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Climate change report

Stand 10, Inventory, 2017

CIM summary

Climate Informed Metric	Value
Total Stocking	Relative Density= 0.0
Tree Species Diversity (Richness)	Overstory Species Count= 0
Tree Species Evenness (Richness Distribution)	Overstory J'= 0.000 Understory J'= 0.714
Large Coarse Woody Debris	0.0 cubic feet per acre
Seedlings and Saplings	Seedlings= 704.1 stems/ac Saplings= 0.0 stems/ac
Climate Risk- Overstory	no trees found
Climate Risk- Established Regeneration	no trees found
Climate Risk- Seedlings	low emissions: 18.6 high emissions: 0.0

Total Stocking

Stocking provides information about the area within a stand that is occupied by trees. Information about the current stocking can inform management decisions, with ideal stocking levels will varying based on forest type, species composition, and management objectives. Information about stocking levels may help to identify whether stands are having a reduced or increased growth response under a changing climate. Further, there is some evidence that maintaining stands at somewhat lower densities may increase their resistance and resilience to droughty conditions (http://www.nrs.fs.fed.us/pubs/46366/), which are expected to increase in some areas.

The stand relative density is **0** of the average maximum stocking expected in undisturbed stands of similar size and species. This density is below the range for best individual tree growth. At this relative density, growth rate of the biggest trees is probably excellent, while growth rate of the medium and smaller-sized trees is probably good and mortality due to crowding low.

Tree Species Diversity (Richness and Evenness)

Climate change is expected to have substantial effects on forest ecosystems, with many forest types having species that are expected to decline. In general, species-rich communities have exhibited greater resilience to extreme environmental conditions and greater potential to recover from disturbance than less diverse ecosystems. Less diverse ecosystems are generally considered to be more vulnerable to climate change and associated stressors, and a greater diversity of species and ecological functions are likely to increase the ability of the forest to buffer changes. Two measures of tree species diversity are easily calculated from commonly collected data - richness and evenness - and give an indication of stand-level diversity. Species richness is the number of species that are present and provides a very simple measure of diversity. Species evenness integrates information about the relative abundance of individual species to assess whether a stand is dominated by one or a few species or if stand composition is relatively even across many species. Together, these metrics can help managers evaluate whether their "eggs are all in one basket".

Species Richness: There are **0** tree species in this stand. Only species where trees with stems of at least 5-inch DBH are counted. The species are, in no particular order: .

Species Evenness: Evenness (J') values range from 0-1, where low values indicate dominance of a single species and higher values indicate greater evenness across species.
Overstory J'= **0.000**
Understory J'= **0.714**

Large Coarse Woody Debris

Coarse woody debris provides many ecological values. Course woody debris, especially large wood that takes longer to decompose important to nutrient cycling and helps maintain biodiversity by providing habitat for a wide range of species, including birds, mammals, reptiles, amphibians, insects, and invertebrates. Where conditions become warmer and drier, coarse woody debris may also help to retain moisture in soils and near the soil surface. This can help to create microclimates beneficial to plants, particularly during germination, and animals. At the same time, course woody debris can serve as fuel in fire-dependent forests or in forests that experience droughty conditions, potentially increasing fire risk.

The estimated volume of coarse woody debris in this stand is **0.0** cubic feet per acre. There are zero observations on thirty four transects. Each transect is 198 feet long, with a combined length of 6732 feet.

Seedlings and Saplings

Changes in climate may affect plant germination in various ways. Warmer temperatures and altered precipitation and moisture may affect the maturation and dispersal of seeds, seed persistence in soils, germination rates, or germinant success. For these reasons, the seedlings may provide an early warning system for greater changes that may occur in the future. The abundance and composition of seedlings (< 1 inch DBH) and saplings (1-4 inches DBH) can provide valuable information about the future forest. There are **704.1** seedling and **0.0** sapling stems per acre on this stand.

