - Successional classes: In lieu of infrequent catastrophic, stand replacing wildfire in large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model does not apply to small patch BSAs

     Early successional stands following flooding or wind throw disturbance or rare stand-replacing fire comprise about 25% of the BSA, with 15% dominated by grasses and sedges and/or shrub thickets dominated by tag alder and winterberry (<30 years), and 10% dominated by 30-55 year old cedar, black spruce, tamarack, balsam fir, black ash, and red maple. Mid-successional stands comprise 20% of the BSA and are dominated by cedar, black spruce, balsam fir, tamarack and red maple (56-115 years). Late successional, uneven-aged stands comprise 55% of the BSA, and are dominated by cedar, black spruce and balsam fir, with tamarack, white pine, hemlock and a variety of hardwoods as associates in the canopy (>115 years).

- Regeneration: Natural regeneration and recruitment of yellow birch, white pine, cedar, and hemlock is continually occurring on hummock and nurse logs, supplemented by planting as needed to restore specific species (e.g. hemlock). Cedar regeneration can occur via layering after wind throw events. Blowdowns present physical barriers that promote conifer regeneration and recruitment.

3. Disturbance form and frequency:
    - Low Intensity: Patchy, naturally occurring wind throw creates small-scale canopy gaps. Low intensity fire has return intervals of 120 years for wetlands in fire prone landscapes and 685 years for wetlands adjacent to northern hardwoods.
    - High Intensity: Catastrophic disturbance [Predominantly flooding (return interval of 300 years), wind throw (600 year return interval), and rarely stand replacing fire (3,000 year return interval)] naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest.

4. Stressors/Threats: High threat invasive species (emerald ash borer) populations are low or absent. Resistance to Dutch elm disease allows American elm to recruit into the overstory. Herbivory does not significantly affect conifer regeneration or impact species diversity.

Mesic Northern Forest

1. Site Suitability: Stands are located on coarse-textured ground and end moraines, silty/clayey lake plains, thin glacial till over bedrock, and medium-textured moraines. Locally sited on kettle-kame topography, moderately well-drained to well-drained sandy lake plain, and on north-facing sand dunes (NLP Kotar habitat types AFO and AFOCa; EUP Kotar habitat types ATFD, AFPo, and AFOAs; WUP Kotar habitat types AArAst, AArLy, TMC, ATM, ATM-O, ATM-Sm, ATFAs, ATD, ATD-Hp, ATD-Ca, AOCa).

2. Vegetative composition, structure, and function:
    - Dominant Species: Sugar maple, beech, yellow birch, hemlock, on a regional specific basis.
    - Minor species: Basswood, white pine, red oak, red maple, paper birch and white ash, and also contains many of the other characteristic native plant species described in the MNFI abstract.
    - Stand structure: Large, contiguous blocks of forest, exhibiting the full range of gap phase dynamics, and the presence of dead snags (>10 per acre), stumps, tip-up mounds, and coarse woody debris. All-aged structure, with an emphasis on representation of larger diameter trees (including trees >30 inch dbh), supercanopy trees (one per 5 acres), higher residual basal area than under conventional management, and with multi-cohort hemlock and/or white pine on appropriate sites.
    - Successional classes: Early-successional stands (0-39 years) comprise approximately 5% of the BSA, and are dominated by aspen and paper birch (1% of area) or mid-tolerant species (4% of area). Mid-successional stands comprise approximately 20% of the BSA and are mix of mid and shade tolerant species including yellow birch, black cherry, red oak, white ash, basswood, hemlock and white pine (40-150 years), with a component of mature even-aged aspen-birch (40-100 years) and a developing multi-aged mid-canopy of sugar maple and red maple. Late-successional stands are all–aged (with dominant

overstory trees >150 years), comprise approximately 75% of the BSA and are dominated by sugar maple, hemlock, yellow birch, basswood, and beech, with a component of supercanopy white pine, or dominated by hemlock, white pine and yellow birch.

- Regeneration: Advanced regeneration and diverse herbaceous and understory layers (e.g. ground hemlock, hemlock) are present, and not inhibited by herbivory.

