

LANDFIRE- BASED INFORMATION FOR THE STONE-MOSS MID-SCALE PLANNING UNIT

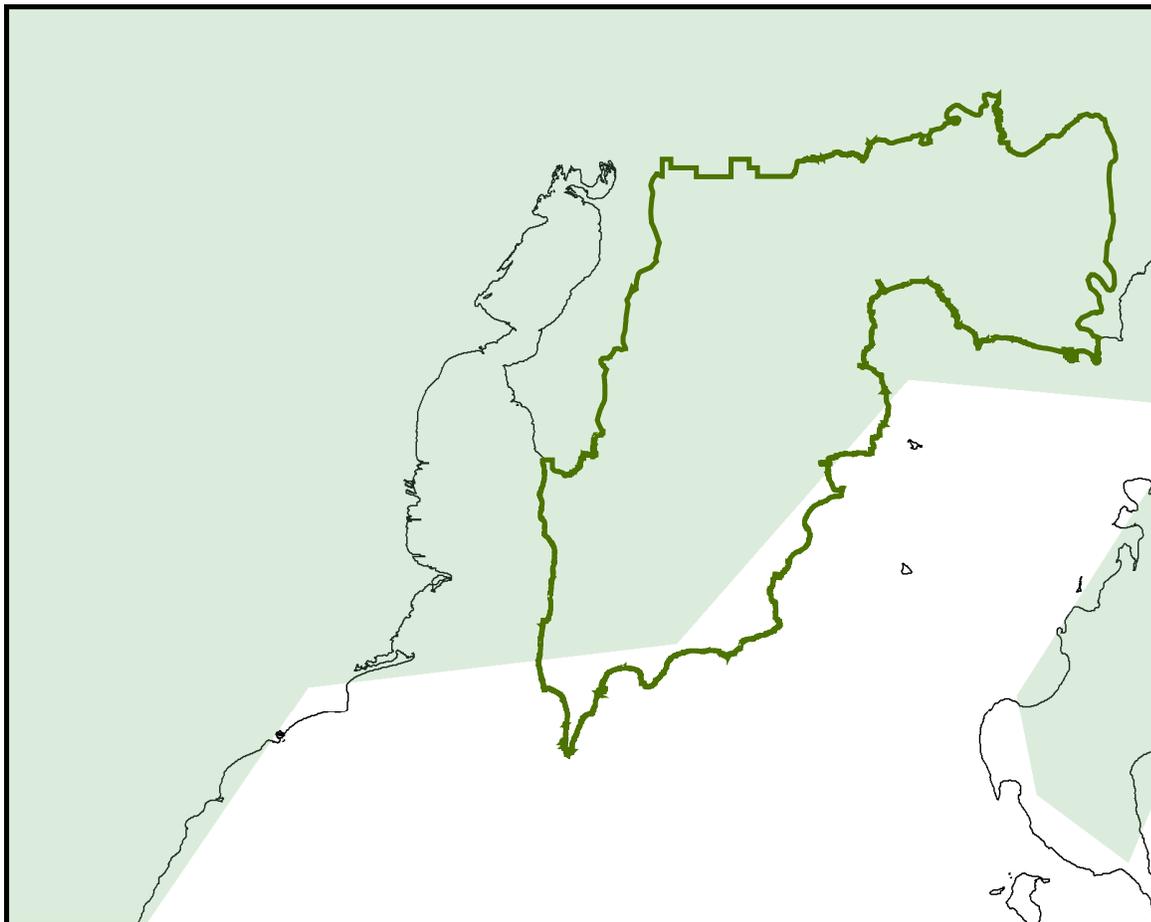
Hiawatha National Forest

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INTRODUCTION

In autumn of 2009, United States Forest Service (USFS) Region 9 staff and The Nature Conservancy (TNC) staff met in Milwaukee, WI to discuss partnership opportunity. One collaborative goal was for TNC to help the region apply LANDFIRE data, with a focus on the Hiawatha National Forest. This document demonstrates how LANDFIRE data and tools are used to inform the Stone-Moss mid-scale planning effort, a western unit of the Hiawatha project whose administrators seek to identify opportunities for sound landscape management.

The Stone-Moss planning unit covers the Stonington Peninsula of the Upper Peninsula of Michigan. This area is also a TNC Portfolio Site, an area of special conservation focus. In terms of LANDFIRE data, the Stone-Moss planning unit falls mainly in LANDFIRE Map Zone 51, with a small portion extending into LANDFIRE Map Zone (see map below). *Results and interpretation in this document will be limited to the areas in the Stone-Moss planning unit covered by LANDFIRE Map Zone 51 data (~89k acres of ~103k acres total for planning unit, or about 86% of the area).*



Map of Stone Moss Planning Unit, and LANDFIRE Data Coverage used.