Seedlings and Saplings

Species	Seedlings (stems/ac.)	Saplings (stems/ac.)
swamp white oak	347.6	
green ash	169.3	
American elm	53.5	
American sycamore	44.6	
silver maple	35.7	
common hackberry	26.7	
pin oak	17.8	
red mulberry	8.9	
TOTALS	704.1	0.0

Climate Risk Metrics

Many forests are already responding to changing conditions, and climate change is anticipated to have a pervasive influence on forests over the coming decades. Many changes are expected to influence the habitat of tree species- warmer temperatures, altered precipitation, and increased stressors may decrease the ability for certain species to persist in some areas, while increasing the potential habitat available for others.

This report provides information for natural resource managers to assess some of the potential risks of climate change on the areas that they manage by showing anticipated changes in tree species' habitats at a regional scale. Importantly, local site conditions and past and current management ultimately determine how a forest will respond to climate change- thus, it is up to the manager to consider how regional climate impacts pertain to a particular location and set of management objectives. For more information on incorporating climate change into management, view the *Forest Adaptation Resources* www.forestadaptation.org/far.

The following tables help to identify the proportion of a stand that may be at risk of decline as a result of climate change. These data are based on modeled changes in habitat suitability using the Climate Change Tree Atlas (www.nrs.fs.fed.us/atlas/tree). Data are presented under two climate change scenarios- a low climate change scenario (PCM B1) and a high climate change scenario (GFDL A1FI)- in order to demonstration a potential *range* of change that may be expected by the end of the century (2070-2100).

Species identified as being at risk are projected to have 20% or greater decrease in suitable habitat in the region that was selected for analysis. Species that are projected to have a large decrease in suitable habitat (suitable habitat is expected to decrease 50% or more) may be at an even greater risk. **This does not mean that the species are projected to die or disappear- rather, this indicates that habitat suitability is expected to be lower, making conditions less suitable for the particular species across the region.**

At a stand level, a species is likely to be at greatest risk when a species is projected to decrease under both climate change scenarios *and* when local conditions and expertise suggest that the species is vulnerable to anticipated changes in the region. Published regional assessments provide valuable information about regional climate change impacts on forests, including additional information on how individual species may respond. These can be accessed online at www.forestadaptation.org/vulnerability-assessment. The data used for this risk assessment are from the **Southern Wisconsin** assessment area.

The climate risk tables have the following columns for each species:

- **Adaptability**= Ratings are based upon the tree species' life history and ability to respond to disturbance and provide an indication of the ability of a species to adapt to changing conditions across its entire range. Adaptability is summarized as high, medium, or low in the table. Details on each species' trains can be found on the Climate Change Atlas (http://www.fs.fed.us/nrs/atlas).
- **Model Reliability**= Ratings indicate the ability of the Climate Change Atlas models to predict a species reliably. For example, rare species often have lower model reliability because less data are available to develop the model.

- **Basal Area**= Dominance, based on the basal area of all stems or individuals of a given species (square feet).
- **Stems Per Acre**= Density, based on the mean stems per acre, based on stems counted in each plot cluster.
- **Frequency**= The percentage of plot clusters where this species was observed, based on the number of plot clusters where species occurred divided by total number of plot clusters.
- **Importance Value**= Species importance is based upon the combination of a species' basal area, stems per acre, and frequency within a stand. Values range from 0 to 100, with more important species having higher values.
- **Low Emissions**= Under a less harsh climate scenario (PCM B1):
  - **Future:Current**= The ratio of future (projected for 2100) species importance to current importance. Values greater than 1 indicate a projected increase in suitable habitat (e.g., ratio of 1.2 is a 20% increase).
  - **Change class**= Rating of projected change in suitable habitat based upon the future:current values (Details at www.fs.fed.us/nrs/atlas/products/#ra).
  - **At risk %**= Species that are projected to have reduced suitable habitat in the future (change class is Decrease or Large Decrease) are considered to be potentially at risk from climate change. The percentage of the stand at risk is based upon the Importance Values for at-risk species.
- **High Emissions**= Under a harsh climate scenario (GFDL A1FI):
  - **Future:Current**= The ratio of future (projected for 2100) species importance to current importance. Values greater than 1 indicate a projected increase in suitable habitat (e.g., ratio of 1.2 is a 20% increase).
  - **Change class**= Rating of projected change in suitable habitat based upon the future:current values (Details at www.fs.fed.us/nrs/atlas/products/#ra).
  - **At risk %**= Species that are projected to have reduced suitable habitat in the future (change class is Decrease or Large Decrease) are considered to be potentially at risk from climate change. The percentage of the stand at risk is based upon the Importance Values for at-risk species.