3. Disturbance form and frequency:
   - Low Intensity: Naturally occurring single tree windthrow create small-scale (0.005-0.025 acre, or 9-20 foot radius) to medium-scale (0.025-0.1 acre, or 20-41 foot radius) canopy gaps, but may be mimicked by timber harvest in current even-aged stands. Severe ice storm events create larger gaps with a return interval of 20-100 years.
   - High Intensity: Naturally occurring catastrophic windthrow and/or fire are infrequent (return interval 1,200+ years for windthrow and 1,400 years for fire), but potentially significant (up to 9,000+ acres).

4. Stressors/Threats: Herbivory and high threat invasive species populations are minimal. The incidence of emerald ash borer and beech bark disease mortality is below epidemic thresholds.

Mesic Southern Forest

1. Site Suitability: Stands are located on medium- or fine-textured ground moraine, medium- or fine-textured end moraine, and silty/clayey glacial lake plainlevel moraines in the interior of the State , and locally on western sand dunes and sandy lake plains.

2. Vegetative composition, structure, and function:
   - Dominant Species: Sugar maple and beech (up to 80% canopy composition).
   - Minor species: Basswood, bitternut hickory, American elm, black cherry, hop-hornbeam, red oak, tulip poplar, white ash, and white oak, and also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Large, contiguous blocks of forest, exhibiting the full range of gap phase dynamics, and the presence of dead snags (>6 per acre), stumps, tip-up mounds, and coarse woody debris (covering approximately 2% of the forest floor). All-aged structure and close to 100% canopy closure, with high tree density (approximately 100 trees/ac), basal area >109 ft^2/ac, and representation of larger diameter canopy trees (ranging from 14-47 inch dbh).
   - Successional classes: No more than 5% of the total area is within a recent gap (<1 year old), and is frequently dominated by sugar maple and beech in small gaps, or trembling aspen, white ash, tulip poplar, or other mid-tolerant species (<35 years old) in larger gaps. Mid-successional species occur in multiple treefall gaps and comprise approximately 20% of the BSA, and are mix of intolerant to shade tolerant species including basswood, bitternut hickory, black cherry, red oak, tulip tree, white ash, and white oak (35-75 years), and increasingly dominated over time by a developing multi-aged mid-canopy of sugar maple (75-150 years). Late-successional stands are all–aged and perpetuate in the landscape (with dominant overstory trees >200 years), comprising approximately 75% of the BSA and are dominated by sugar maple and beech.
   - Regeneration: Advanced regeneration and a highly diverse herbaceous layer are present, and not inhibited by herbivory.

3. Disturbance form and frequency:
   - Low Intensity: Naturally occurring single tree windthrow create small-scale (0.005-0.025 acre, or 9-20 foot radius) to medium-scale (0.025-0.1 acre, or 20-41 foot radius) canopy gaps. Severe ice storm events create larger gaps with a return interval of 20-100 years.
   - High Intensity: Catastrophic windthrow from tornados is infrequent (return interval 1,200+ years for windthrow) affecting less than 1% of the forest. Fire affects less than 0.2% of the forest.

4. Stressors/Threats: Herbivory and high threat invasive species populations are minimal. The incidence of emerald ash borer and beech bark disease mortality is below epidemic thresholds.

Northern and Southern Hardwood Swamp

1. Site Suitability: Stands are located on poorly-drained sapric peat overlaying a mineral substrate in abandoned lake beds, level to hummocky glacial lake plains, shallow basins, groundwater seeps, low and level terrain near rivers and lakes, and small depressions around edges of peatlands, and may be correlated to circa-1800 records.

2. Vegetative composition, structure, and function:
   - Dominant Species:
     - Northern Hardwood Swamp: Black ash, Michigan holly, and speckled alder.
     - Southern Hardwood Swamp: Silver and red maple, and green and black ash, American elm, and yellow birch are variably dominant dependent upon hydrology.
   - Minor species:
     - Northern Hardwood Swamp: Red maple, American elm, silver maple, yellow birch, basswood, balsam fir, northern white cedar, green ash, and hemlock. Also contains many of the other characteristic native plant species described in the MNFI abstract.
     - Southern Hardwood Swamp: Sugar maple, shagbark hickory, hackberry, beech, white ash, tulip poplar, black gum, sycamore, cottonwood, black cherry, swamp white oak, bur oak, southern pin oak, and basswood. Conifers are rare (tamarack) to absent. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: Exhibit the full range of gap phase dynamics, and the presence of dead snags (>10 per acre), stumps, pit and mound topography, and coarse woody debris. All-aged structure, with trees ranging from 6 to 26 inches dbh. The northern variant has a more open canopy due to the physical characteristics of black ash.
   - Successional classes: This successional model does not apply to small patch BSAs.