This document will provide the following background information in support of suggested management opportunities:

1. Map and acreages of LANDFIRE Biophysical Settings (BpS) and Existing Vegetation Types
2. Ecological Departure (officially known as Fire Regime Condition Class, FRCC)
3. Fire and other disturbance regimes by BpS
4. Acres disturbed annually per BpS under natural disturbance regimes

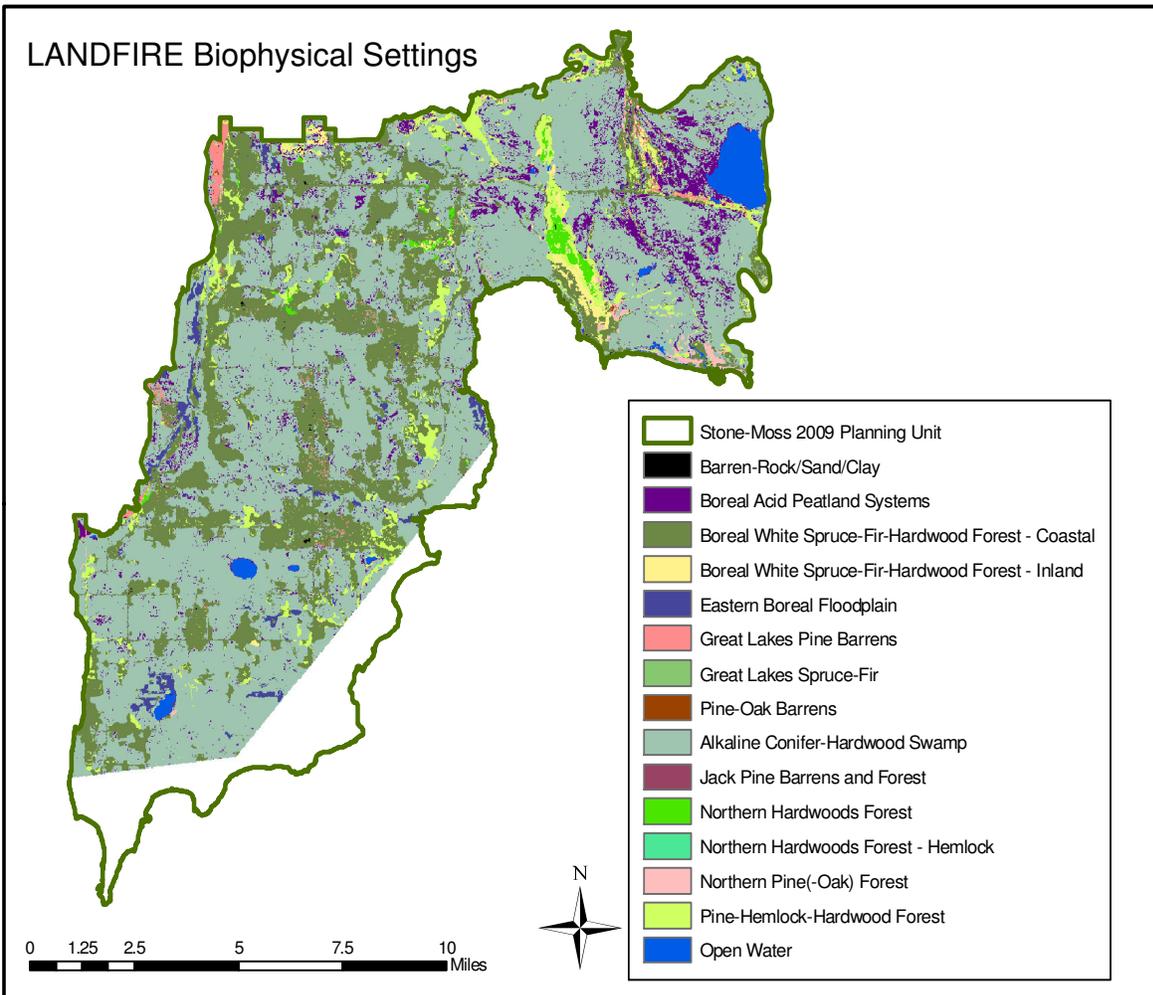
DATA AND ANALYSIS

LANDFIRE Biophysical Settings represent vegetation that may have been dominant on the landscape prior to European settlement and are based on both current biophysical environment (soils, surficial geology, climate) and on modeled historic disturbance regimes. Importantly, this layer differs from Presettlement vegetation maps based on General Land Office (GLO) surveys in two ways. First, BpSs are dynamic in that they have multiple succession classes. For example, the BpS data may indicate “Laurentian Acadian Northern Hardwoods” for a particular site. This particular BpS includes five succession classes based on species, height and percent cover. Therefore, on an L.A. Northern Hardwood site, there could have been aspen and paper birch trees due to a recent (and rare for this BpS) blowdown followed by fire. The modeling of disturbances and the dynamic nature of BpSs is an attempt to get past the “snapshot” issue posed by GLO survey based maps of presettlement vegetation. Second, on GLO-based maps, one vegetation designation may actually represent multiple ecological communities. For example, sites mapped as “Aspen-Birch” may occur on sites that, as they undergo succession, may trend toward very different vegetation types, such as Red-White Pine or Northern Hardwoods, due to soil characteristics. The LANDFIRE BpS data attempts to address this issue by modeling vegetation patterns and community dynamics. Therefore, while a site with well-drained rich loamy soils may have aspen at one particular point in time, the BpS concept recognizes that once the aspen dies, the next cohort will be sugar maples and not red pines which tend to dominate on more coarsely textured sands and sandy-loam soils.

