

Analysis of Climate Change Impacts on Tree Species of the Eastern US: Wall-to-Wall Results of DISTRIB-II and SHIFT Modeling

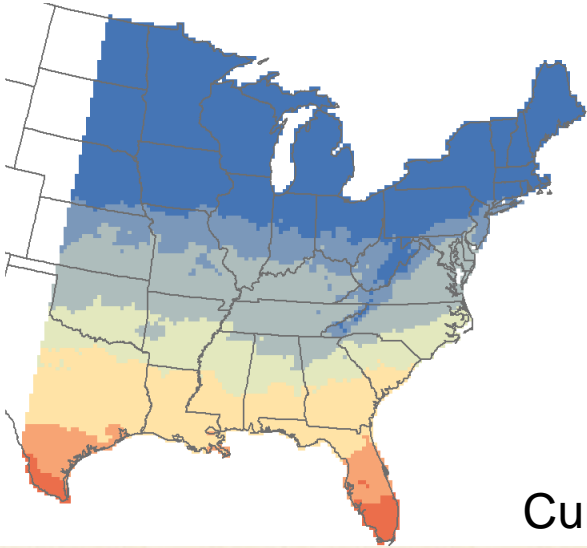
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Anantha M. Prasad¹, Stephen N. Matthews^{1,2}

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Northern Institute of Applied Climate Science,
Delaware, OH, USA

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The Ohio State University,
Columbus, OH, USA



PRISM 1981-2010



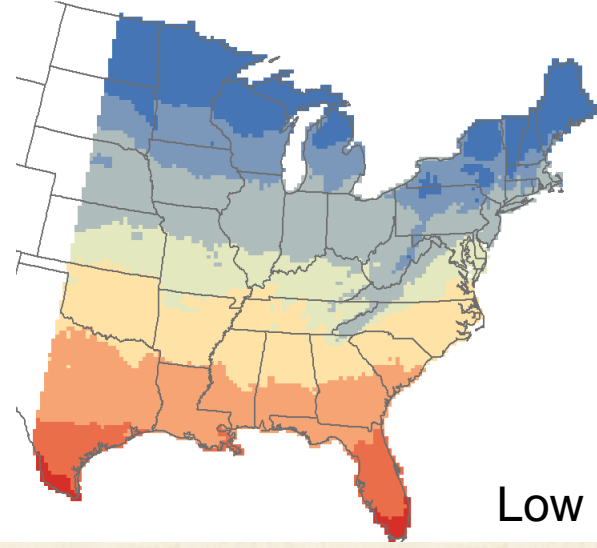
Mean Annual C

- 2 - 10
- 11 - 12
- 13 - 15
- 16 - 17
- 18 - 20
- 21 - 22
- 23 - 25
- 26 - 28

Current

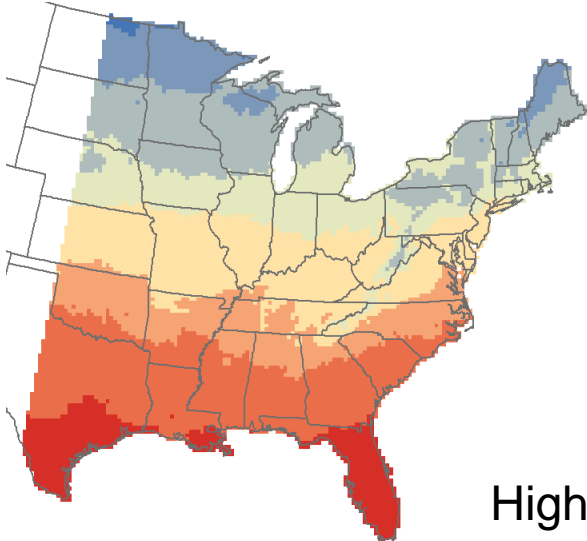
Temperature will increase,
a lot, especially under high emissions

CCSM4 RCP 4.5
(2070-2099)



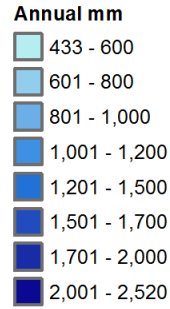
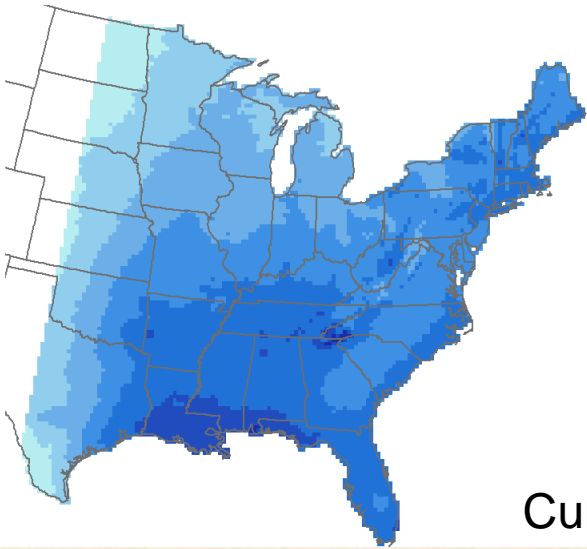
Low Emissions

GFDL-CM3 RCP 8.5
(2070-2099)



High Emissions

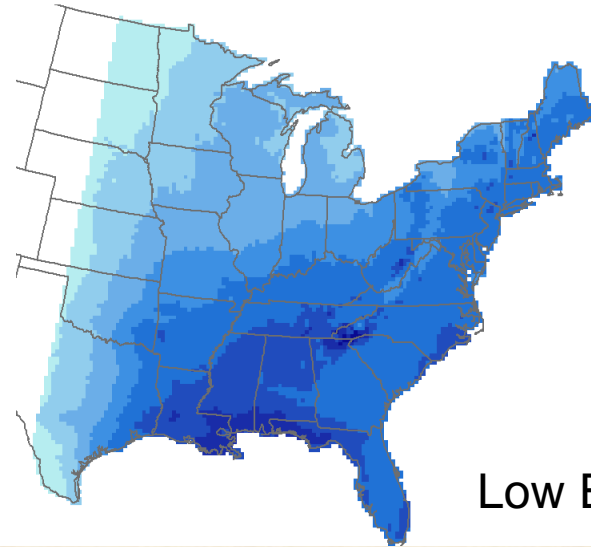
PRISM 1981-2010



Current

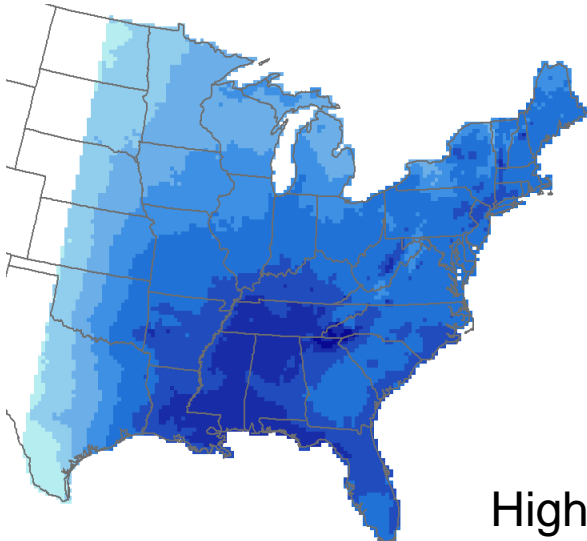
Precipitation may increase,
but still more physiological drought

CCSM4 RCP 4.5
(2070-2099)



Low Emissions

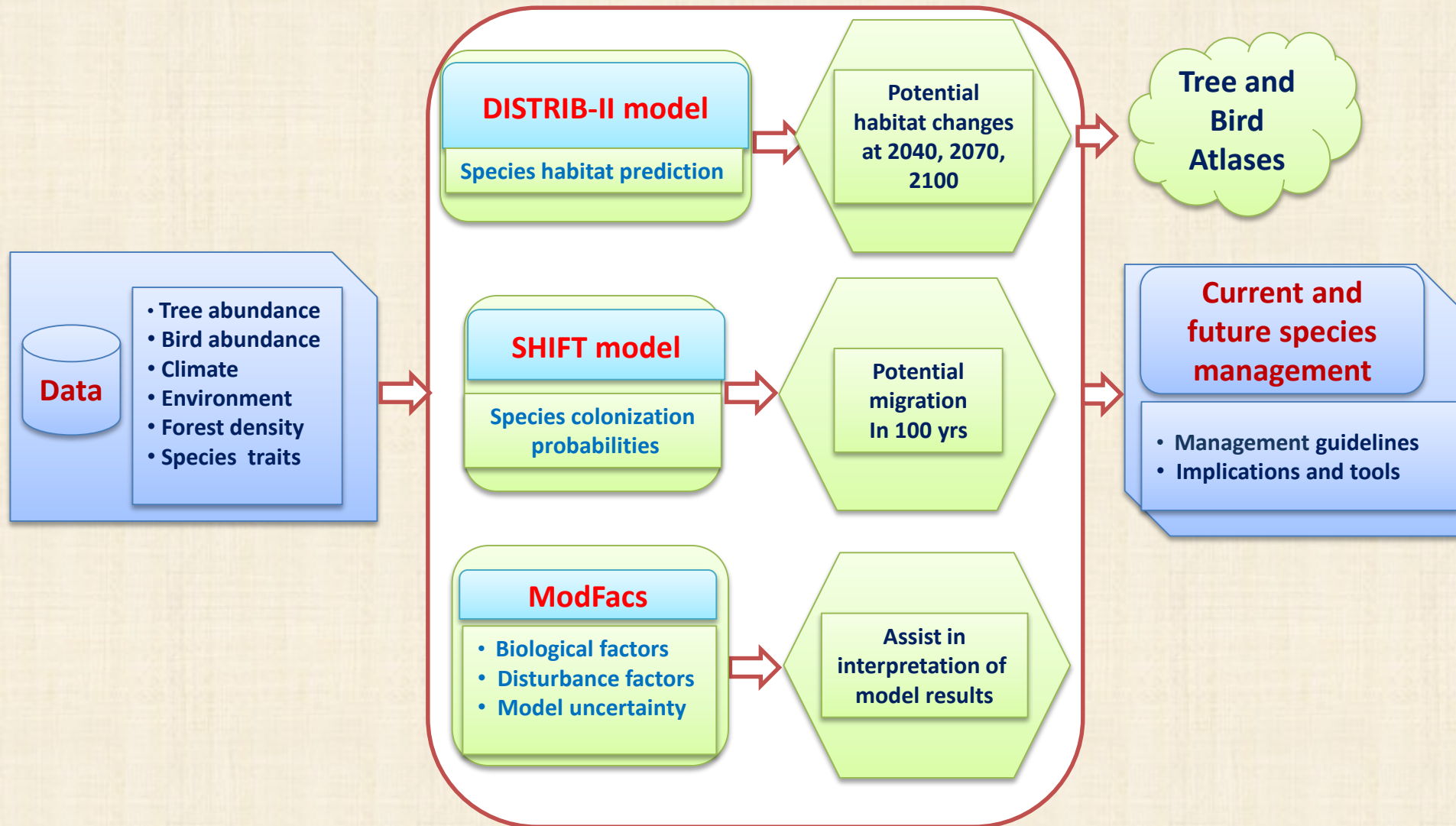
GFDL-CM3 RCP 8.5
(2070-2099)



High Emissions

MODELING POTENTIAL CHANGES IN TREE SPECIES HABITATS

Multi-stage modeling scheme



black oak (*Quercus velutina*)

Model Reliability: High ●

Current Distribution

Projected Future Habitat ●

Predictor Maps

⚠ Cautions & Model Info

Current Distribution Maps for black oak

Help »

Current Forest Inventory and Analysis ▾

Compare Two Species

Notice:

This is an updated version of the Climate Change Tree Atlas. You can view the [previous black oak page](#), or [browse the previous Tree Atlas](#).