     25% of a BSA is early successional and dominated by an open grass and sedge meadow and open to dense shrub thickets (0-29 years). Mid-successional, closed canopy stands comprise 35% of a BSA (30-79 years). Late-successional, closed canopy stands comprise 40% of a BSA (80+ years).
   - Regeneration: Natural regeneration and recruitment of tree species (as listed in the MNFI community abstract) is continually occurring in small gaps, on windthrow generated coarse woody debris and micro-topography, and where windthrow provides a physical barrier to herbivory.

3. Disturbance form and frequency:
    - Low Intensity: Annual spring flooding occurs. Small-scale windthrow event are common and frequent source of CWD, with a return interval of 100-140 years.
    - High Intensity: Catastrophic flooding and wind disturbance occur with return intervals of 300 and 600 years respectively. Replacement fires are rare, with a return interval of 1,000+ years.

4. Stressors/Threats: High threat invasive species populations (i.e. emerald ash borer) are low or absent. The incidence of Dutch elm disease currently restricts American elm to a mid-canopy status.

N. Wet Meadow-Shrub Thicket/Poor Fen/Poor Conifer Swamp/Muskeg/Bog (Weakly Minerotrophic to Ombrotrophic peatlands) Climate, topography, near-surface geology, soils and vegetation influence the hydrology of peatlands. Succession within peatland systems is stochastic, with rates and pathways of succession determined by a complex array of these biotic and abiotic factors.

1. Site Suitability: Located in kettle depressions on pitted outwash and moraines and in flat areas and shallow depressions on glacial outwash and glacial lake plain (commonly in association with lakes), with saturated, strongly acidic to neutral sapric peat in the early successional communities to increasingly fibric peat in the latter successional communities. The expression of these related communities is dependent upon variability in hydrology and the incidence of disturbance regimes.

2. Vegetative composition, structure, and function: Contains many of the characteristic native plant species described in the MNFI abstracts/community summaries, including:
    - Dominant Species:
        - N. Wet Meadow-Shrub Thicket: Bluejoint grass, sedge species, sphagnum moss, meadowsweet, and tag alder.
        - Poor Fen: Few-seed sedge, wiregrass sedge, sphagnum moss, bog rosemary, leatherleaf, and black chokeberry.
        - Poor Conifer Swamp: Sphagnum moss, black spruce, tamarack, labrador tea, chokeberry and mountain holly.
        - Muskeg: Sphagnum moss, black spruce, tamarack, and leatherleaf.
        - Bog: Sphagnum moss, leatherleaf, labrador tea, and black chokeberry.
    - Minor species:
        - N. Wet Meadow-Shrub Thicket: Balsam fir, red maple, black ash, tamarack, black spruce, balsam poplar, quaking aspen and northern white cedar.
        - Poor Fen: Black spruce, and tamarack.
        - Poor Conifer Swamp: Balsam fir, white pine, jack pine, and paper birch.
        - Muskeg: Jack pine, and white pine.
        - Bog: Black spruce, tamarack, jack pine, white pine, and red maple.
    - Stand structure:
        - N. Wet Meadow-Shrub Thicket:
        - Poor Fen: Open, weakly minerotrophic sphagnum peatlands, dominated by sedges or low shrubs. Trees widely scattered (<10% canopy cover) and stunted.
        - Poor Conifer Swamp: Conifer-dominated sphagnum peatlands with a sparse canopy of often even-aged, stunted trees (25-100% canopy cover, 6-60 high, 4-12 inches