The LANDFIRE BpS data mapped 13 BpSs in the Stone-Moss planning unit, two of which represented 85% of the area:

Biophysical Setting	Acres	Percentage
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	56,754	64
Boreal White Spruce-Fir-Hardwood Forest - Coastal	18,382	21
Boreal Acid Peatland Systems	5,948	7
Laurentian-Acadian Pine-Hemlock-Hardwood Forest	4,037	5
Eastern Boreal Floodplain	1,239	1
Boreal White Spruce-Fir-Hardwood Forest - Inland	947	1
Great Lakes Pine Barrens	896	1
Laurentian-Acadian Northern Hardwoods Forest	640	1
Laurentian-Acadian Northern Pine(-Oak) Forest	366	0

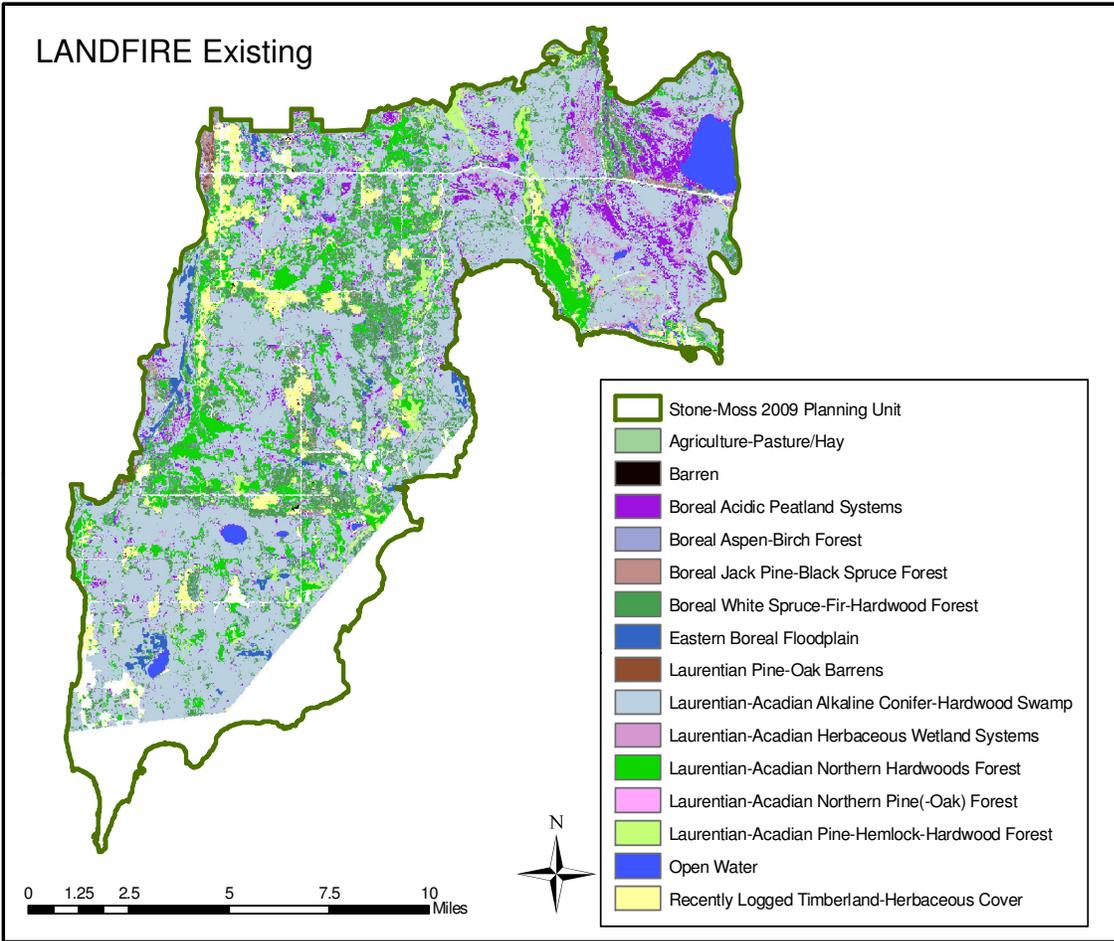
Laurentian Pine-Oak Barrens	42	0
Great Lakes Spruce-Fir	19	0
Laurentian-Acadian Northern Hardwoods Forest - Hemlock	3	0
Laurentian-Acadian Jack Pine Barrens and Forest	0	0
TOTALS	89,273	100



To map Existing Vegetation (EVT), LANDFIRE used ca2000 satellite imagery truthed by thousands of plots nationwide including Forest Inventory and Analysis plots. Due to the different methods of developing the BpS and Existing Vegetation spatial datasets, and variation in the legend, comparisons should be made only for trends and assessed by local experts.