▼ About black oak

Family: Fagaceae

Guild: persistent, large-seeded, advance growthdependent

Functional Lifeform: medium-size to large deciduoustree

- [Life History and Disturbance Response](#)
- [Silvics Manual](#)
- [Photos of black oak in USDA Plants Database](#)
- [View current and modeled black oak distributions in Google Earth](#) (227 KB)

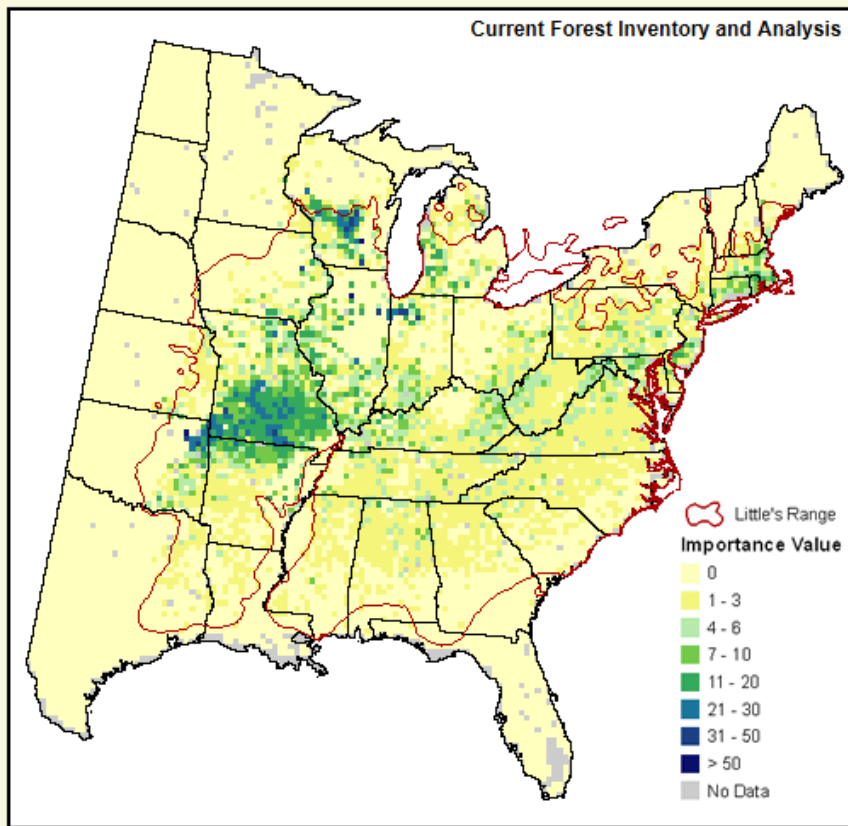
[Download Google Earth for free](#)

► Climate Change Adaptability

► Summary of Predicted Changes

► Range and Niche Maps

► Predictor Analysis



Potential Changes in Abundance and

| GCM SCENARIO | % Area Occ | Ave IV | Sum |
|--------------|------------|--------|-------|
| Actual FIA | 36 | 4.4 | 15,33 |

Climate Change Atlas - 4.5 m page views

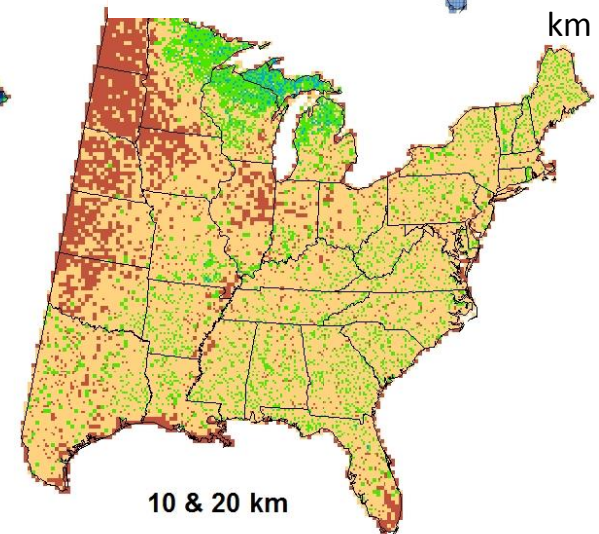
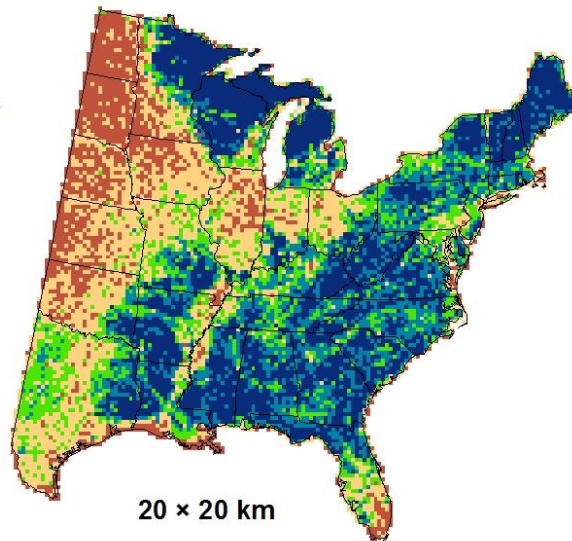
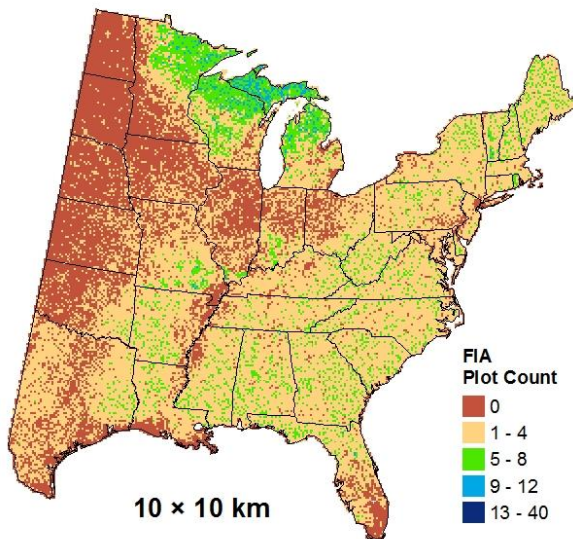
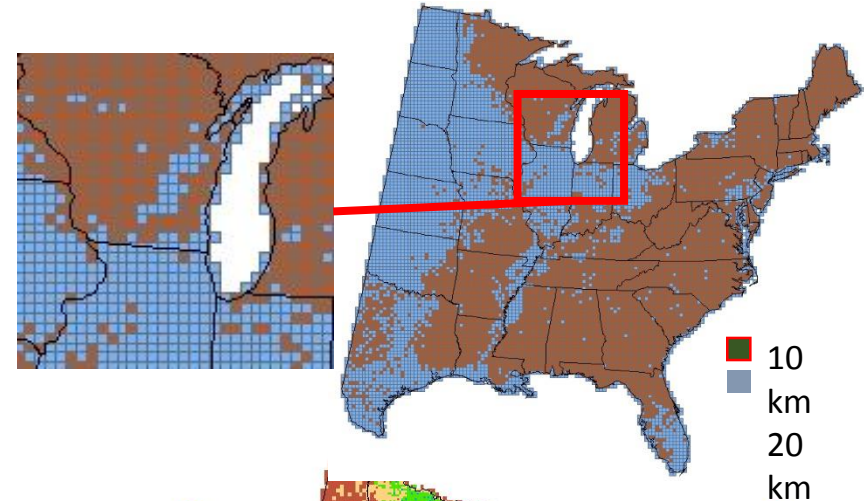
<http://www.nrs.fs.fed.us/atlas>

DISTRIB-II - Updates

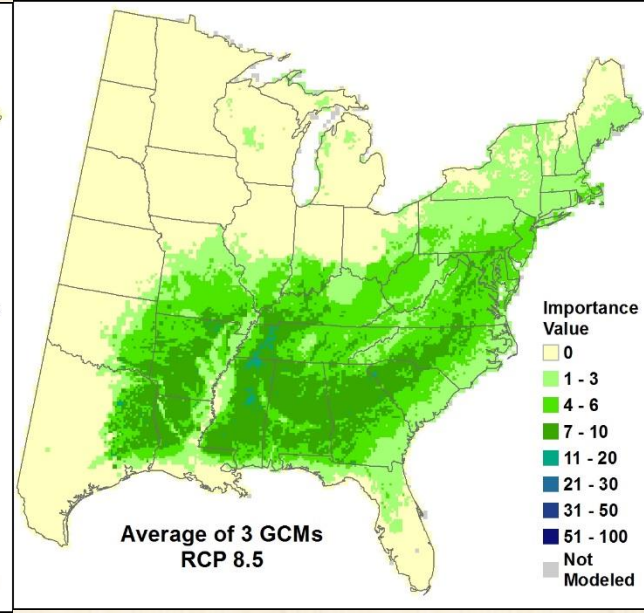
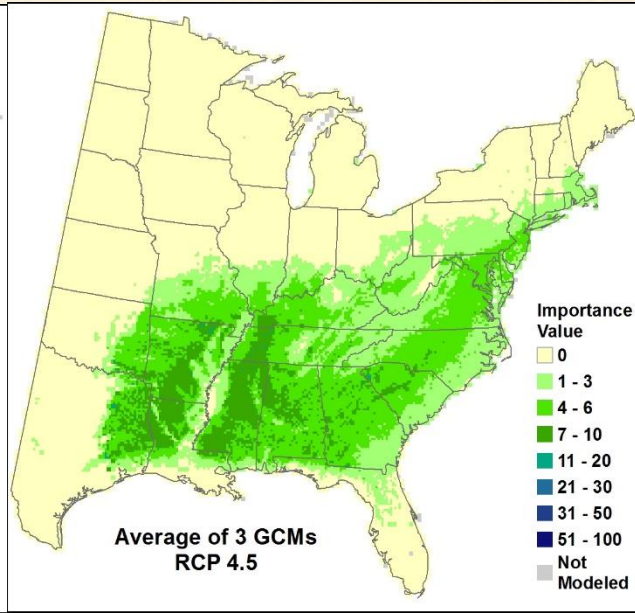
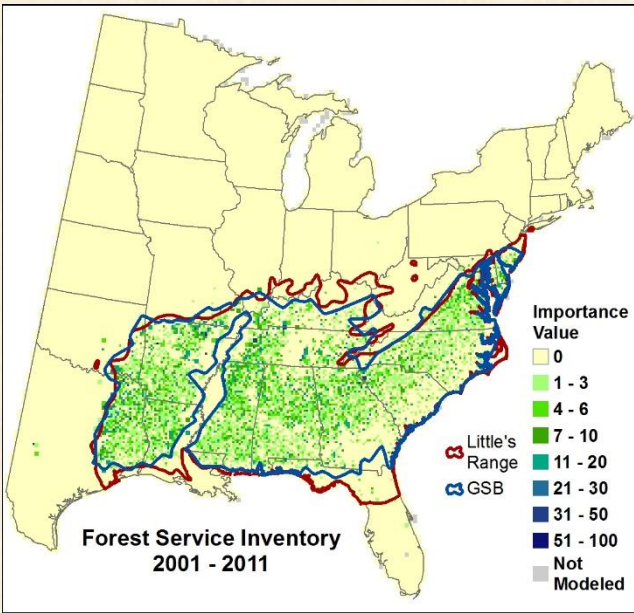
- Newer Forest Inventory data (2001 – 2011)
- AR5 Climate projections
 - 3 GCMs (CCSM4, GFDL 3.0, HadGEM2-ES)
 - 2 RCPs (4.5 and 8.5)
- Updated and New Variables
 - Climate
 - Soils
 - Day length (Latitude & solar radiation surrogate)
- New methodology
 - Fine-tuning of predicted values
 - Hybrid grid

New: Hybrid 10x10 or 20x20 km Grid to create a more representative inventory

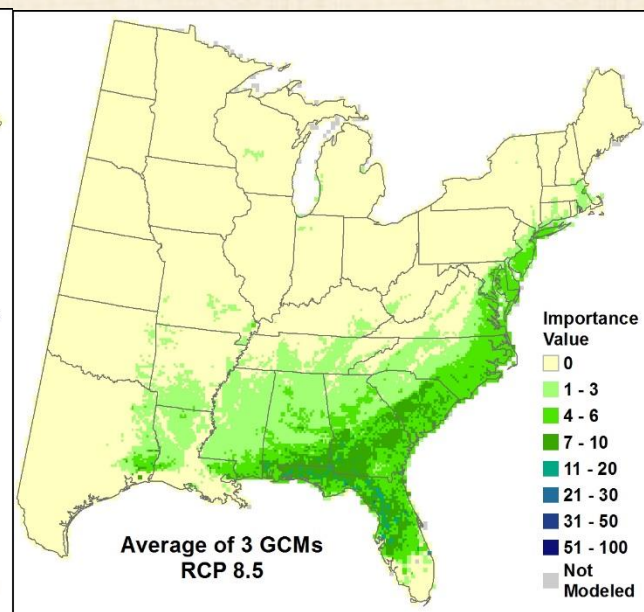
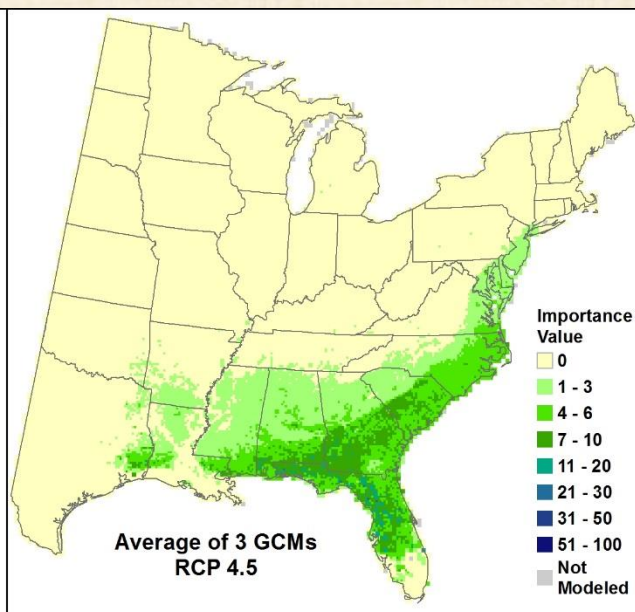
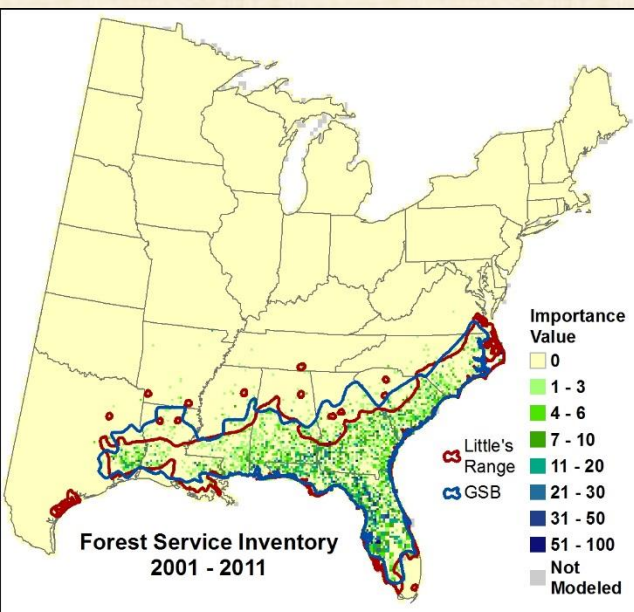
- Maximize resolution based on number of FIA plots per cell
- Reduce extrapolated area
- Evens out number of plots per cell