DBH, and a maximum of 200-300 years old). Exhibit moderate pit and mound topography, dead snags, and coarse woody debris.
  - Muskeg: Forested sphagnum peatlands with a variable 10-25% canopy cover of dwarf trees 2-6 inches DBH. Exhibit moderate pit and mound topography, dead snags, and coarse woody debris.
  - Bog: Open sphagnum peatlands. Trees are widely scattered and stunted (<10% canopy cover and <20 feet in height).
- Landscape Composition: These community types occur along a related successional pathway. Approximately 15% of a landscape is early successional northern wet meadow-shrub thicket, 15% is mid-successional poor fen, 35% is late-successional poor conifer swamp, 25% is late-successional muskeg, and 10% is late-successional open bog.
- Regeneration: Natural regeneration and recruitment of black spruce and tamarack is continually occurring on exposed mineral soil from fire, windthrow and nurse logs, supplemented by planting as needed to restore specific species (e.g. mesic conifers). Vegetative reproduction of black spruce and tamarack occasionally occurs via layering.

3. Disturbance form and frequency:
   - Low Intensity: Naturally occurring, small-scale wind throw and insect mortality create numerous small-scale canopy gaps in poor conifer swamp and muskeg.
   - High Intensity: Catastrophic disturbance [Predominantly flooding, wind throw (500-700 year return interval), and rarely stand replacing fire (100-300 year return interval in fire-prone landscapes and 300-1,000 year return interval in fire-protected landscapes)] naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest.

4. Stressors/Threats: High threat invasive species populations are rare. The incidence of larch sawfly, larch caseborer, and spruce budworm are below epidemic thresholds.

Oak-Pine Barrens

1. Site Suitability: Stands are located on coarse-textured, excessively well-drained sand or loamy sands on moraines to very fine-textured sands on lake plains (NLP Kotar habitat type PVCd), and may be correlated with records indicating the presence of circa-1800 barrens.

2. Vegetative composition, structure, and function:
   - Dominant Species: White oak, black oak (south of transition zone), northern pin oak (north of transition zone), white pine, red pine, jack pine, little bluestem, big bluestem and Pennsylvania sedge.
   - Minor Species: Red maple, black cherry (where fire is suppressed), and aspen. Also contains many of the other characteristic native plant species as described in the MNFI abstract.
   - Stand structure: Open savanna of variable 5-60% canopy cover within a graminoid matrix, and with 1% of the area being fully-stocked closed canopy forest.
   - Successional classes: This successional model does not apply to small patch BSAs.

     Early-successional stands comprise approximately 5% of the BSA and are dominated by sedges and grass (0-10 years). Mid-successional stands (11-50 years) comprise

approximately 25% of the BSA and are dominated by northern pin oak, white oak, and jack and red pine, with 1% being in shrubby clumps or less commonly a dense closed sapling layer, and the remainder being a scattered canopy of single or grouped trees. Late-successional stands comprise approximately 70% of the BSA and are dominated by mature oaks (50-120 years old) and pines (150-200 years old), in an open savanna of variable 5-60% canopy cover, and with 1% of the area being fully-stocked closed canopy forest.

- Regeneration: Natural regeneration and recruitment of tree and herbaceous species are occurring, supplemented by planting as needed.

3. Disturbance form and frequency:
   - Low intensity: Low intensity ground fire naturally occurs naturally or is prescribed with a return interval of 5-30 years.
   - High Intensity: Infrequent canopy fire (100 year return interval) naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest.

4. Stressors/Threats: High threat invasive species populations are low or absent.

Pine Barrens - This DFC applies to areas where pine barrens are currently or have historically been present and where restoration of pine barrens is both feasible and desired.

1. Site Suitability: Pine stands are located on excessively-drained sand soils (NLP Kotar habitat type PVCd; EUP Kotar habitat type PVE; WUP Kotar habitat types PVDc and PVCx), and may be correlated with records indicating the presence of circa-1800 barrens.

2. Vegetative composition, structure, and function:
   - Dominant Species: Jack pine, Pennsylvania sedge, poverty grass, and little bluestem.
   - Minor species: Red pine (common), white pine (uncommon), and stunted northern pin oak, black cherry, and aspen. Also contains many of the other characteristic native plant species as described in the MNFI abstract.
   - Stand structure: Late successional stands are 40-70% open grasslands, with an average of 8 scattered mature trees or clumps of trees (>6 inch DBH) per acre, or closed canopy jack pine forest. Red and white pine trees can form a scattered supercanopy. Jack pine snags are present.
   - Successional classes: This successional model does not apply to small patch BSAs.