Existing Vegetation Type	Acres	Percentage
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	49,122	53
Boreal White Spruce-Fir-Hardwood Forest	10,448	11
Laurentian-Acadian Northern Hardwoods Forest	9,162	10
Boreal Acidic Peatland Systems	5,685	6
Recently Logged Timberland-Herbaceous Cover	4,379	5
Boreal Aspen-Birch Forest	2,906	3
Laurentian-Acadian Pine-Hemlock-Hardwood Forest	2,665	3
Laurentian-Acadian Herbaceous Wetland Systems	1,880	2
Open Water	1,807	2
Eastern Boreal Floodplain	1,743	2
Agriculture-Cultivated Crops and Irrigated Agriculture	1,264	1
Boreal Jack Pine-Black Spruce Forest	747	1
Laurentian-Acadian Northern Pine(-Oak) Forest	279	0
Laurentian Pine-Oak Barrens	204	0
Barren	183	0
Agriculture-Pasture/Hay	10	0
Central Interior and Appalachian Floodplain Systems	3	0
Great Lakes Coastal Marsh Systems	1	0
Managed Tree Plantation	1	0
TOTAL	92,489	100

LANDFIRE mapped 19 vegetation types in the EVT dataset, including modern vegetation types such as “Recently Logged Timberland-Herbaceous Cover,” and “Agriculture-Cultivated Crops and Irrigated Agriculture.” Developed lands were removed from this table. The modern vegetation types totaled ~6% of the Stone-Moss landscape.



To explore potential trends between the BpS and EVT LANDFIRE datasets, a “combine” function was used in ArcMap 9.2. This comparison suggests that roughly 62% of the landscape has not changed in vegetation from presettlement to ca2000. The BpS that mapped most differently in the EVT dataset was the “Boreal White Spruce-Fir-Hardwood Forest-Coastal” (see table 2).

BpSs that have different EVT-top five by acreage	Acres
Boreal White Spruce-Fir-Hardwood Forest - Coastal	16,147
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	11,701
Laurentian-Acadian Pine-Hemlock-Hardwood Forest	2,397
Boreal Acid Peatland Systems	2,322
Boreal White Spruce-Fir-Hardwood Forest - Inland	1,006

Overall, most differences between the BpS and EVT datasets are believed to be either legend or mapping issues (see table 3). For example, the most acres of difference between the datasets occurred between the “Boreal White Spruce-Fir-Hardwood Forest-Coastal” BpS and the “L.A. Northern Hardwoods Forest” EVT, both of which share most of the same species.

BpS Name	EVT Name	Acres
Boreal White Spruce-Fir-Hardwood Forest - Coastal	Laurentian-Acadian Northern Hardwoods Forest	5206
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	Boreal White Spruce-Fir-Hardwood Forest	4024
Boreal White Spruce-Fir-Hardwood Forest - Coastal	Recently Logged Timberland-Herbaceous Cover	3583
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	Laurentian-Acadian Northern Hardwoods Forest	2664
Boreal White Spruce-Fir-Hardwood Forest - Coastal	Boreal Aspen-Birch Forest	1988
Boreal Acid Peatland Systems	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	1771
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	Boreal Acid Peatland Systems	1728
Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	Laurentian-Acadian Herbaceous Wetland Systems	1673
Boreal White Spruce-Fir-Hardwood Forest - Coastal	Laurentian-Acadian Alkaline Conifer-Hardwood Swamp	1433
Boreal White Spruce-Fir-Hardwood Forest - Coastal	Agriculture-Cultivated Crops and Irrigated Agriculture	1094