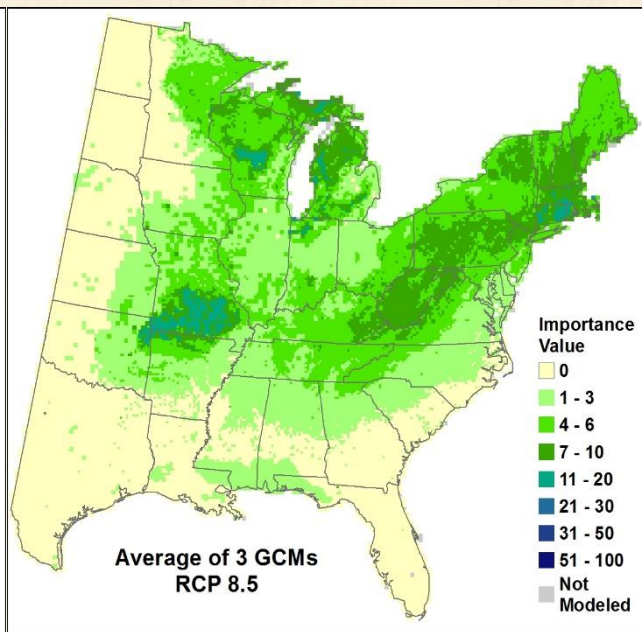
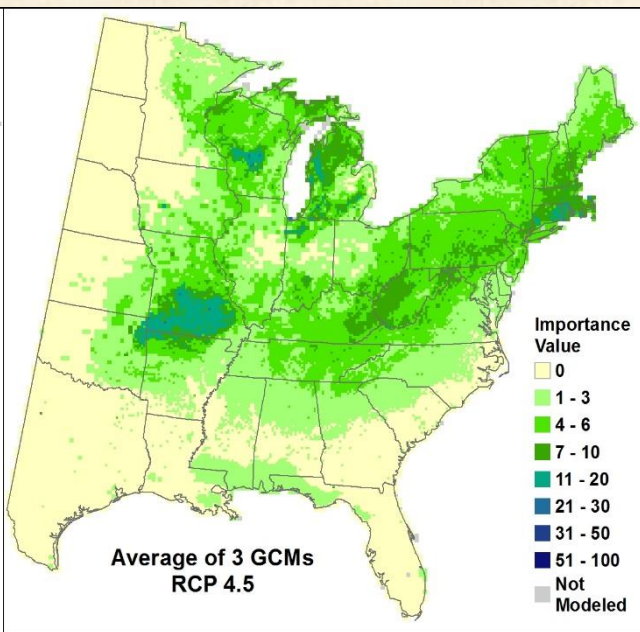
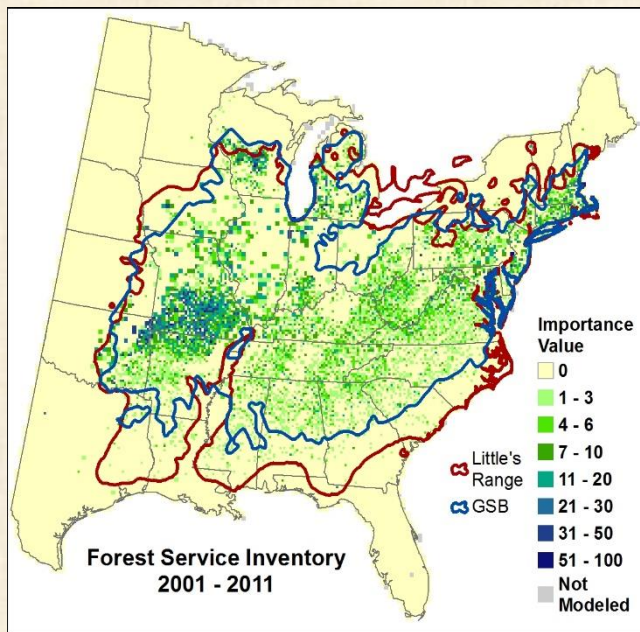
Southern Red Oak



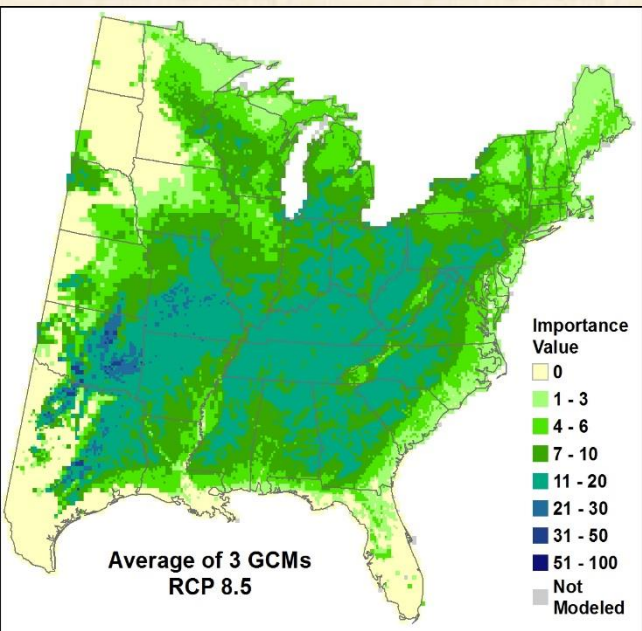
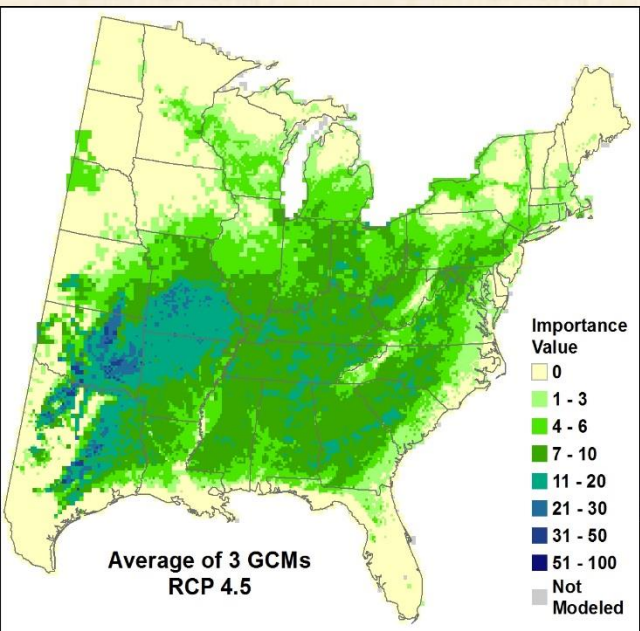
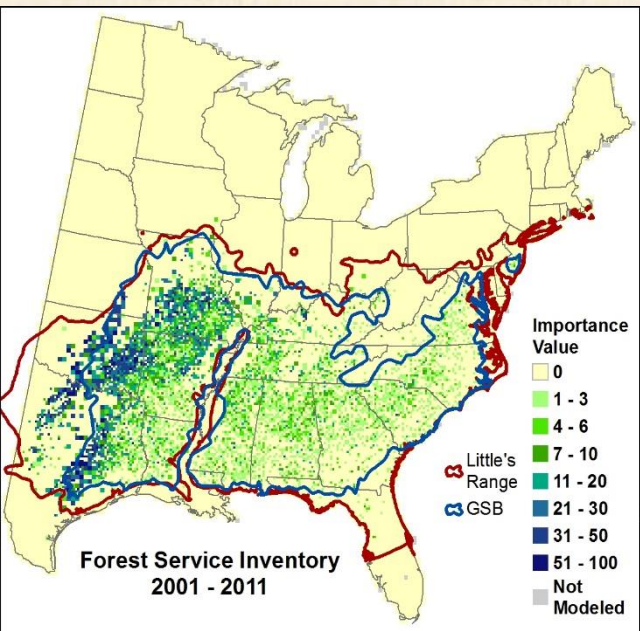
Laurel Oak



Black Oak

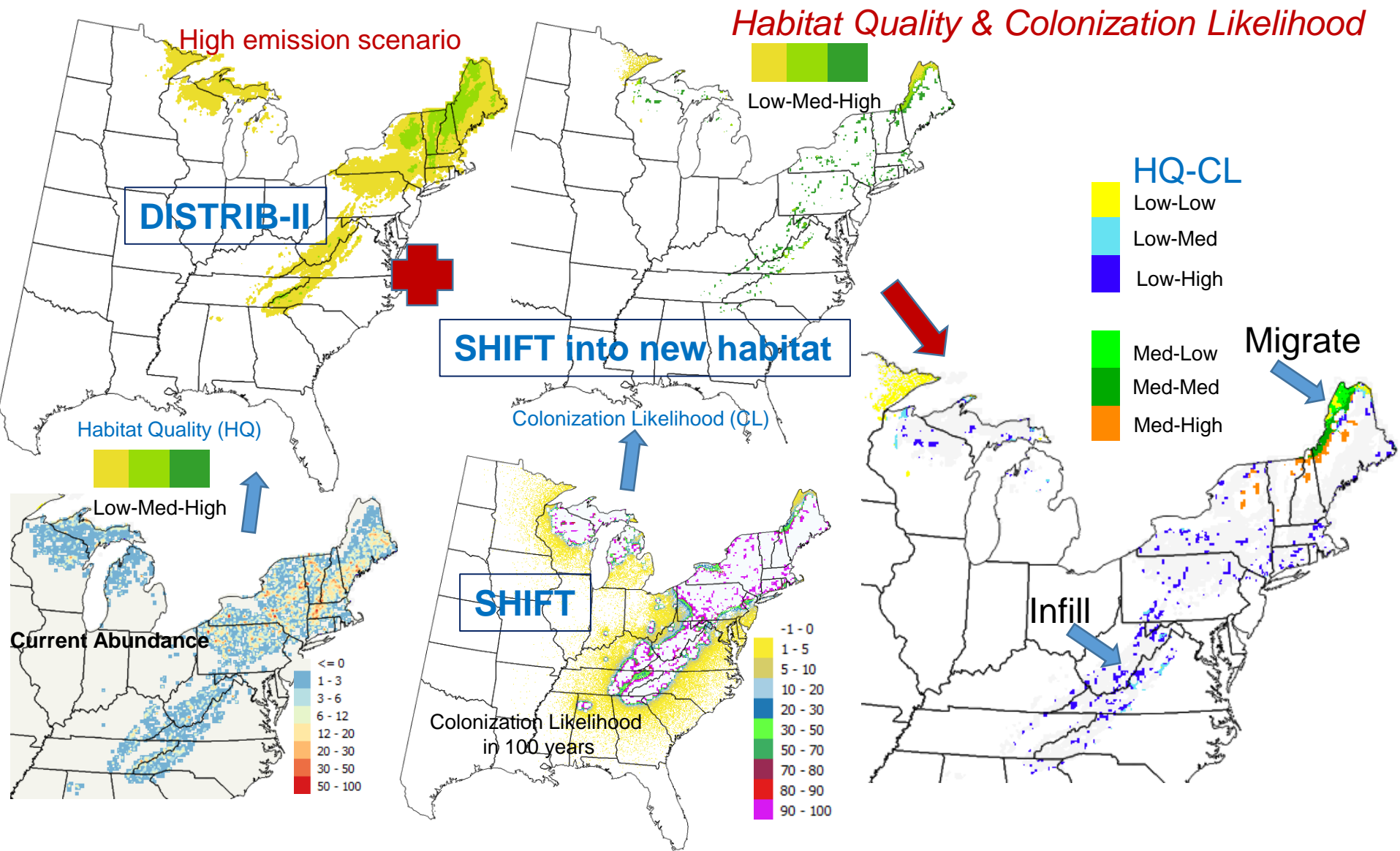


Post Oak



Merging DISTRIB-II with SHIFT

Eastern Hemlock



SUMMARIZING BY NATIONAL FOREST (AND OTHER REGIONS)

Enable managers/publics to understand potential changes in climatic conditions and tree species for each particular area



Example Species Report

Chaquamagon Nicolet NF N. Wisconsin

43 species of trees sorted in decreasing order of importance, plus 25 species with new habitat appearing by 2100 under high emissions