     Early-successional stands comprise approximately 15% of the BSA and are dominated by sedges and grasses with scattered jack pine regeneration (0-5 years). Mid-successional stands comprise approximately 25% of the BSA, and are grasslands with a patchwork of clumped jack pine regeneration seedlings or saplings with scattered red pine and northern pin oak and isolated paper birch and aspen (6-15 years). Late-successional stands comprise approximately 60% of the BSA, with 50% of stands are dominated by sedges, grasses and scattered patches of mature jack pine and scattered supercanopy red and white pine trees, and 10% of the BSA are dominated by closed canopy jack pine forest (15-100 years old).

- Regeneration: Natural regeneration and recruitment of tree species is occurring, supplemented by planting as needed.

3. Disturbance form and frequency:
   - Low Intensity: Low intensity ground fire naturally occurs naturally or is prescribed with a return interval of 15-50 years.
   - High Intensity: Catastrophic stand replacing fire (return interval of 50-60 years) naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest and post-harvest prescribed fire.

4. Stressors/Threats: High threat invasive species populations are low or absent. The incidence of naturally occurring jack pine budworm mortality is below epidemic thresholds.

Rich Conifer Swamp

1. Site Suitability: Stands are located on saturated, coarse woody peat in outwash channels, outwash plains, glacial lake plains, and in depressions on coarse- to medium-textured ground moraines, and may be correlated circa-1800 records.

2. Vegetative composition, structure, and function:
   - Dominant Species: Northern white cedar, often in monotypic cohorts.
   - Minor species: Balsam fir, tamarack, black spruce, white spruce, hemlock, white pine, black ash, red maple, yellow birch, paper birch, American elm, quaking aspen and balsam poplar. Also contains many of the other characteristic native plant species described in the MNFI abstract.
   - Stand structure: All-aged structure, with an emphasis on representation of larger diameter trees. Mid to late successional stands have >75% canopy cover. Exhibit the full range of gap phase dynamics, and the presence of dead snags (>10 per acre), stumps, tip-up mounds, and coarse woody debris.
   - Successional classes: In lieu of infrequent catastrophic, stand replacing wildfire in large patch landscapes, the following natural community structure (by seral state) is suggested from LANDFIRE modeling. This successional model does not apply to small patch BSAs.
     Early successional stands following flooding or wind throw disturbance or rare stand-replacing fire comprise about 25% of the BSA, with 15% dominated by fen grasses and sedges and/or shrub thickets dominated by tag alder and winterberry (<30 years), and 10% dominated by 30-55 year old cedar, black spruce, tamarack. Mid-successional stands comprise 20% of the BSA and are dominated by cedar, black spruce, balsam fir, tamarack and red maple (56-115 years). Late successional, uneven-aged stands comprise 55% of the BSA, and are dominated by cedar with some black spruce, balsam fir (>115 years). Other canopy associates may include tamarack, white pine, hemlock and a variety of hardwoods including red maple and yellow birch.
   - Regeneration: Natural regeneration and recruitment of cedar, yellow birch, white pine, and hemlock is continually occurring on hummock and nurse logs, supplemented by planting as needed to restore specific species (e.g. hemlock). Cedar regeneration can occur via layering after wind throw events. Blowdowns present physical barriers that promote conifer regeneration and recruitment.

3. Disturbance form and frequency:
    - Low Intensity: Naturally occurring, patchy wind throw creates small-scale canopy gaps.
    - High Intensity: Catastrophic disturbance [Predominantly flooding (return interval of 300 years), wind throw (600 year return interval), and rarely stand replacing fire (3,000 year return interval)] naturally occurs (as limited by legal fire suppression requirements), or is mimicked by timber harvest.

4. Stressors/Threats: High threat invasive species populations (e.g. glossy buckthorn) are low or absent. Herbivory does not significantly affect conifer regeneration or impact species diversity.

Rich Tamarack Swamp

1. Site Suitability: Located on alkaline peat soils where calcareous groundwater seeps are present, often at the base of moraines or in kettle depressions and typically in association with headwater streams and adjacent to inland lakes.