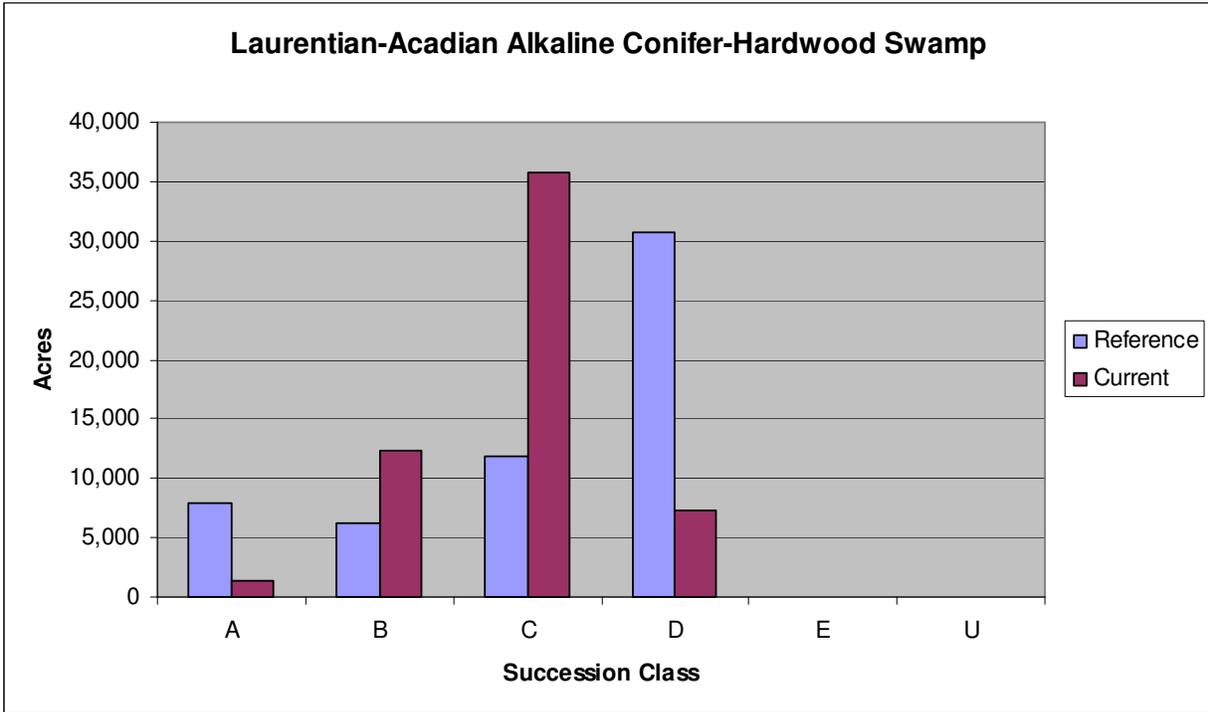
Table 3. Presentation of situations where the BpS type mapped different than the EVT type, situations over 1,000 acres. There were 222 of these combinations total, most of which were fewer than 100 acres.

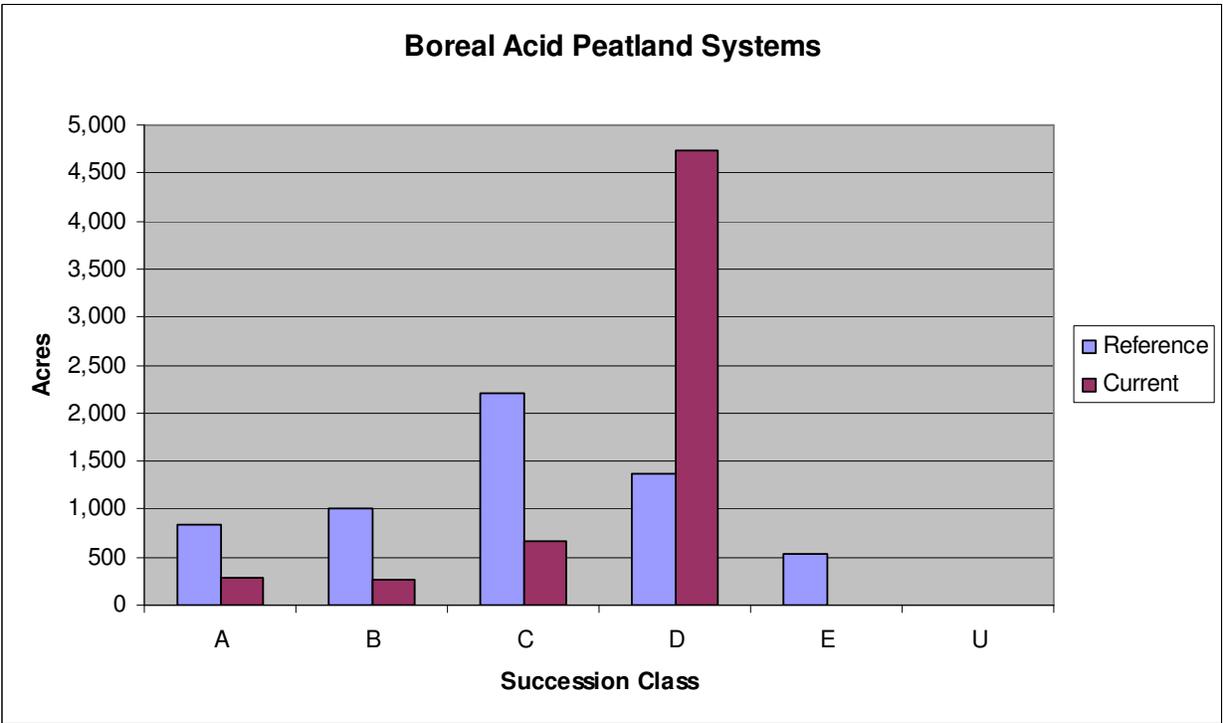
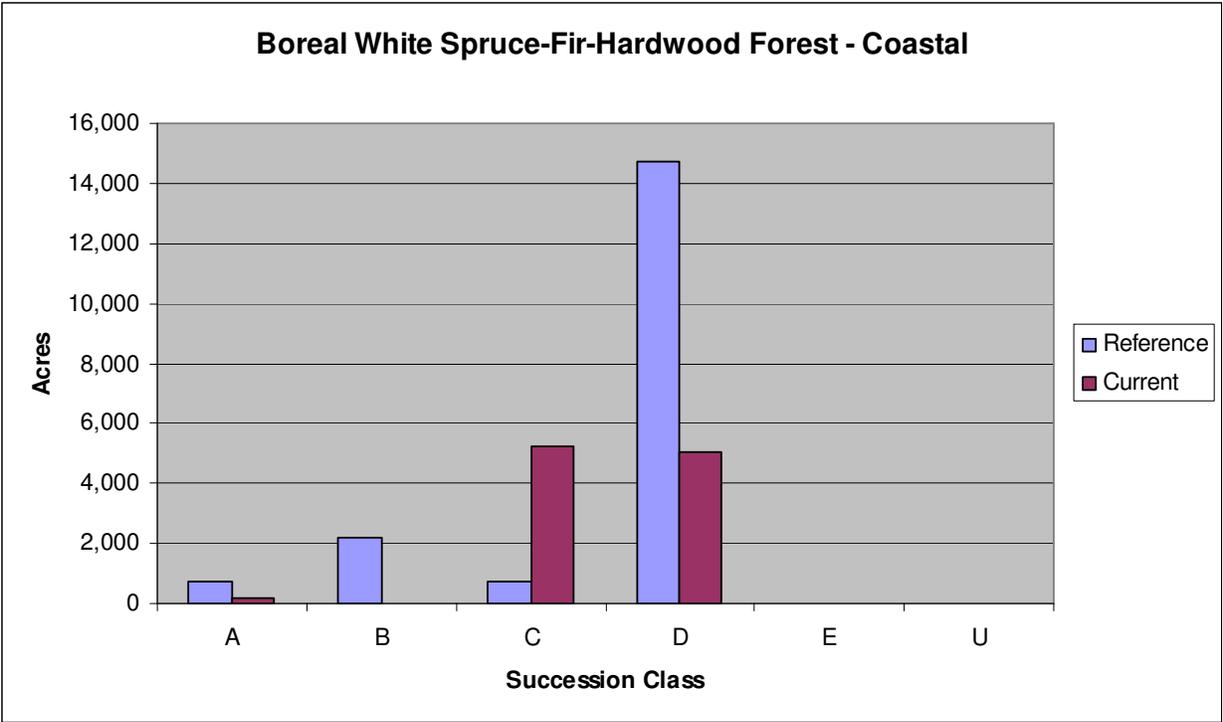
The major ecological shifts in the Stone-Moss unit are within BpSs with the percentage of each succession class represented on the landscape. Conceptually, to compute ecological departure the modeled (“reference”) percentage of each succession class within a particular BpS is compared to the current percentage of each succession class. For this report, LANDFIRE’s Fire Regime Condition Class Mapping Tool was used to calculate departure for this particular landscape. The inputs for this tool are:

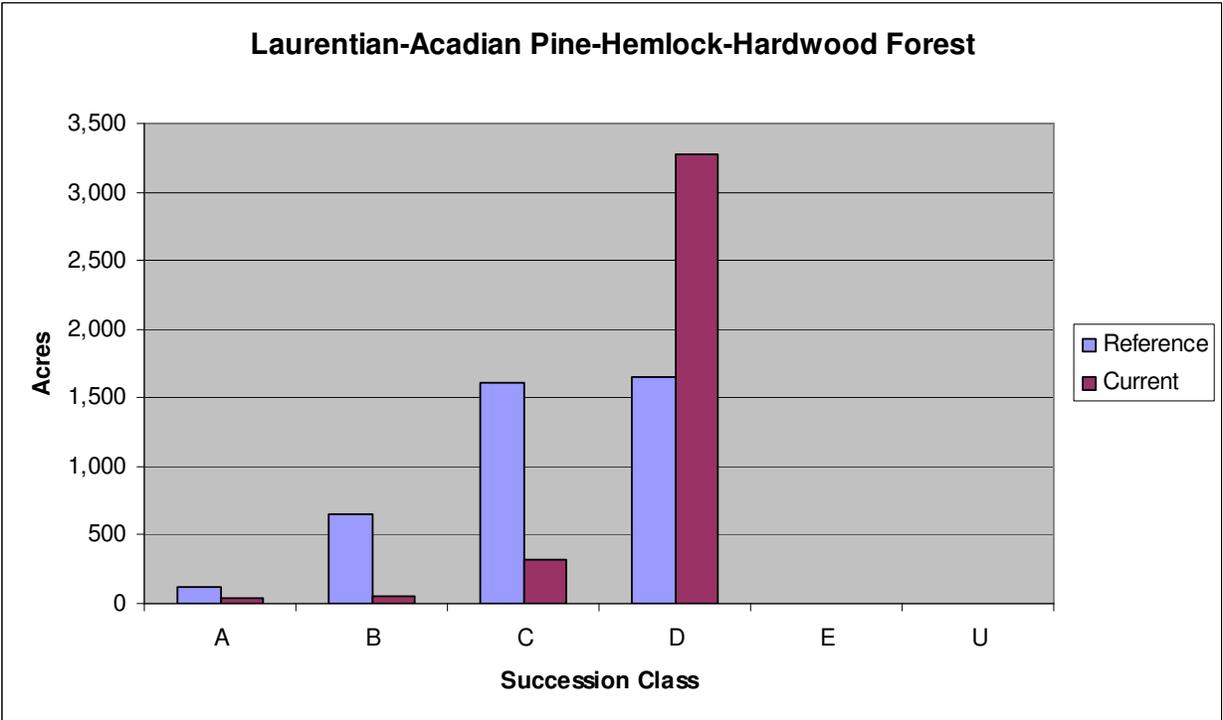
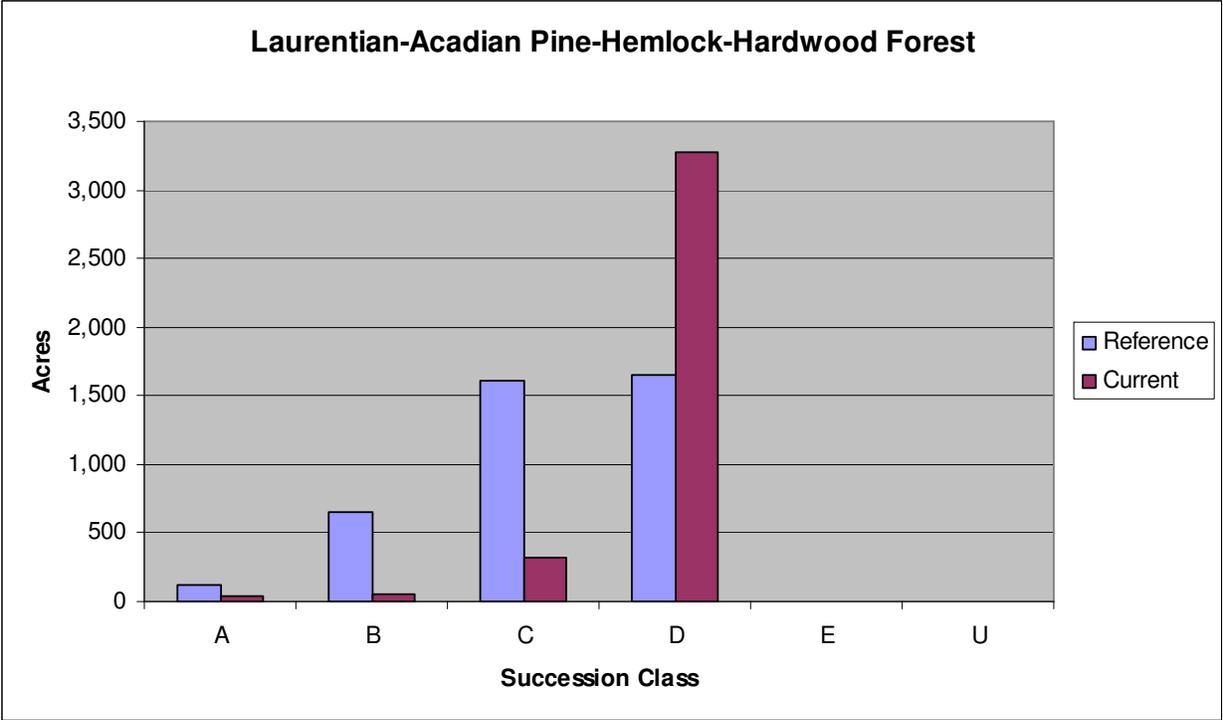
1. REFCON table-this Microsoft Access Database contains the reference condition percentages for each BpS.
2. BpS layer.
3. Succession Class layer-contains the “current” data to which “reference” conditions are compared to.
4. Boundary layer-in this case the Stone-Moss perimeter, minus data from Map Zone 50 that was not utilized in this report.