Overstory (> 4.5 inch DBH)

no trees found

Established Regeneration(1-4.5 inch DBH)

no trees found

Seedlings (<1 inch DBH)

Seedlings (<1 inch DBH)

Species	Adaptability	Model Reliability	Basal Area	Stems Per Acre	Frequency	Importance Value	Low Emissions Future:Current	Low Emissions Change class	Low Emissions At risk %	High Emissions Future:Current	High Emissions Change class	High Emissions At risk %
swamp white oak	**Medium**	**Low**	**0.0**	**347.6**	**58.8**	**51.0**	4.360	Large increase	0.0	10.050	Large increase	0.0
common hackberry	**High**	**Medium**	**0.0**	**26.7**	**5.9**	**4.5**	5.100	Large increase	0.0	6.160	Large increase	0.0
silver maple	**High**	**Medium**	**0.0**	**35.7**	**5.9**	**5.2**	2.730	Large increase	0.0	3.120	Large increase	0.0
American elm	**Medium**	**Medium**	**0.0**	**53.5**	**8.8**	**7.7**	1.770	Small increase	0.0	1.930	Small increase	0.0
green ash	**Medium**	**Medium**	**0.0**	**169.3**	**14.7**	**18.6**	0.800	Small decrease	18.6	1.420	Small increase	0.0
pin oak	**Low**	**Medium**	**0.0**	**17.8**	**5.9**	**3.9**	78.000	Large increase	0.0	270.000	Large increase	0.0
red mulberry	**Medium**	**Low**	**0.0**	**8.9**	**2.9**	**1.9**	10.500	Large increase	0.0	14.370	Large increase	0.0
American sycamore	**Medium**	**Medium**	**0.0**	**44.6**	**8.8**	**7.1**	0.000	New habitat	0.0	0.000	New habitat	0.0
Total			**0.0**	**704.1**	**111.8**	**100.0**			18.6			0.0

Tree species that are expected to have increased suitable habitat across the region

Underlined species are currently found in this stand

- Low Emissions

    - **Expected to increase**: boxelder, American hornbeam, bitternut hickory, shagbark hickory, hophornbeam, chinkapin oak, American elm and slippery elm
    - **Substantial increase**: silver maple, river birch, pignut hickory, common hackberry, flowering dogwood, American beech, white ash, honeylocust, black walnut, eastern redcedar, red mulberry, eastern cottonwood, black cherry, chokecherry, swamp white oak, pin oak, black locust, sassafras and black willow
    - **Possible new habitat**: Ohio buckeye, pawpaw, mockernut hickory, pecan, eastern redbud, tuliptree, osage orange, longleaf pine, American sycamore, scarlet oak, shingle oak, turkey oak and post oak
- High Emissions
    - **Expected to increase**: boxelder, shagbark hickory, white ash, green ash, balsam poplar, American elm and slippery elm
    - **Substantial increase**: silver maple, river birch, American hornbeam, pignut hickory, common hackberry, flowering dogwood, American beech, honeylocust, black walnut, eastern redcedar, red mulberry, eastern cottonwood, American plum, swamp white oak, chinkapin oak, pin oak, black locust, sassafras and black willow
    - **Possible new habitat**: Ohio buckeye, pawpaw, mockernut hickory, pecan, shellbark hickory, black hickory, eastern redbud, sugarberry, common persimmon, sweetgum, tuliptree, osage orange, blackgum, slash pine, loblolly pine, American sycamore, shingle oak, blackjack oak, post oak and cedar elm