2. Vegetative composition, structure, and function:
    - Dominant Species: Tamarack, poison sumac, smooth highbush blueberry, winterberry, black chokeberry, alder-leaved buckthorn, black ash, yellow birch, and sedge species.
    - Minor species: American elm, red maple, swamp white oak, quaking aspen, eastern red cedar, and occasional white pine and northern white cedar. Also contains many of the other characteristic native plant species described in the MNFI abstract.
    - Stand structure: Forested stands are often zones within larger wetland complexes, associated with southern shrub-carr, prairie fen, southern wet meadow, emergent marsh, and/or poor conifer swamp communities. Early successional stands are open fens. Mid-successional stands have variably open to densely clumped canopy cover. The structure of late-successional stands is highly variable with a tree density of 400-800 trees/ac and a basal area of 40-90 ft^2/ac. The canopy of late-successional stands remains relatively open due to the open branching and conical form of tamarack, which results in a high level of light that supports a very dense and diverse shrub layer (90-130% canopy cover). Coarse woody debris and tip-up mounds are present from windthrow.
    - Successional classes: Early successional areas are prairie fen communities, which follow flooding or rare stand-replacing fire, and are dominated by fen grasses and sedges and/or shrub thickets dominated by tag alder and winterberry (<30 years). Mid-successional stands are dominated by tamarack saplings and a developing shrub layer. Late successional, uneven-aged stands are dominated by mature tamarack (12+ inches) and the very dense and diverse shrub layer. Other canopy associates may include the minor trees species listed above.
    - Regeneration: Natural regeneration and recruitment of tamarack occurring on hummocks and exposed organic soil, supplemented by planting as needed. Tamarack regeneration can occur in gaps after wind throw events.

3. Disturbance form and frequency:
    - Low Intensity: Patchy wind throw creates small-scale canopy gaps.

- High Intensity: Catastrophic disturbance mechanisms are predominantly naturally occurring flooding, wind throw, and rarely stand replacing fire (as limited by legal fire suppression requirements). Return interval data are not available.

4. Stressors/Threats: Populations of red maple are low or absent. High threat invasive species populations (e.g. glossy buckthorn, purple loosestrife, reed canary grass, and phragmites) are low or absent. Larch sawfly, eastern larch beetle and tamarack casebearer outbreaks are below epidemic thresholds.

Wooded Dune and Swale Complex

1. Site Suitability: Not applicable – the community is restricted in occurrence to coastal embayments and on large spits along the shorelines of the Great Lakes.

2. Vegetative composition, structure, and function: There are five sub-types based upon a combination of geographic location and processes of beach ridge formation, which result in significantly assemblages of plant species.
   - Dominant Species (by sub-type):
     - Southern Lake Huron: Dunes dominated by cottonwood and black walnut. Swales dominated by buttonbush.
     - N. Lake Huron/Michigan Low Dune: Swales and many of the dunes support wetland vegetation. Low dunes dominated by white pine, white and black spruce, red maple, balsam fir, and northern white cedar. Drier swales also dominated by northern white cedar.
     - N. Lake Huron/Michigan High Dune: Dunes dominated by white pine, red pine, red oak and paper birch. Moist swales contain northern white cedar, speckled alder, willow species, and red maple.
     - Lake Superior High Dune: Few swales with wetland vegetation. Most dunes and swales dominated by jack pine and red pine dry northern forest.
     - Lake Superior Low Dune: Dunes dominated by swamp forests of white and black spruce, tamarack and balsam fir. Swales dominated by northern white cedar, black spruce, red maple, speckled alder, sphagnum mosses. Leatherleaf, bog rosemary and Labrador tea dominate in the first swale behind the shoreline.
   - Minor species (by sub-type):
     - Southern Lake Huron: Not specified in abstract.
     - N. Lake Huron/Michigan Low Dune: Low dunes occasionally contain tamarack. Wet swales support emergent wetland species.
     - N. Lake Huron/Michigan High Dune: Dunes sub-dominate species are bigtooth aspen, balsam fir and red maple.
     - Lake Superior High Dune: White birch, bigtooth aspen, and red maple on dunes and swales.
     - Lake Superior Low Dune: Not specified in abstract.
   - Stand structure: Late successional forested dunes are all-aged. Low dune field tree species often form a scattered overstory canopy. Windthrow creates coarse woody debris.
   - Successional classes: Wooded dune and swale complexes are generally equally comprised of early seral dunes (25%), early seral swales (25%), mid to late seral dunes (25%), and mid to late seral swales (25%).