From this analysis, it is possible to compare “reference” conditions to current. In this report, the Ecological Departure of the top five BpSs is presented in the following charts.

ECOLOGICAL DEPARTURE CHARTS-TOP FIVE MOST WIDE-SPREAD BIOPHYSICAL SETTINGS







NOTES ON, AND RECOMMENDATIONS FROM, ECOLOGICAL DEPARTURE CHARTS

Laurentian Acadian Alkaline Conifer-Hardwood Swamp

This BpS, the most widespread in the Stone-Moss planning unit, is indicated by white cedar, balsam fir, black spruce, tamarack, white pine, black ash, red maple and eastern hemlock, which are found on shallow, poorly drained organic soils, primarily peat over sands. There has not been a significant shift in overall acres between modeled reference and current for this BpS (56,754 acres reference; 56,743 acres currently). However, there has been a significant shift in representation of the succession classes with a decline in succession class D (54% reference; 13% currently) accompanied by an increase in succession class C (21% reference; 63% currently). LANDFIRE data does not break out species individually, but it is hypothesized that this shift is largely due to a loss of the larger trees greater than 25m tall.

Dominant species	
Succession Class C	Succession Class D
White Cedar	White Cedar
Black Spruce	Black Spruce
Tamarack	Black Ash
Red Maple	Balsam Fir
71-90% cover, 5-25m	71-90% cover, 25-50m

Additionally, it is hypothesized that succession class D could be further compromised due to the loss of Ash from predicted Emerald Ash Borer infestations.

Recommendations:

1. Explore linkages between this BpS and its Succession Class D to biodiversity targets and other resource values. What does a reduction in Succession Class D mean to the Hiawatha and stakeholders?
2. Engage in any and all Emerald Ash Borer survey and research projects possible.
3. Give significant consideration to any Black Ash removals. It may be that thinning is a strategy for increasing Black Ash sustainability and resistance to Emerald Ash Borer.
4. Focus silviculture on techniques that facilitate growth of large trees, e.g., Timber Stand Improvement cuts (TSI).
5. Succession Class D is maintained by frequent windthrow. Use silvicultural techniques that mimic windthrow, such as small group selection harvests, and tipping over stumps to expose mineral soils and create microtopography.

Boreal White Spruce-Fir-Hardwood Forest-Great Lakes Coastal

The Boreal White Spruce-Fir-Hardwood Forest-Great Lakes Coastal Bps, is indicated by eastern white cedar, black spruce, balsam fir, paper birch and trembling aspen, and occurs primarily on sand dunes, in glacial lake plains, and on thin soil over bedrock, both igneous and calcareous (e.g., limestone and dolomite cobble or pavement). Current Ecological Departure from reference conditions is found primarily between Succession Classes C and D, with much more Succession Class D under reference disturbance regimes (80% of this BpS under reference conditions; 29% currently), and an increase in Succession C under current conditions.

Dominant species	
Succession Class C	Succession Class D
Paper Birch	White Cedar
Trembling Aspen	Black Spruce
Balsam Fir	Balsam Fir
White Pine	White Pine
71-90% cover, 5-10m	70-100% cover, 10-25m

Overall, there has been a loss of this BpS in terms of total acreage between predicted reference conditions and current (~35k acres difference). Furthermore, it appears that most of the change within this BpS has occurred at the expense of Succession Class D.

Recommendations:

1. Explore linkages between this BpS and its Succession Class D to biodiversity targets and other resource values. What does a reduction in Succession Class D mean to the Hiawatha and stakeholders?
2. Limit conversion of this type to other BpSs.
3. Look for opportunities to expand Succession Class D through field identification of sites with correct species mix, and potential for larger size class trees.
4. Apply silvicultural techniques such as patch harvests, white pine out planting and longer rotation intervals, and selective thinning from below to facilitate larger tree sizes.

Boreal Acid Peatland Systems

The Boreal Acid Peatland Systems are indicated by black spruce, tamarack, bog birch, carex species, and sphagnum moss, and form on small ice-block basins and poorly-drained, level terrain. The most significant pattern when comparing reference to current conditions with this BpS is the significantly larger percentage of succession class D on the landscape than was predicted for the reference condition (23% reference; 80% current). It is hypothesized that altered fire regimes may be responsible for the increase in percent cover and therefore succession class D. The LANDFIRE model for this BpS used a relatively rare replacement fire regime (> 1,000 years return interval) and a more frequent surface fire regime (~100 years). However, initial testing of this hypothesis in Vegetation Dynamics Development Tool suggests that only around 20% of the increase of succession class D in the current condition can be explained by altered fire regimes. A second hypothesis is based on the LANDFIRE reference condition model itself. Most of the succession classes are stand-alone systems that were lumped into this BpS because they could not be mapped as separate BpSs. It may be that succession class D has higher than predicted representation due to the surficial geology and/or soils of the Stone-Moss planning unit.

Dominant species	
Succession Class C	Succession Class D
Tamarack	Labrador tea
Black Spruce	Black Spruce
Chamaedaphne	Three seeded sedge
Sphagnum	Sphagnum
5-25m, 30-50% cover	5-25m, 50-70% cover

Recommendations:

1. Explore linkages between this BpS and its Succession Class D to biodiversity targets and other resource values. What does a potentially overabundant Succession Class D and a reduction of succession classes other succession classes mean to the Hiawatha and stakeholders?
2. Work with experts to review LANDFIRE reference condition model, BpS maps/descriptions and any existing survey data to address discrepancy between reference and current conditions.
3. Consider prescribed fire in areas with succession class D to reduce percent cover. The goal for these areas should be 31-50% cover with black spruce and tamarack in the overstory.
4. Adapt relevant LANDFIRE model to current conditions and explore effects of altered and potential fire regimes on this BpS.