

# Climate Change Exposure Mapping

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Important work has been done downscaling projected changes in climate conditions, modeling shifts in suitable habitat, and mapping historical disturbance patterns across the region to better inform forest management under changing climate regimes. But none has combined all these products into one cohesive assessment of potential forest exposure to climate change, how it varies by species and across the region.

The Northeastern Forest Climate Change Exposure Mapping Tool was designed to aggregate these valuable but disparate spatial data sets to provide a more comprehensive assessment of relative exposure to climate change at the species and community levels.

## Methods

Input Data Layers - normalized based on data distribution across the region

- Species Abundance - FEMC Species Basal Area Maps
- Disturbance Frequency - FEMC Forest Health Atlas
- Projected Change in Suitable Habitat - Climate Change Tree Atlas
- Predicted change in climate metrics - Developed as a part of this project based on TerraClimate data

### Species-Specific Exposure Calculations

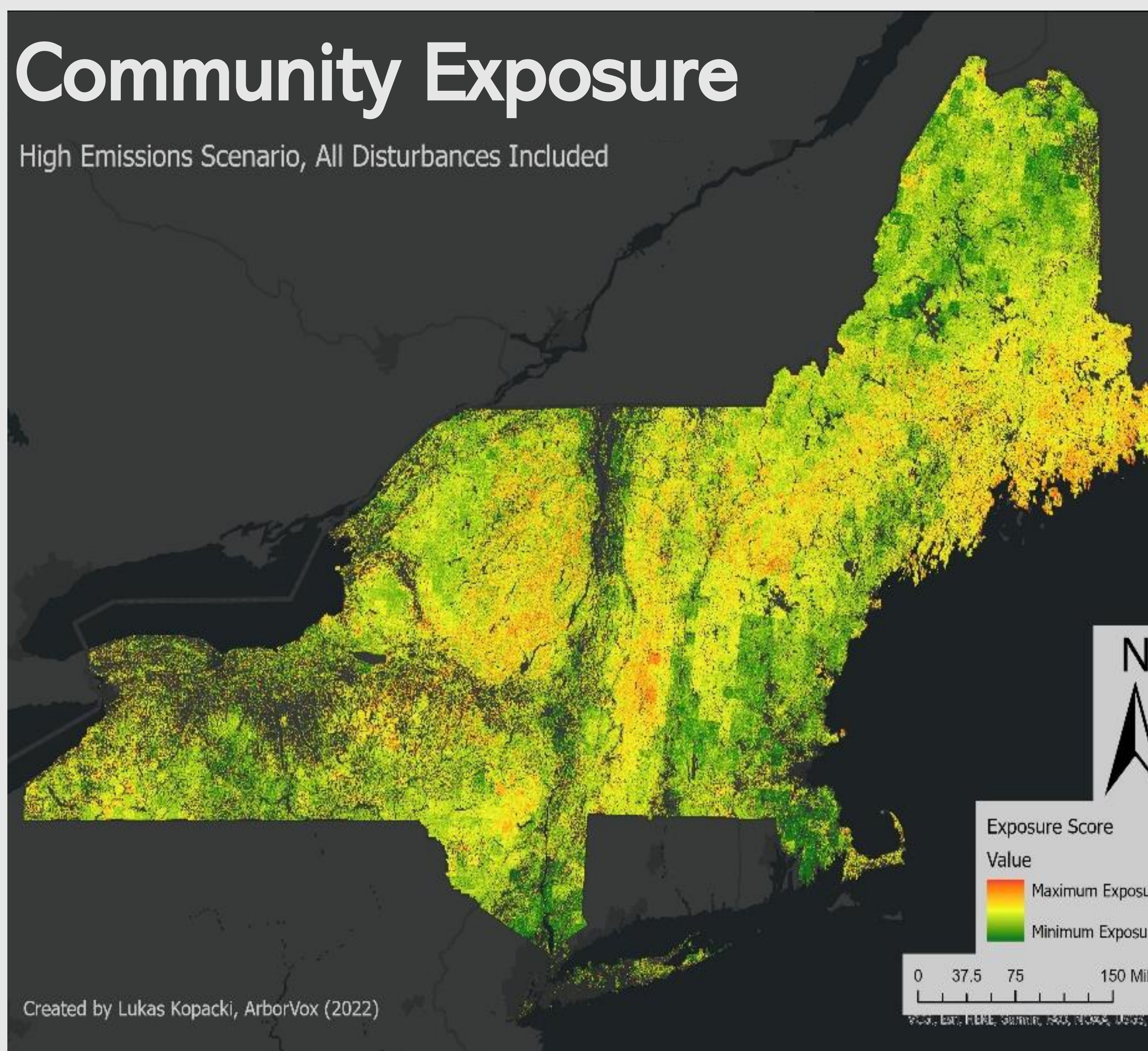
For each species, the sum of the normalized input data layers was used to calculate an aggregate climate exposure value at the 30m pixel level. Aggregate models were created for low and high emission scenarios and three disturbance scenarios (no disturbance, all disturbance, climate related disturbance only).

### Community Exposure Calculations

Community-level climate exposure models were developed to aggregate exposure across all species present at each 30m pixel. Calculated as a weighted (%BA) average of species-level climate exposure values, the result is map of relative climate exposure for forested systems that can be used to help inform adaptive management across the region.