- Regeneration: Regeneration of tree species is naturally occurring. Regeneration of cedar is not significantly inhibited by herbivory.

3. Disturbance form and frequency:
    - Low Intensity: Small-scale wind throw is common. Low intensity fire occurs with a return interval of 150 years.
    - High Intensity: Shifting of dune sands in major storm events may convert early seral dunes into early seral swales or conversely swales into dunes, with a probability of occurrence every 100 years. Beaver flooding from damming of streams can convert forested swales to emergent marsh and northern wet meadow. Replacement fires on late seral dunes are rare, with a 1,000 year return interval.

4. Stressors/Threats: High threat invasive species populations (purple loosestrife, reed canarygrass, and giant bulrush) are low or absent. The incidence of jack pine budworm is below epidemic thresholds.

Glossary

Biodiversity: The spectrum of life forms and the ecological processes that support and sustain them. Biological diversity occurs at four interacting levels: genetic, species, community, and ecosystem. The variety of living organisms considered at all levels of organization, from genetics through species, to higher taxonomic levels, also; the term encompasses the variety of habitats and ecosystems supporting the organisms, as well as the processes occurring within those systems.

Biodiversity Conservation Planning Process (BCPP): A planning document approved by the MDNRE's leadership that identified a coarse-filter approach to conserving biodiversity through the designation of high quality natural communities and groups of natural communities with special management objectives (or BSAs) on a portion of MDNRE lands.

Biodiversity Stewardship: Management that protects, conserves, or restores native gene pools, species, or ecosystems.

Biodiversity Stewardship Area (BSA): Functional landscape units selected to help achieve ecological representation of natural communities as identified through the BCPP. BSAs can cross multiple ownerships and they usually are comprised of multiple natural communities.

Ecological Reference Areas (ERAs): Areas that serve as models of ecological reference within the state and may be located on any land ownership. They are high-quality examples of functioning ecosystems that are primarily influenced by natural ecological processes. ERAs are currently defined as areas that have a natural community classification Global or State Rank of G1, G2, G3, S1, S2, S3 and an Element Occurrence (EO) Rank A or B. The initial set of ERAs is based on known high-quality natural communitities from MNFI's April 2005 database (MNFI 2008). Additional ERAs will be identified through the Biodiversity Conservation Planning Process.

Ecosystems: A dynamic and natural complex of living organisms interacting with each other and with their associated nonliving elements in the environment.

Exemplary Natural Community: A natural community of sufficient quality (based on assessment of condition, landscape context and size) to be tracked by the Michigan Natural Features Inventory in the Biotics database (MNFI 2008). Each of MNFI's natural community types has a specific set of criteria that must be met for a site to be considered an Exemplary Natural Community element occurrence (MNFI 1988).

Functional or Functionality: The ability of a BSA to maintain healthy, natural communities ecological systems, or viable species over the long-term (100+ years), including the ability to respond to natural or human-caused environmental change.

Geographic Range: The distribution of occurrence of a natural community relative to Albert's subsections. The definition of types of geographic ranges for natural communities below are used in the BCPP to determine (along with a consideration of spatial pattern) natural community representation guidelines by subsection.

> Restricted/Limited: a natural community that occurs primarily in one subsection or a few adjacent subsections. Can also be a natural community that occurs in several subsections (i.e. Widespread) but is restricted to an extremely small portion of the subsections it

occurs within or a natural community that occurs in several subsections but is restricted to the Great Lakes region.

Widespread: widely distributed in several subsections.

High Conservation Value Areas (HCVAs): Areas (including ERAs) that have been recognized for their contribution to specific conservation objectives or attributes through a recognized MDNRE process such as legislation, administrative rule, Director's or Natural Resource Commission Orders, but not including the Open House/Compartment Review process. Examples of recognized processes include Dedicated Natural, Wilderness or Wild Areas, Natural Rivers, and Kirtland's Warbler plan.

Landscape: An area composed of adjacent and interacting ecosystems that are related because of geology, land forms, soils, climate, biota, and human influences.

Native: Native communities are characterized by native species and maintained by natural processes. Native species are found naturally in an area and are not introduced accidentally or purposefully by people. Native species include both endemic and indigenous species.