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngC145 | ChngC185 | Adapt | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | St | N | |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|-----------|-----------|-----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 | |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 | |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 | |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 | |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 | |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 | |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 | |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 | |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 | |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 | |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 | |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 | |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 | |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 | |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 | |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 | |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 | |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 | |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 | |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 | |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 | |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 | |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 | |
| green ash | Fraxinus pennsylvanica | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 | |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 | |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 | |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 | |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 | |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 | |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 | |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 | |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 | |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 | |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 | |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 | |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 | |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 | |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 | |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 | |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 | |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 | |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 | |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 | |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 | |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 | |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 | |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 | |
| shagbark hickory | Carya ovata | WSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 49 | |
| bigleaf magnolia | Magnolia macrophylla | NSL | Low | 0 | 0 | 0 | Unknown | Unknown | Medium | Absent | Unknown | Unknown | | | 0 | 50 | |
| sugarberry | Celtis laevigata | NDH | Medium | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 | |
| scarlet oak | Quercus coccinea | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | 3 | 52 | |
| pignut hickory | Carya glabra | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 53 |
| sycamore | Platanus occidentalis | NSL | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 54 |
| swamp white oak | Quercus bicolor | NSL | Low | 2.54 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 55 |
| | | | | | | | | | | | | | Migrate++ | Migrate++ | 3 | 56 | |
| | | | | | | | | | | | | | | | 3 | 57 | |
| | | | | | | | | | | | | | | | Migrate+ | 3 | 58 |
| | | | | | | | | | | | | | | | Migrate+ | 3 | 59 |
| | | | | | | | | | | | | | | | Migrate+ | 3 | 60 |
| | | | | | | | | | | | | | | | Migrate++ | 3 | 61 |
| | | | | | | | | | | | | | | | Migrate+ | 3 | 62 |
| | | | | | | | | | | | | | Migrate++ | Migrate++ | 3 | 63 | |

Species Common and Latin Name

Species Report

Chaquamagon Nicolet NF

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngCI45 | ChngCI85 | Adapt | Abund | Capabil45 | Capabil85 | SHFIT45 | SHFIT85 | St | N | |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|----------|-----------|----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 | |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 | |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 | |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 | |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 | |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 | |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 | |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 | |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 | |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 | |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 | |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 | |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 | |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 | |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 | |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 | |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 | |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 | |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 | |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 | |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 | |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 | |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 | |
| green ash | Fraxinus pennsylvanica | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 | |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 | |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 | |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 | |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 | |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 | |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 | |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 | |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 | |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 | |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 | |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 | |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 | |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 | |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 | |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 | |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 | |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 | |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 | |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 | |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 | |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 | |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 | |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 | |
| shagbark hickory | Carya ovata | WSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 49 | |
| bigleaf magnolia | Magnolia macrophylla | NSL | Low | 0 | 0 | 0 | Unknown | Unknown | Medium | Absent | Unknown | Unknown | | | 0 | 50 | |
| sugarberry | Celtis laevigata | NDH | Medium | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 | |

FIAsum– Calibrated (to 1x1 degree cell) sum of Importance Value X area of species occupation within the area of interest (Sorted by this variable).

| | | | | | | | | | | | | | | | | | |
|-----------|---------------------|-----|--------|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|-----------|----|----|
| hackberry | Celtis occidentalis | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 60 |
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate++ | 3 | 61 |
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 62 |
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 | |

Species Report

Chaquamagon Nicolet NF

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngC145 | ChngC185 | Adapt | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | St | N |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|----------|-----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 |
| green ash | Fraxinus pennsylvanica | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 |
| shagbark hickory | Carya ovata | WSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 49 |
| bigleaf magnolia | Magnolia macrophylla | NSL | Low | 0 | 0 | 0 | Unknown | Unknown | Medium | Absent | Unknown | Unknown | | | 0 | 50 |
| sugarberry | Celtis laevigata | NDH | Medium | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 |

Change Class – our interpretation of potential habitat changes by 2100, based on evaluating both low (RCP 4.5) and high (RCP 8.5) emissions scenarios.

| | | | | | | | | | | | | | | | | | |
|----------|------------------|-----|--------|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|-----------|----|----|
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate++ | 3 | 61 |
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 62 |
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 | |

Species Report

Chaquamagon Nicolet NF

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngC145 | ChngC85 | Adapt | Abund | Capabil45 | Capabil85 | SHFT45 | SHFT85 | S | N | |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|----------|-----------|----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 | |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 | |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 | |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 | |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 | |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 | |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 | |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 | |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 | |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 | |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 | |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 | |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 | |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 | |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 | |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 | |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 | |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 | |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 | |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 | |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 | |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 | |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 | |
| green ash | Fraxinus pennsylvanicus | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 | |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 | |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 | |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 | |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 | |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 | |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 | |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 | |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 | |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 | |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 | |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 | |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 | |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 | |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 | |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 | |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 | |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 | |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 | |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 | |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 | |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 | |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 | |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 | |

Adaptability – capability to deal with extra disturbances with changing climate
 Low values (pink) – species likely to do worse than Change Class;
 Medium values (yellow) – species may do roughly as modeled;
 High values (green) – species likely to do better than Change Class

| | | | | | | | | | | | | | | | | | |
|----------|------------------|-----|--------|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|-----------|----|----|
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate++ | 3 | 61 |
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 62 |
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 | |

Species Report

Chaquamagon Nicolet NF

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngCI45 | ChngCI85 | Adapt | Abund | Capabil45 | Capabil85 | SHFT45 | SHFT85 | St | N |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|----------|-----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 |
| green ash | Fraxinus pennsylvanica | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 |
| shagbark hickory | Carya ovata | WSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 49 |
| bigleaf magnolia | Magnolia macrophylla | NSL | Low | 0 | 0 | 0 | Unknown | Unknown | Medium | Absent | Unknown | Unknown | | | 0 | 50 |
| sugarberry | Celtis laevigata | NDH | Medium | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 |
| scarlet oak | Quercus coccinea | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | 3 | 52 |

Abundance— Abundant/common/rare/absent class, based on FIAsum value. Used with Adaptability, and Change Class to generate Capability

| | | | | | | | | | | | | | | | | | |
|----------|------------------|-----|--------|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|-----------|----|----|
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate++ | 3 | 61 |
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 62 |
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 | |

Species Report

Chaquamagon Nicolet NF

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIAiv | ChngC145 | ChngC85 | Adapt | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | St | N | |
|----------------------|-------------------------|-------|--------|-------|--------|-------|---------------|---------------|--------|----------|-------------|-------------|----------|-----------|----------|----|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 | |
| red maple | Acer rubrum | WDH | High | 100 | 548.33 | 13.84 | No change | No change | High | Abundant | Very Good | Very Good | | | 1 | 2 | |
| sugar maple | Acer saccharum | WDH | High | 100 | 485.17 | 13.65 | Sm. dec. | Sm. dec. | High | Abundant | Good | Good | | | 1 | 3 | |
| balsam fir | Abies balsamea | NDH | High | 97.46 | 315.42 | 8.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 4 | |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | 221.35 | 6.96 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 5 | |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | 176.33 | 10.63 | Sm. dec. | Sm. dec. | Low | Abundant | Good | Good | | | 1 | 6 | |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | 161.77 | 7.35 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 7 | |
| paper birch | Betula papyrifera | WDH | High | 93.23 | 159.6 | 4.41 | No change | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 8 | |
| black spruce | Picea mariana | NSH | High | 64.32 | 124.91 | 6.47 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 9 | |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | 122.8 | 5.11 | Sm. inc. | Sm. inc. | High | Abundant | Very Good | Very Good | | | 1 | 10 | |
| northern white-cedar | Thuja occidentalis | WSH | High | 54.01 | 113.9 | 7.16 | Sm. dec. | No change | Medium | Abundant | Good | Very Good | | | 1 | 11 | |
| American basswood | Tilia americana | WSL | Medium | 80.53 | 112.45 | 4.37 | Sm. inc. | No change | Medium | Abundant | Very Good | Very Good | | | 1 | 12 | |
| bigtooth aspen | Populus grandidentata | NSL | Medium | 65.48 | 106.74 | 4.85 | No change | Sm. dec. | Medium | Abundant | Very Good | Good | | | 1 | 13 | |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | 105.82 | 3.51 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 14 | |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | 96.91 | 4.47 | Sm. inc. | Sm. inc. | Low | Abundant | Very Good | Very Good | | | 1 | 15 | |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | 79.45 | 3.85 | No change | No change | Low | Abundant | Very Good | Very Good | | | 1 | 16 | |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | 77.19 | 12.67 | Sm. dec. | Lg. dec. | High | Abundant | Good | Good | | | 1 | 17 | |
| white spruce | Picea glauca | NSL | Medium | 69.53 | 56.88 | 2.4 | No change | No change | Medium | Common | Good | Good | | | 1 | 18 | |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | 49.63 | 1.81 | Lg. inc. | Lg. inc. | Low | Common | Very Good | Very Good | | | 1 | 19 | |
| American elm | Ulmus americana | WDH | Medium | 49.6 | 44.77 | 2.4 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 20 | |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 | |
| eastern hophornbeam | Ostrya virginiana | WSL | Low | 50.63 | 36.95 | 1.48 | Sm. inc. | Sm. inc. | High | Common | Very Good | Very Good | | | 1 | 22 | |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | 36.02 | 4.63 | Sm. dec. | Sm. dec. | High | Common | Fair | Fair | Infill++ | Infill++ | 1 | 23 | |
| green ash | Fraxinus pennsylvanica | WSH | Low | 23.4 | 24.22 | 1.49 | Sm. inc. | Sm. inc. | Medium | Common | Very Good | Very Good | | | 1 | 24 | |
| bur oak | Quercus macrocarpa | NDH | Medium | 11 | 20.33 | 4.29 | No change | No change | High | Common | Good | Good | Infill++ | Infill++ | 2 | 25 | |
| American hornbeam | Carpinus caroliniana | WSL | Low | 27.08 | 16.52 | 1.28 | Sm. dec. | Sm. dec. | Medium | Common | Fair | Fair | | | 1 | 26 | |
| chokecherry | Prunus virginiana | NSLX | FIA | 25.24 | 5.46 | 0.54 | Unknown | Unknown | Medium | Common | FIA Only | FIA Only | | | 0 | 27 | |
| pin cherry | Prunus pensylvanica | NSL | Low | 5.66 | 5.45 | 0.89 | No change | Very Lg. dec. | Medium | Common | Good | Lost | | | 1 | 28 | |
| serviceberry | Amelanchier spp. | NSL | Low | 9.31 | 3.94 | 0.53 | Sm. inc. | No change | Medium | Rare | Good | Fair | | | 1 | 29 | |
| silver maple | Acer saccharinum | NSH | Low | 0.85 | 3.7 | 10.93 | Sm. dec. | Sm. dec. | High | Rare | Poor | Poor | Infill+ | Infill+ | 2 | 30 | |
| butternut | Juglans cinerea | NSLX | FIA | 2.54 | 1.74 | 1.71 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 31 | |
| balsam poplar | Populus balsamifera | NSH | Medium | 0.85 | 1.4 | 0.83 | Very Lg. dec. | Very Lg. dec. | Medium | Rare | Lost | Lost | | | 0 | 32 | |
| slippery elm | Ulmus rubra | WSL | Low | 2.54 | 0.82 | 0.81 | Sm. inc. | Sm. inc. | Medium | Rare | Good | Good | Infill++ | Infill++ | 2 | 33 | |
| bitternut hickory | Carya cordiformis | WSL | Low | 2.54 | 0.45 | 0.66 | Sm. inc. | Sm. inc. | High | Rare | Good | Good | Infill++ | Infill++ | 2 | 34 | |
| mountain maple | Acer spicatum | NSL | Low | 11.85 | 0.43 | 0.25 | Lg. dec. | Lg. dec. | High | Rare | Poor | Poor | | | 1 | 35 | |
| white oak | Quercus alba | WDH | Medium | 0.85 | 0.43 | 0.63 | No change | No change | High | Rare | Fair | Fair | Infill+ | Infill+ | 2 | 36 | |
| Norway spruce | Picea abies | NSH | FIA | 0.85 | 0.27 | 0.8 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 37 | |
| Scotch pine | Pinus sylvestris | NSH | FIA | 0.85 | 0.18 | 0.52 | Unknown | Unknown | NA | Rare | NNIS | NNIS | | | 0 | 38 | |
| peachleaf willow | Salix amygdaloides | NSLX | FIA | 0.85 | 0.13 | 0.37 | Unknown | Unknown | Medium | Rare | FIA Only | FIA Only | | | 0 | 39 | |
| rock elm | Ulmus thomasii | NSLX | FIA | 0.85 | 0.09 | 0.27 | Unknown | Unknown | Low | Rare | FIA Only | FIA Only | | | 0 | 40 | |
| pecan | Carya illinoensis | NSH | Low | 0 | 0 | 0 | Unknown | New Habitat | Low | Absent | Unknown | New Habitat | | | 0 | 41 | |
| red spruce | Picea rubens | NDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Low | Absent | New Habitat | New Habitat | | | 0 | 42 | |
| American beech | Fagus grandifolia | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 | |
| black locust | Robinia pseudoacacia | NDH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 | |
| eastern redcedar | Juniperus virginiana | WDH | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 | |
| eastern cottonwood | Populus deltoides | NSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 46 |
| black walnut | Juglans nigra | WDH | Low | 1.69 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 | |
| sweetgum | Liquidambar styraciflua | WDH | High | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 | |
| shagbark hickory | Carya ovata | WSL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | Unknown | New Habitat | Migrate+ | Migrate+ | 3 | 49 | |
| bigleaf magnolia | Magnolia macrophylla | NSL | Low | 0 | 0 | 0 | Unknown | Unknown | Medium | Absent | Unknown | Unknown | | | 0 | 50 | |
| sugarberry | Celtis laevigata | NDH | Medium | 0 | 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 | |
| scarlet oak | Quercus coccinea | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | Medium | Absent | Unknown | New Habitat | | | 2 | 52 | |