## Community Exposure

High Emissions Scenario, All Disturbances Included



## Results

At the stand level, highest overall exposure to changing climate conditions, disturbance frequency, and shifts in suitable habitat is concentrated in mountainous regions throughout the region and southeastern Maine.

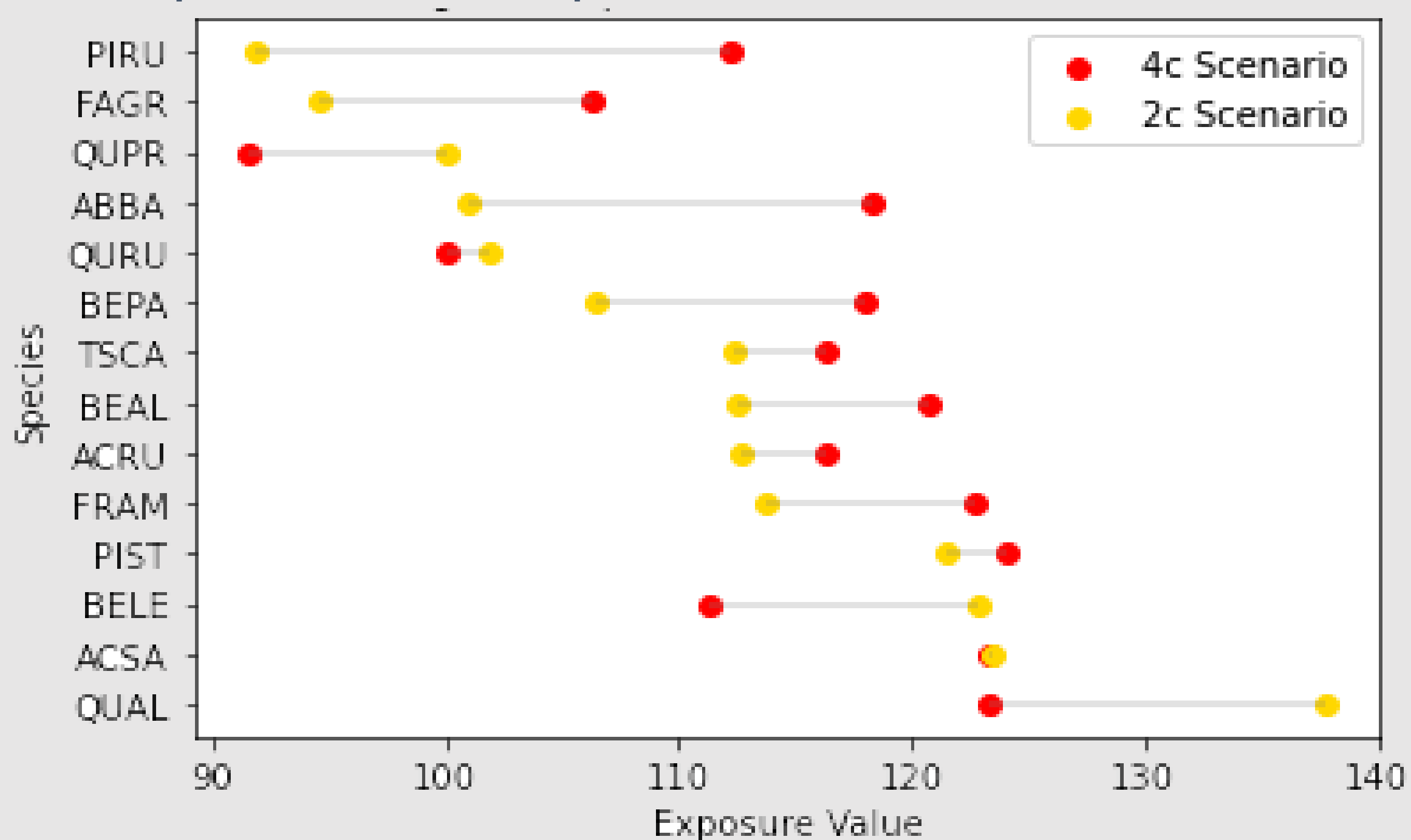
Relative exposure across all species increases by 4 percent between low and high emission scenarios, although the differences between individual species varies widely.

## Web Tool

The FEMC hosts an ArcGIS Online-leveraged GIS hub with raster-based tile maps for each input data layer, each species and community level exposure maps for multiple climate and disturbance scenarios. Maps can be viewed via the online GIS hub or downloaded directly from the FEMC website

Much of our current management is guided by the outcomes of decades of silviculture research, yet many of the conditions under which those results were generated are rapidly changing. These relative exposure maps can help to inform where climate adaptation management applications may be most necessary and successful over time.

**Climate Exposure by Species:** For all map products higher values indicate higher exposure to climate change and potential risk for impacts.



## Species Included in Analysis

- |                  |                    |                 |
|------------------|--------------------|-----------------|
| Northern red oak | Yellow Birch       | Red Maple       |
| White oak        | Eastern white pine | American Beech  |
| Chestnut Oak     | Red spruce         | White Ash       |
| Black Birch      | Balsam Fir         | Eastern Hemlock |
| Paper Birch      | Sugar Maple        |                 |



**Climate Exposure by Ecoregion:** Comparisons by Ecoregion highlight the variability of climate exposure that can be expected across the region and how that may change under low and high emission scenarios.