Natural Community: An assemblage of interacting plants, animals, and other organisms that repeatedly occurs across the landscape under similar environmental conditions and is predominantly structured by natural processes rather than modern anthropogenic disturbances (Kost et al. 2007). The BCPP uses the MNFI natural community classification system to describe the groupings (or classes) of communities.

Natural Community Groups: Associations of related natural communities from the MNFI natural community classification system. In most cases, a BSA will be identified with a single Natural Community Group identifier, although a few BSAs maybe identified with multiple Natural Community Groups. The use of Natural Community Groups and BSAs is based upon the recognition that natural communities occur in the landscape in predictable associations of related communities.

Representation: A principle of reserve selection and design referring to the capture of the full spectrum of biological and environmental variation within a network of reserves or conservation sites, including all genotypes, species, natural communities, ecosystems, habitats, and landscapes. Guidelines for representation (number per subsection) are set based on the spatial pattern (matrix, large patch, or small patch) and geographic range (restricted/limited, or widespread) of each natural community.

Spatial Pattern: The distribution and extent of landscape features. See below for examples of spatial patterns used in this document.

Matrix-forming or Matrix Communities: Communities that form extensive and contiguous cover may be categorized as matrix (or matrix-forming) community types. Matrix communities occur on the most extensive landforms (i.e., moraines, outwash plains, and lakeplains) and typically have wide ecological tolerances. They may be characterized by a complex mosaic of successional stages resulting from characteristic disturbance processes (e.g. mesic northern forest and wind disturbance). Individual occurrences of the matrix type typically range in size from 2000 to 500,000 hectares (4,942 to 1,235,000 acres). In a typical ecoregion, the aggregate of all matrix communities covers, or historically covered, as much as 75-80% of the natural vegetation

of the ecoregion. Matrix community types are often influenced by large-scale processes (e.g. climate patterns, fire, catastrophic windthrow) and are important habitat for wide-ranging or large area dependent fauna, such as large herbivores or birds. (The Nature Conservancy 2000)

Patch Community: Communities nested within matrix communities and maintained primarily by specific environmental features rather than disturbance processes.

Large Patch: Communities that form large areas of interrupted cover. Individual occurrences of this community patch type typically range in size from 50 to 2,000 hectares (124 to 4,942 acres). Large patch communities are associated with environmental conditions that are more specific than those of matrix communities, and that are less common or less extensive in the landscape. Like matrix communities, large-scale processes also influence large-patch communities, but these tend to be modified by specific site features that influence the community. (The Nature Conservancy 2000)

Small Patch: Communities that form small, discrete areas of vegetation cover. Individual occurrences of this community type typically range in size from 1 to 50 hectares (2.5 to 124 acres). Small patch communities occur in very specific ecological settings, such as on specialized landform types or in unusual microhabitats. The specialized conditions of small patch communities, however, are often dependent on the maintenance of ecological processes in the surrounding matrix and large patch communities. In many ecoregions, small patch communities contain a disproportionately large percentage of the total flora, and also support a specific and restricted set of associated fauna (e.g. invertebrates or herptofauna) dependent on specialized conditions. (The Nature Conservancy 2000)

Special Conservation Areas (SCAs): Special Conservation Areas are areas of State Forest land that have had one or more conservation objectives, interests, or elements identified. The type and strength of recognition will vary depending on the process used to identify the conservation value. Some SCA designations will have the force of law, (such as areas identified in Land Use Orders of the Director), some will be by cooperative agreement (such as National Natural Landmarks with the National Park Service), some will be by department process or agreement (such as deer yards, POG, and riparian buffers), and some will be identified by an external group or organization (such as Audubon's Important Bird Areas).

Statewide Biodiversity Team: A group of MDNRE staff that have the responsibility to oversee the implementation of the BCPP.

Statewide Council (SWC): A team composed of all the MDNRE Division chiefs and Ecoteam Chairs who meet periodically to plan and discuss policy, coordination, cooperation, planning and implementation of Department programs.

Sustainability: Maintenance of healthy, functioning ecosystems capable of providing goods, services, and processes upon which human welfare ultimately depends. Also, implied is the idea that the actions of the current generation will not diminish the resources and opportunities available to future generations.