Capability – overall capability (RCP4.5 and 8.5) to cope with a changing climate (based on Abundance now, Change Class, Adaptability & Model Reliability)

| | | | | | | | | | | | | | | | | | |
|----------|------------------|-----|--------|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|-----------|----|----|
| post oak | Quercus stellata | WDH | High | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate++ | 3 | 61 |
| blackgum | Nyssa sylvatica | WDL | Medium | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | | | Migrate+ | 3 | 62 |
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 | |

Species Report

| Common Name | Scientific Name | Range | MR | %Cell | FIAsum | FIaiv | ChngCl45 | ChngCl85 | Adapt | Abund | Capabil45 | Capabil85 | SHIFT45 | SHIFT85 | S | N |
|--------------------|-----------------------|-------|--------|-------|--------|-------|----------|----------|--------|----------|-----------|-----------|---------|---------|---|----|
| quaking aspen | Populus tremuloides | WDH | High | 100 | 641.22 | 16.76 | Sm. dec. | Sm. dec. | Medium | Abundant | Good | Good | | | 1 | 1 |
| red maple | Acer rubrum | WDH | High | 100 | | | | | | | | | | | | 2 |
| sugar maple | Acer saccharum | WDH | High | 100 | | | | | | | | | | | | 3 |
| balsam fir | Abies balsamea | NDH | High | 97.46 | | | | | | | | | | | | 4 |
| black ash | Fraxinus nigra | WSH | Medium | 89.84 | | | | | | | | | | | | 5 |
| red pine | Pinus resinosa | NSH | Medium | 63.61 | | | | | | | | | | | | 6 |
| tamarack (native) | Larix laricina | NSH | High | 70.25 | | | | | | | | | | | | 7 |
| paper birch | Betula papyrifera | WDH | High | 93.23 | | | | | | | | | | | | 8 |
| black spruce | Picea mariana | NSH | High | 64.32 | | | | | | | | | | | | 9 |
| northern red oak | Quercus rubra | WDH | Medium | 65.3 | | | | | | | | | | | | 0 |
| northern white-c | Thuja occidentalis | WSH | High | 54.01 | | | | | | | | | | | | 1 |
| American basswo | Tilia americana | WSL | Medium | 80.53 | | | | | | | | | | | | 2 |
| bigtooth aspen | Populus grandidentat | NSL | Medium | 65.48 | | | | | | | | | | | | 3 |
| yellow birch | Betula alleghaniensis | NDL | High | 85.8 | | | | | | | | | | | | 4 |
| eastern white pine | Pinus strobus | WDH | High | 72.25 | | | | | | | | | | | | 5 |
| eastern hemlock | Tsuga canadensis | NSH | High | 69.98 | | | | | | | | | | | | 6 |
| jack pine | Pinus banksiana | NSH | Medium | 16.93 | | | | | | | | | | | | 7 |
| white spruce | Picea glauca | NSL | Medium | 69.53 | | | | | | | | | | | | 8 |
| black cherry | Prunus serotina | WDL | Medium | 53.32 | | | | | | | | | | | | 9 |
| American elm | Ulmus americana | WDH | Medium | 49.6 | | | | | | | | | | | | 0 |
| white ash | Fraxinus americana | WDL | Medium | 51.51 | 36.96 | 1.95 | Sm. inc. | Sm. inc. | Low | Common | Very Good | Very Good | | | 1 | 21 |
| eastern hophorn | Ostrya virginiana | WSL | Low | 50.63 | | | | | | | | | | | | |
| northern pin oak | Quercus ellipsoidalis | NSH | Medium | 14.23 | | | | | | | | | | | | |
| green ash | Fraxinus pennsylvanic | WSH | Low | 23.4 | | | | | | | | | | | | |

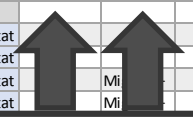
Chaquamagon Nicolet NF

“INFILL” species (low or high emissions)
 Northern pin oak *Quercus ellipsoidalis*
 Bur oak *Quercus macrocarpa*
 Slippery elm *Ulmus rubra*
 Bitternut hickory *Carya cordiformis*
 Silver maple *Acer saccharinum*
 White oak *Quercus alba*

“MIGRATE” under high only
 Eastern cottonwood *Populus deltoids*
 Pignut hickory *Carya glabra*
 Sycamore *Platanus occidentalis*
 Swamp white oak *Quercus bicolor*
 Yellow poplar *Liriodendron tulipifera*
 Mockernut hickory *Carya alba*
 Hackberry *Celtis occidentalis*
 Post oak *Quercus stellate*
 Blackgum *Nyssa sylvatica*

“MIGRATE” species (low or high emissions)
 American beech *Fagus grandifolia*
 Eastern red cedar *Juniperus virginiana*
 Shagbark hickory *Carya ovata*
 Black walnut *Juglans nigra*
 Black locust *Robinia psuedoacacia*
 Black oak *Quercus velutina*
 Boxelder *Acer negundo*

| | | | | | | | | | | | |
|---|---|-------------|-------------|--------|--------|-------------|-------------|----------|-----------|---|----|
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 43 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 44 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate++ | 3 | 45 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 46 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 47 |
| 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 48 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | Migrate+ | Migrate+ | 3 | 49 |
| 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | Unknown | | | 0 | 50 |
| 0 | 0 | Unknown | New Habitat | Medium | Absent | Unknown | New Habitat | | | 0 | 51 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | | 3 | 52 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | Mi | 3 | 53 |
| 0 | 0 | New Habitat | New Habitat | Medium | Absent | New Habitat | New Habitat | | Mi | 3 | 54 |

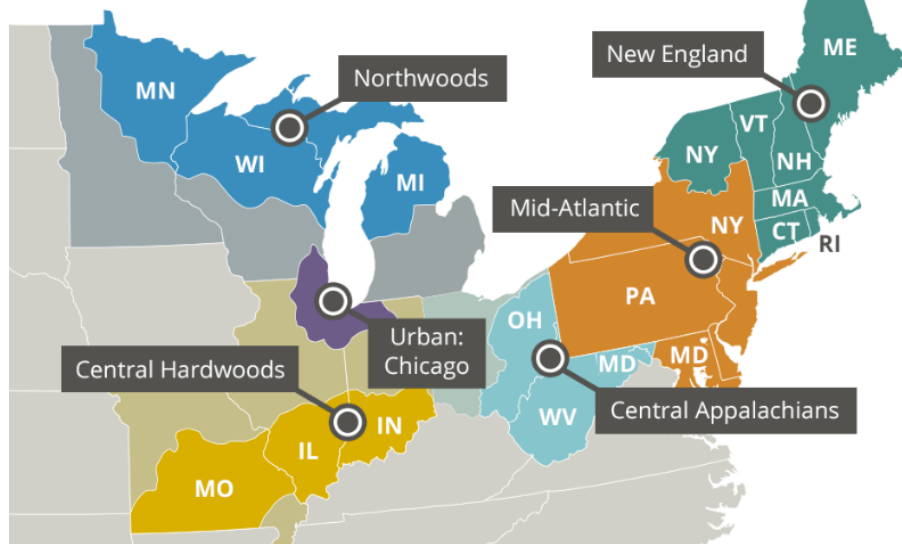


SHIFT – predictions as to *Infill* (+,++) for relatively rare species that could infill (plant to increase abundance where it already is) or *Migrate* (+,++) where New Habitat is projected *and* with a decent probability of colonization in 100 years.

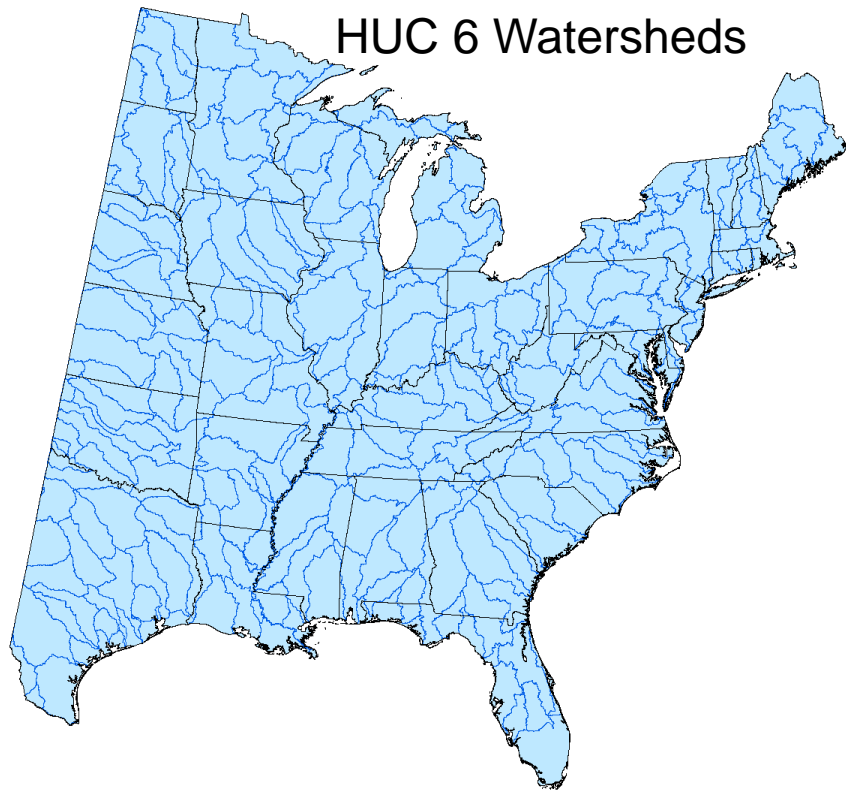
| | | | | | | | | | | | | | | | | |
|----------|--------------|-----|-----|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|---|----|
| boxelder | Acer negundo | WSH | Low | 0 | 0 | 0 | New Habitat | New Habitat | High | Absent | New Habitat | New Habitat | Migrate++ | Migrate++ | 3 | 63 |
|----------|--------------|-----|-----|---|---|---|-------------|-------------|------|--------|-------------|-------------|-----------|-----------|---|----|

We are making these tables for other zones.

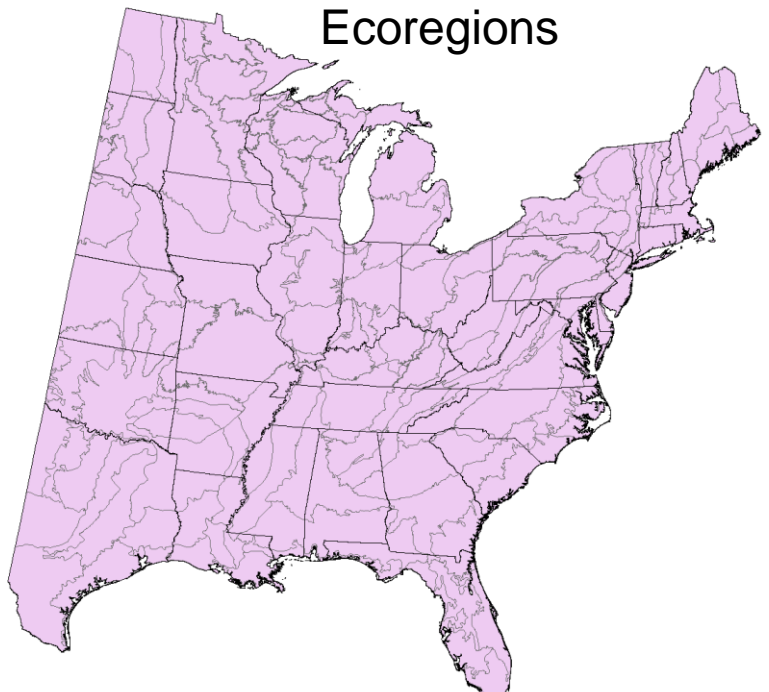
NIACS Vulnerability Assessment Zones



HUC 6 Watersheds



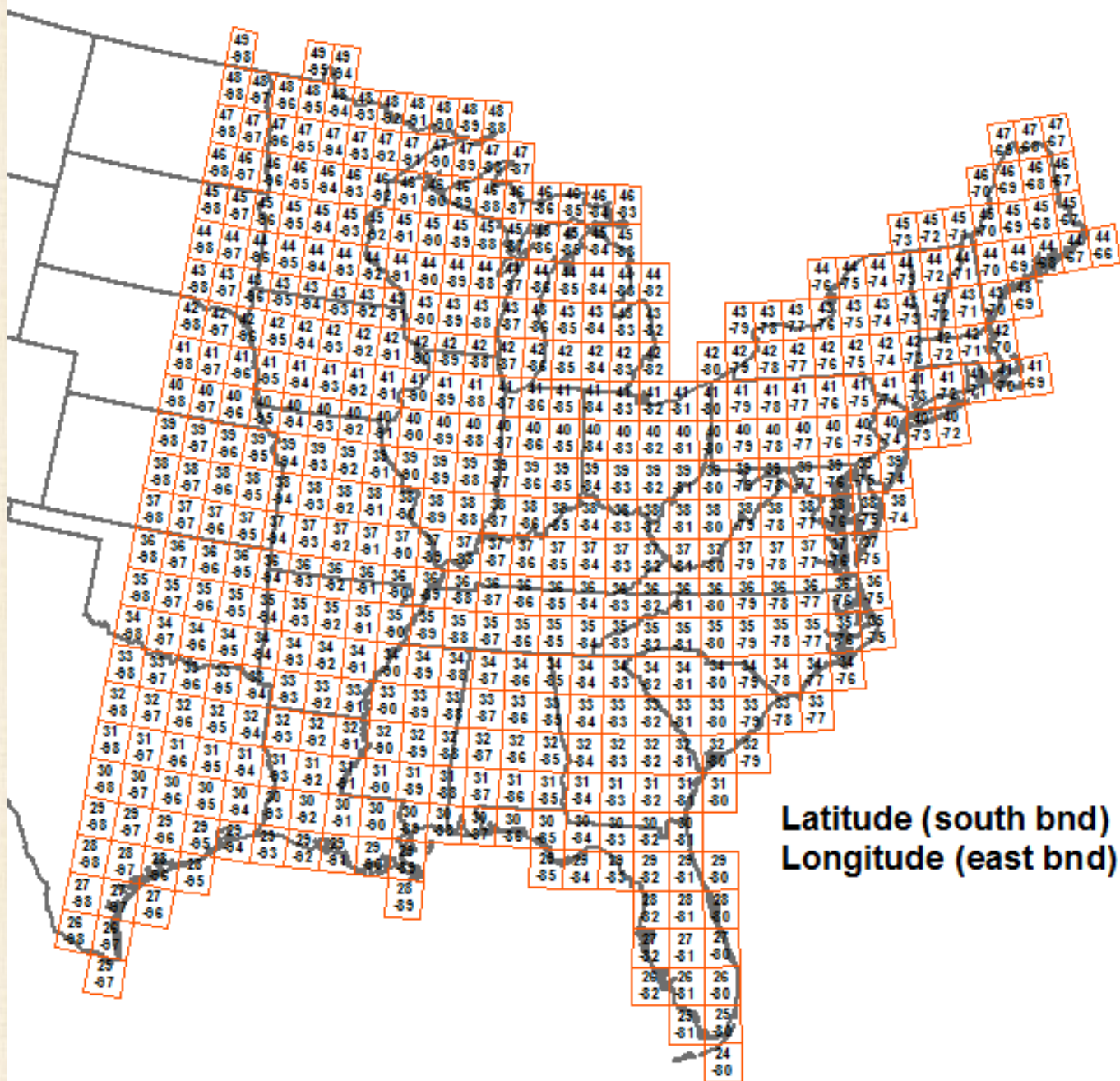
Ecoregions



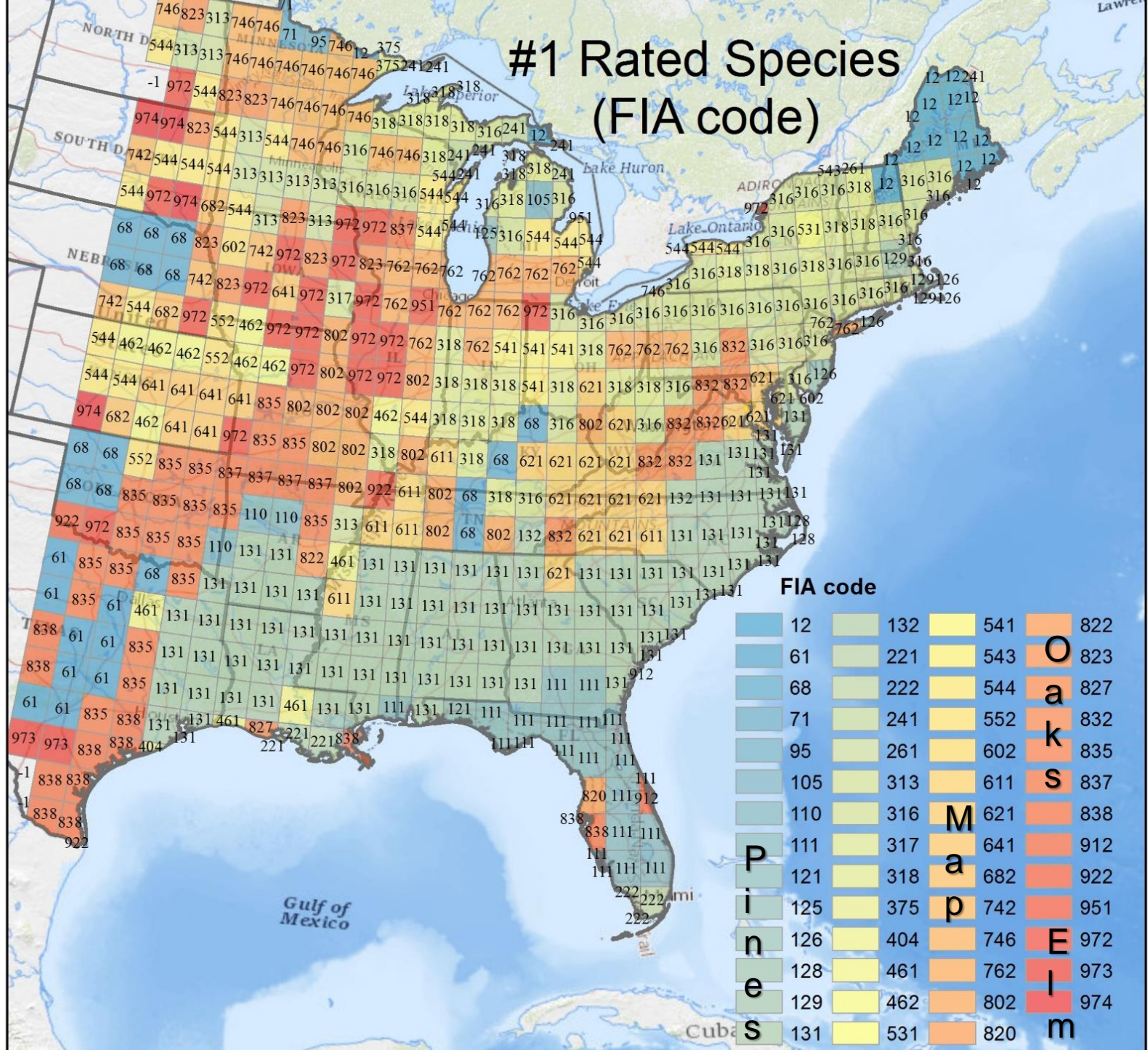
- Underway and Potentials:**
- States
- National Parks
- NCA Regions
- Tribal Areas
- DOD Installations
- Others upon request!

Emphasis on 1x1 degree grid

Identity of 1x1 degree grids (n=494)



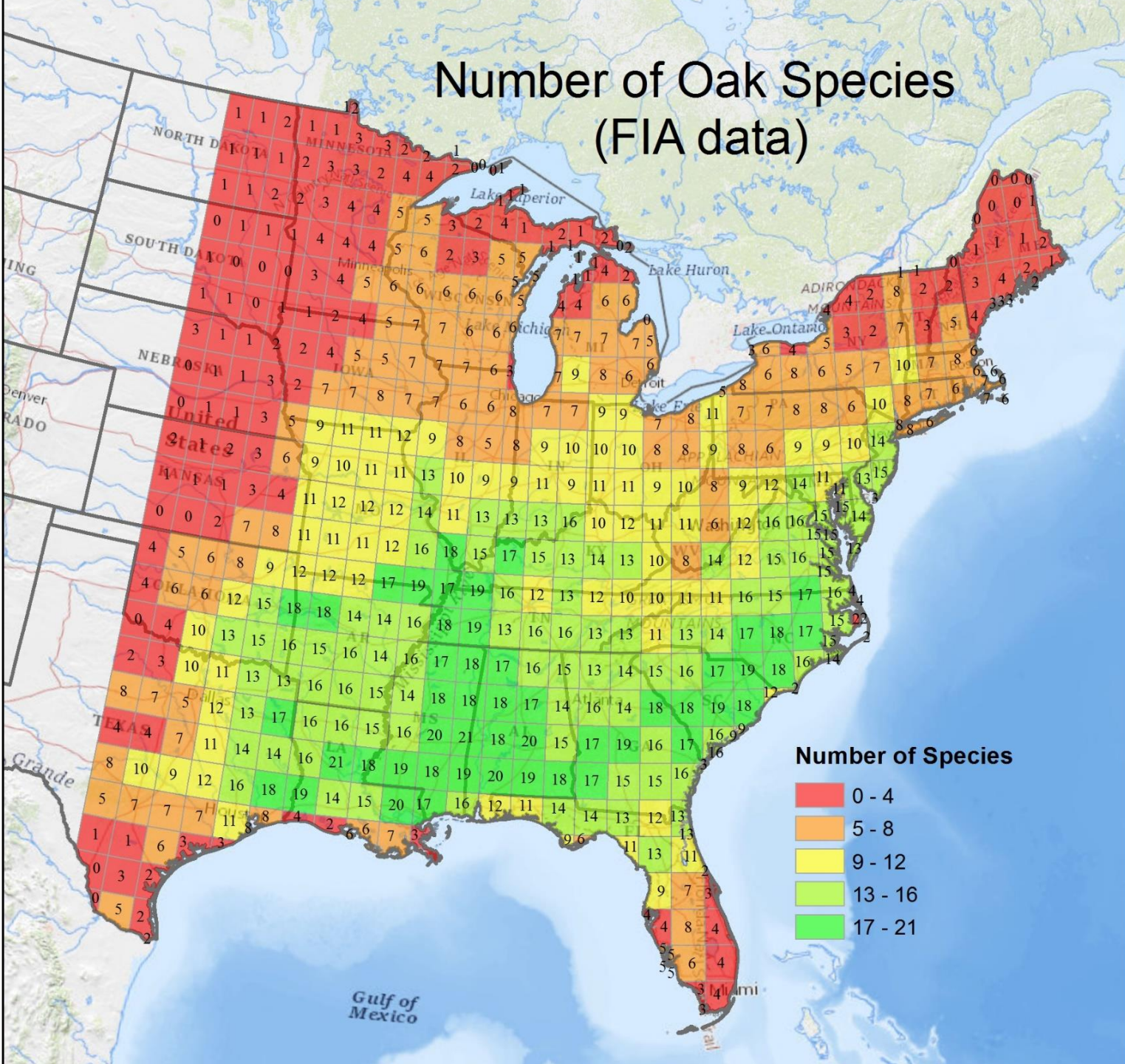
#1 Rated Species (FIA code)



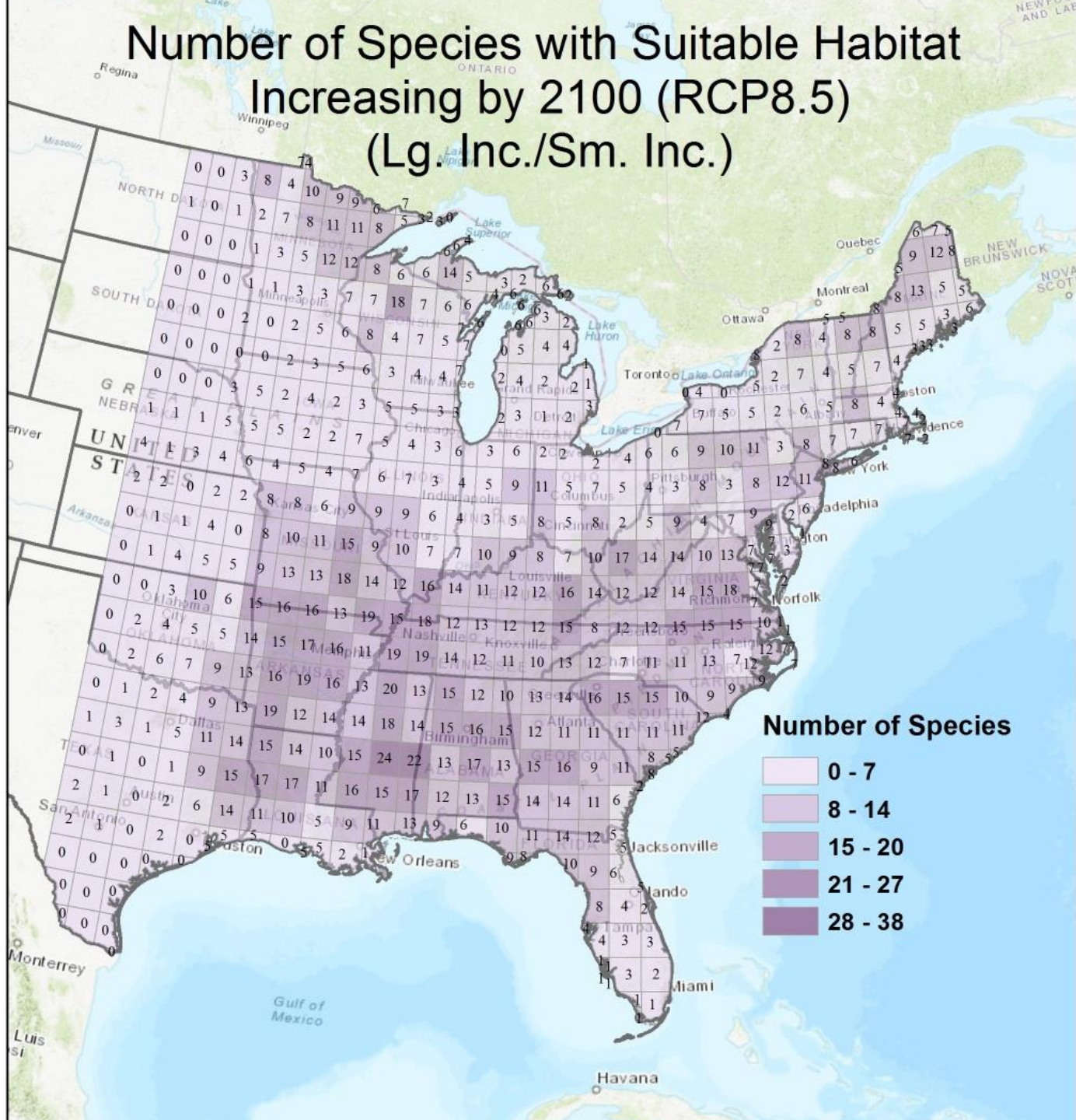
FIA code

| | | | |
|--------------|-----|--------------|--------------|
| 12 | 132 | 541 | 822 |
| 61 | 221 | 543 | O 823 |
| 68 | 222 | 544 | a 827 |
| 71 | 241 | 552 | k 832 |
| 95 | 261 | 602 | s 835 |
| 105 | 313 | 611 | S 837 |
| 110 | 316 | M 621 | 8 838 |
| P 111 | 317 | a 641 | 9 912 |
| 121 | 318 | p 682 | 2 922 |
| 125 | 375 | 742 | 5 951 |
| 126 | 404 | 746 | E 972 |
| 128 | 461 | 762 | 7 973 |
| 129 | 462 | 802 | 3 974 |
| S 131 | 531 | 820 | m |

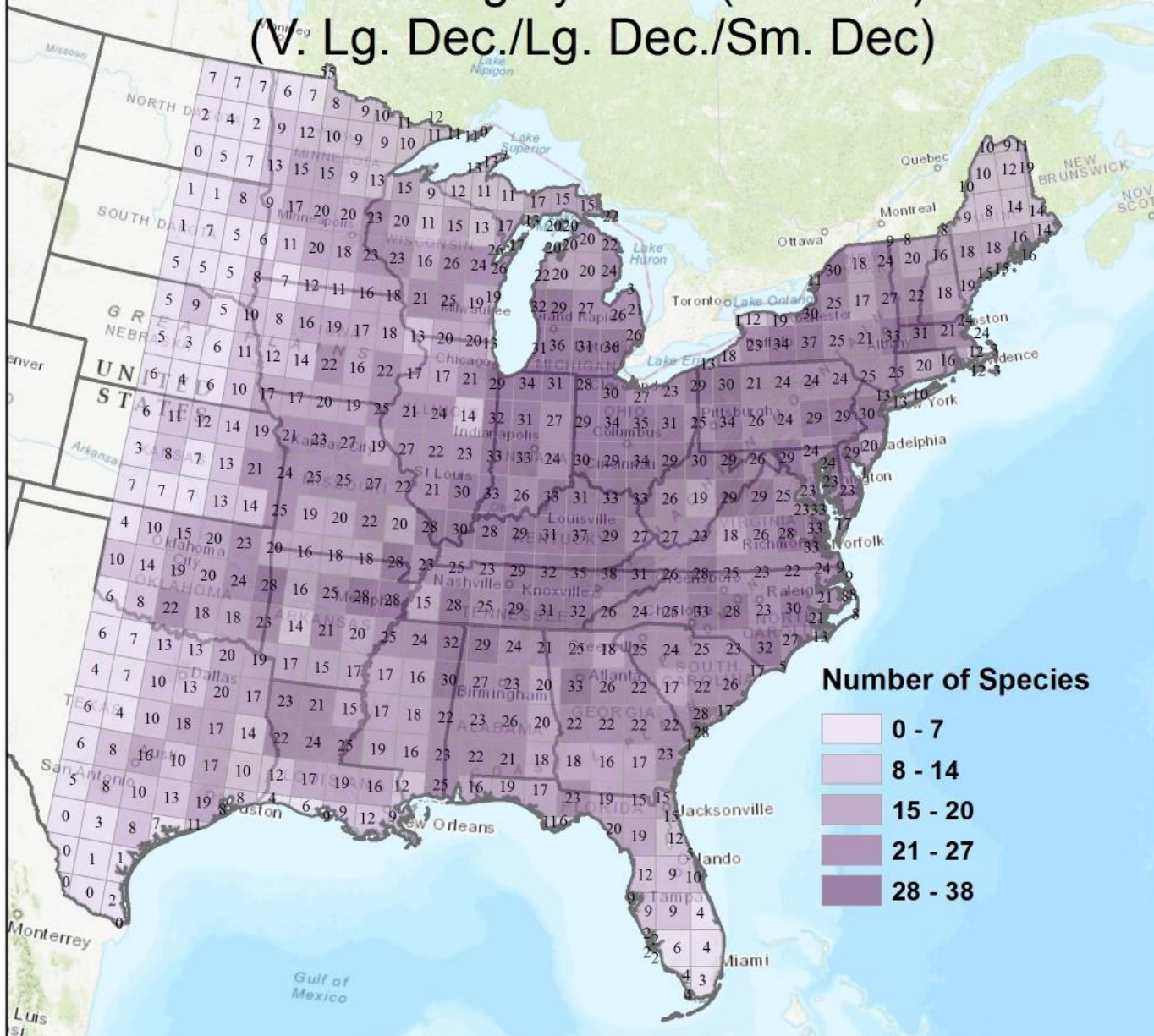
Number of Oak Species (FIA data)



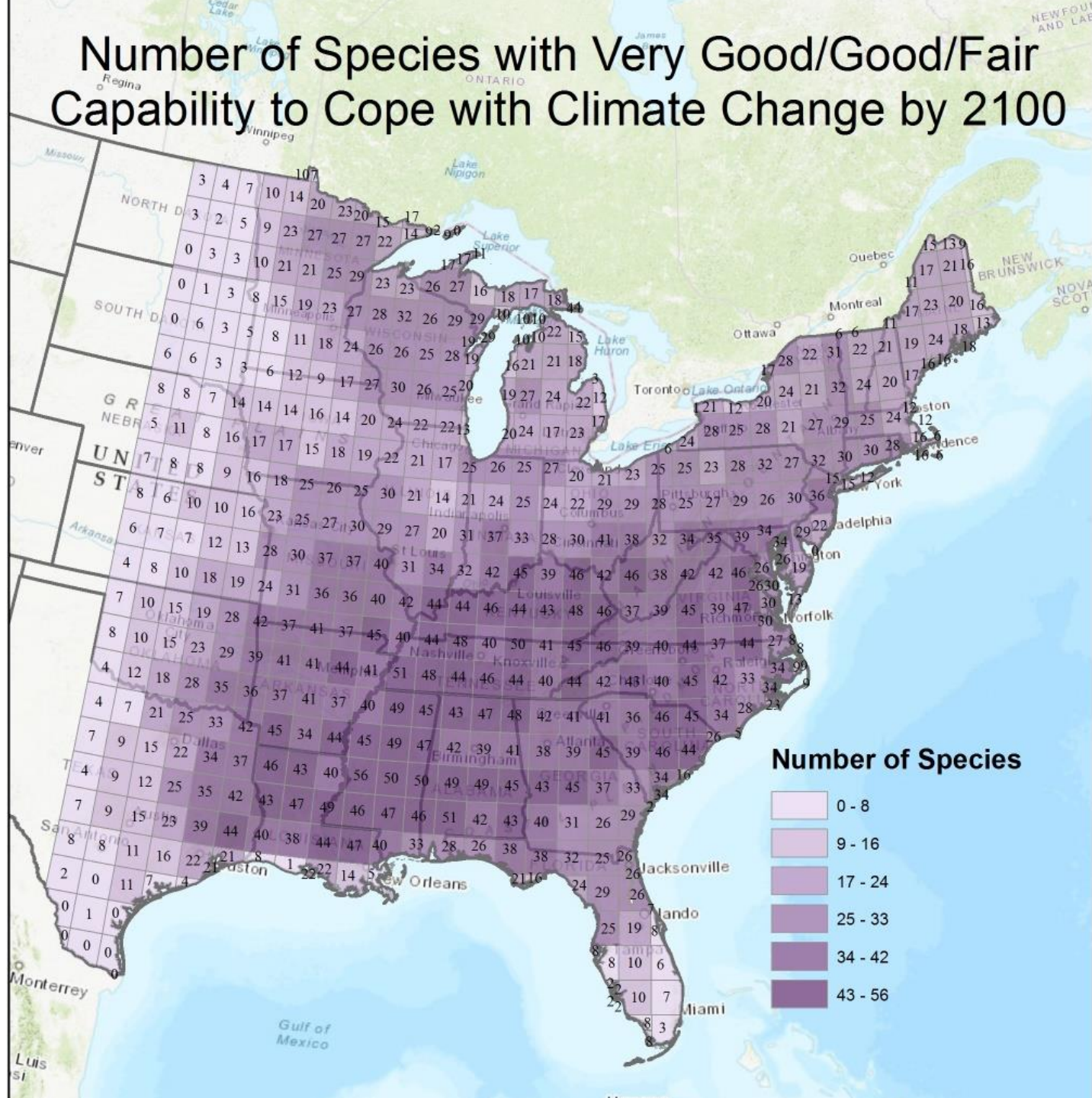
Number of Species with Suitable Habitat Increasing by 2100 (RCP8.5) (Lg. Inc./Sm. Inc.)



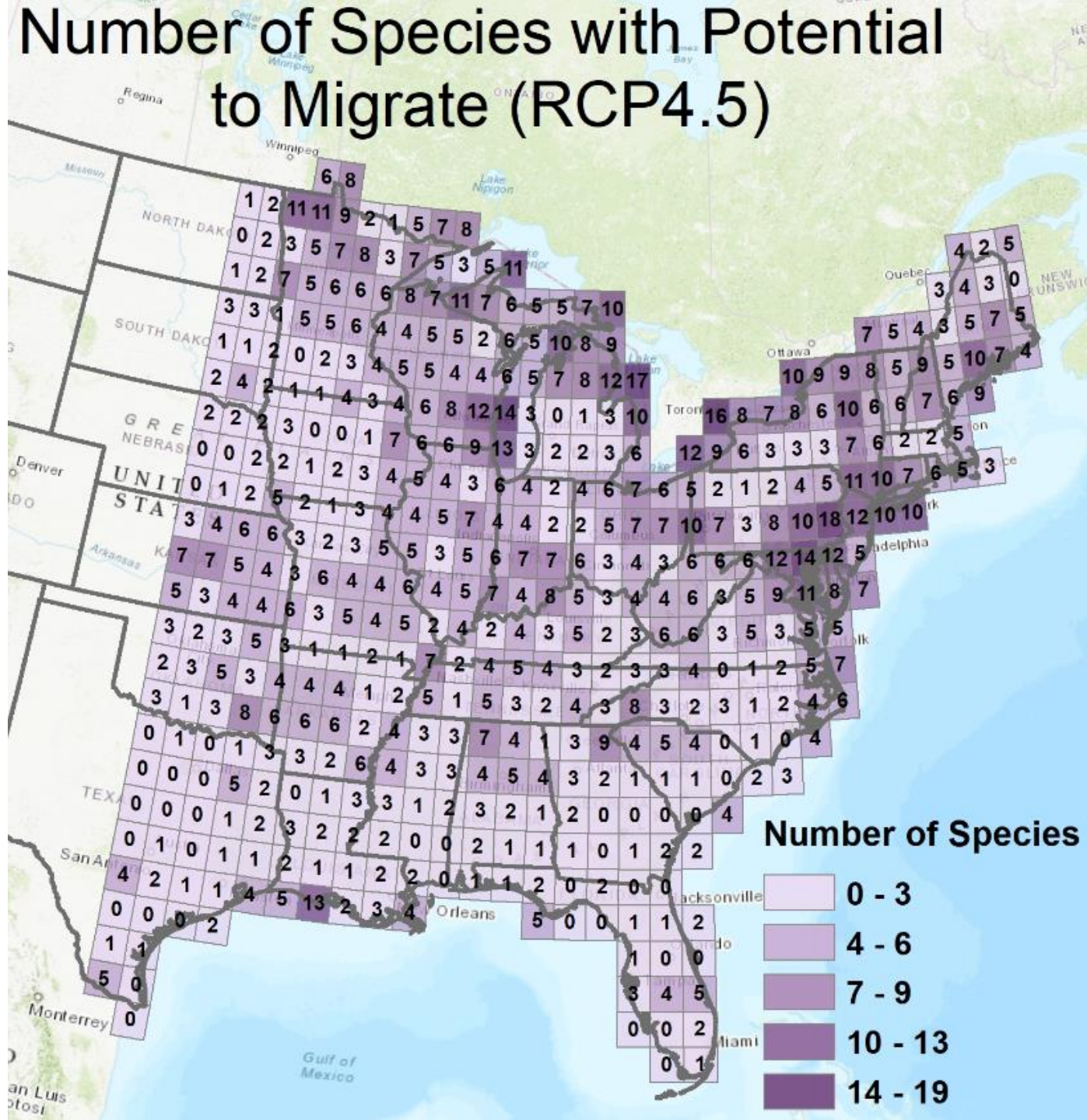
Number of Species with Suitable Habitat Decreasing by 2100 (RCP8.5) (V. Lg. Dec./Lg. Dec./Sm. Dec)



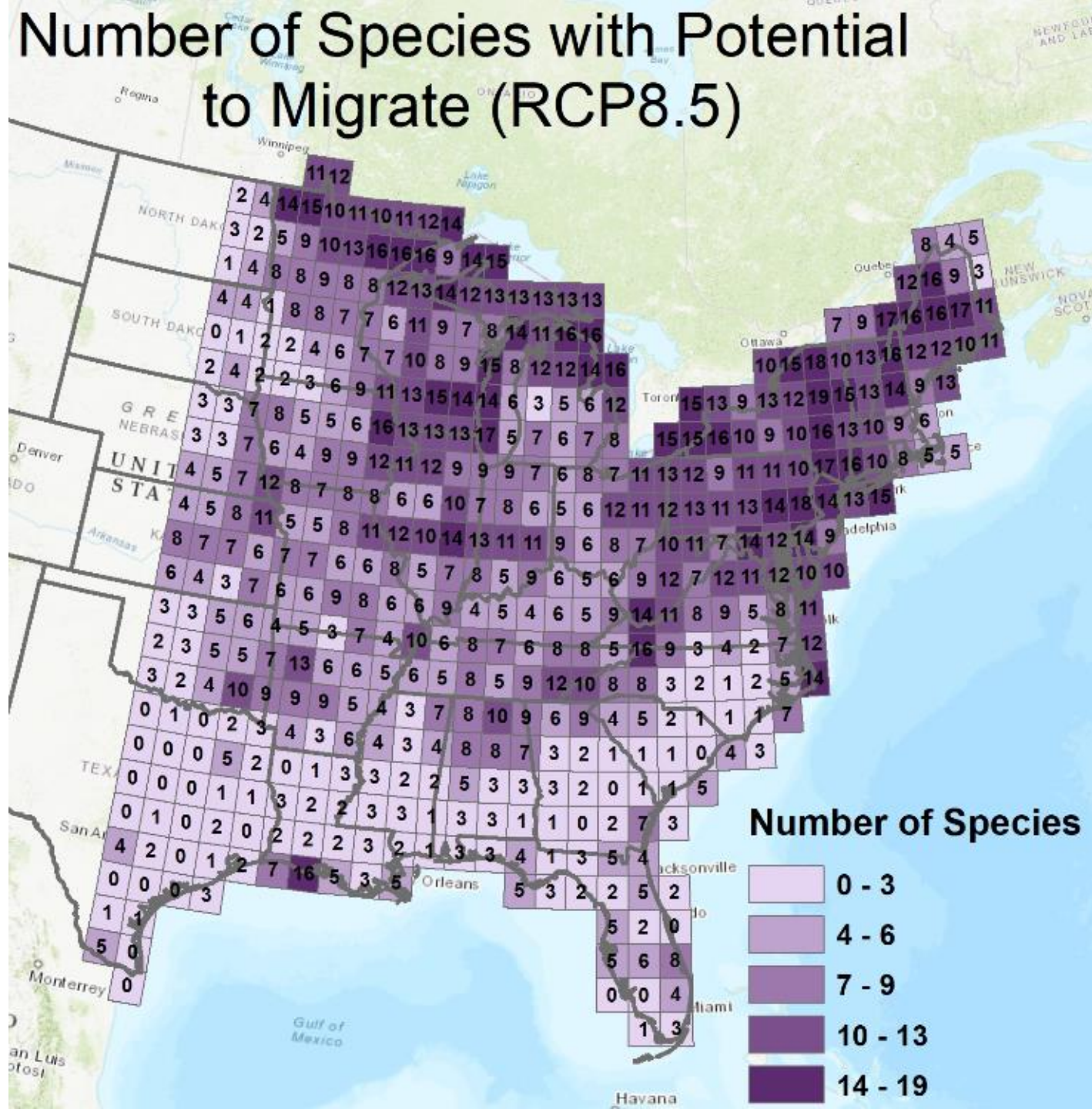
Number of Species with Very Good/Good/Fair Capability to Cope with Climate Change by 2100



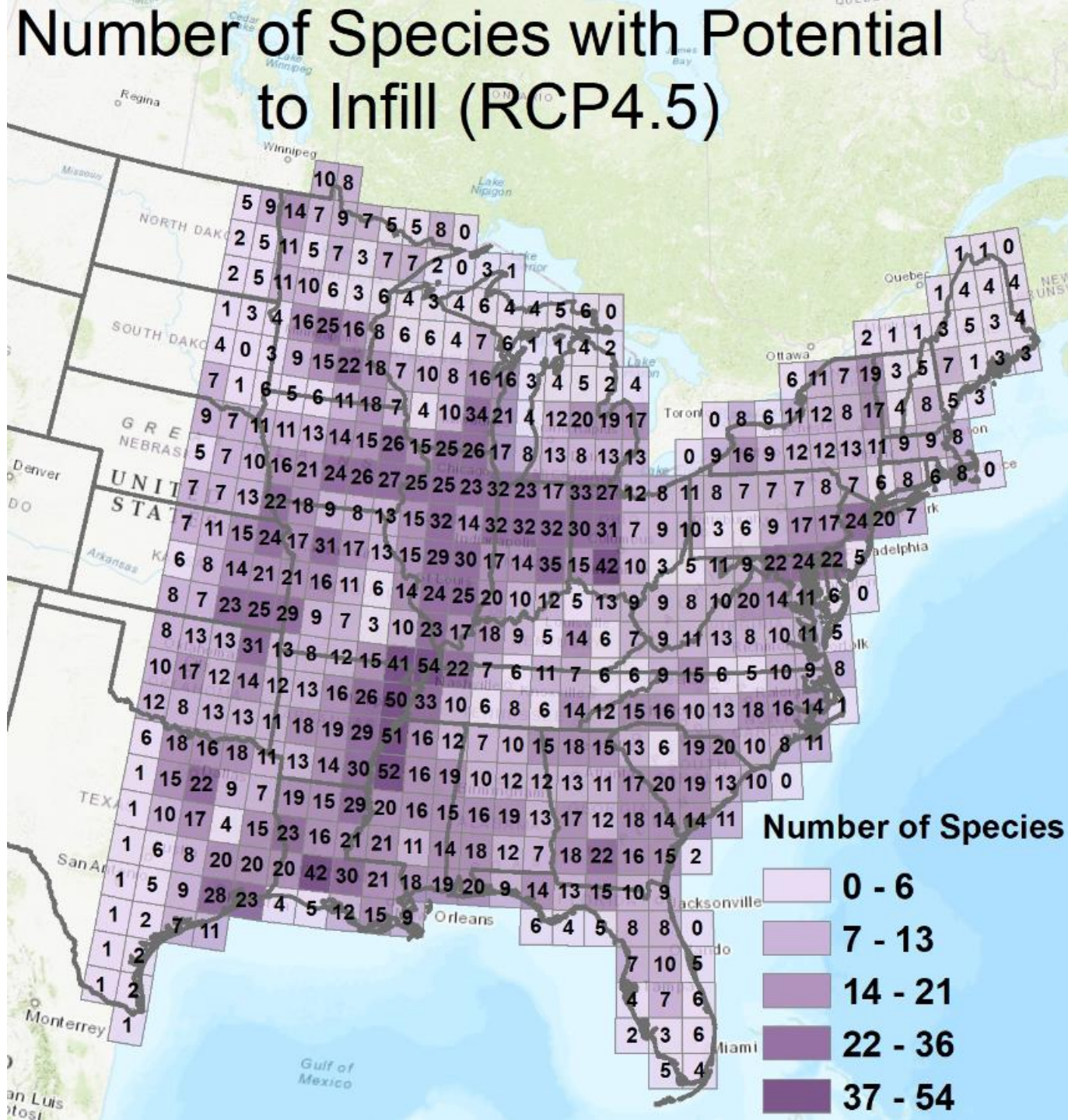
Number of Species with Potential to Migrate (RCP4.5)



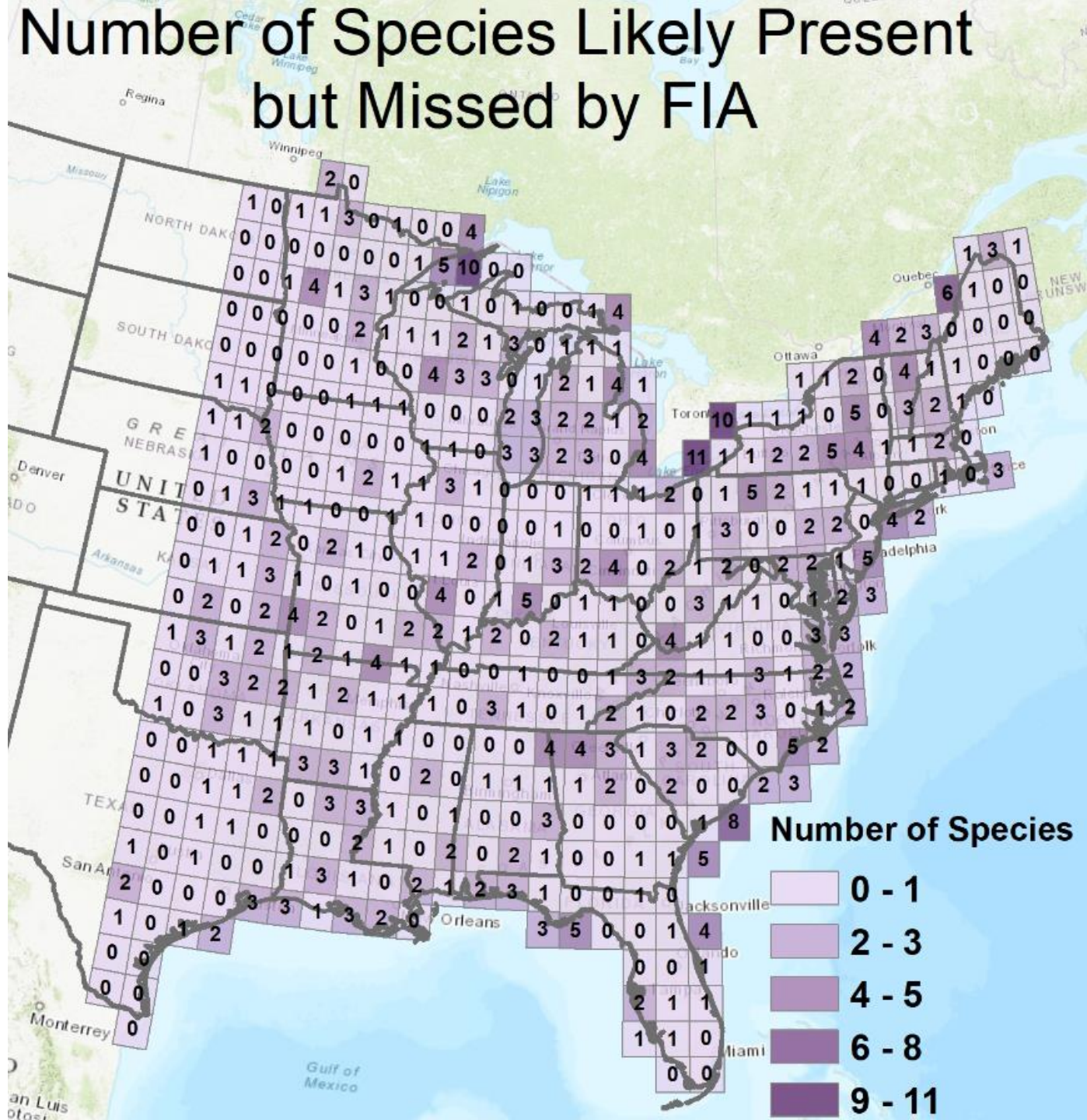
Number of Species with Potential to Migrate (RCP8.5)



Number of Species with Potential to Infill (RCP4.5)

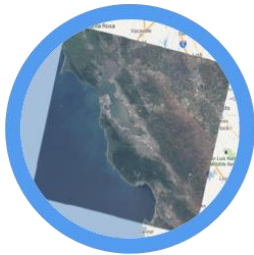


Number of Species Likely Present but Missed by FIA

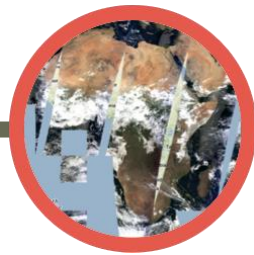


Spatial Trends of Ancillary Information to the 1x1 Grids

The Earth Engine Data Catalog



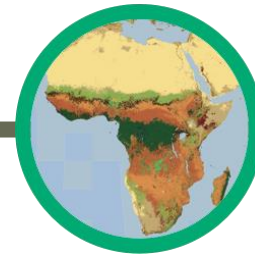
**Landsat & Sentinel 1,
2**
10-30m, weekly



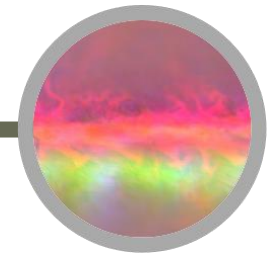
MODIS
250m daily



Vector Data
WDPA, Tiger



**Terrain &
Land Cover**



Weather & Climate
NOAA NCEP, OMI, ...

... and upload your own vectors and
rasters

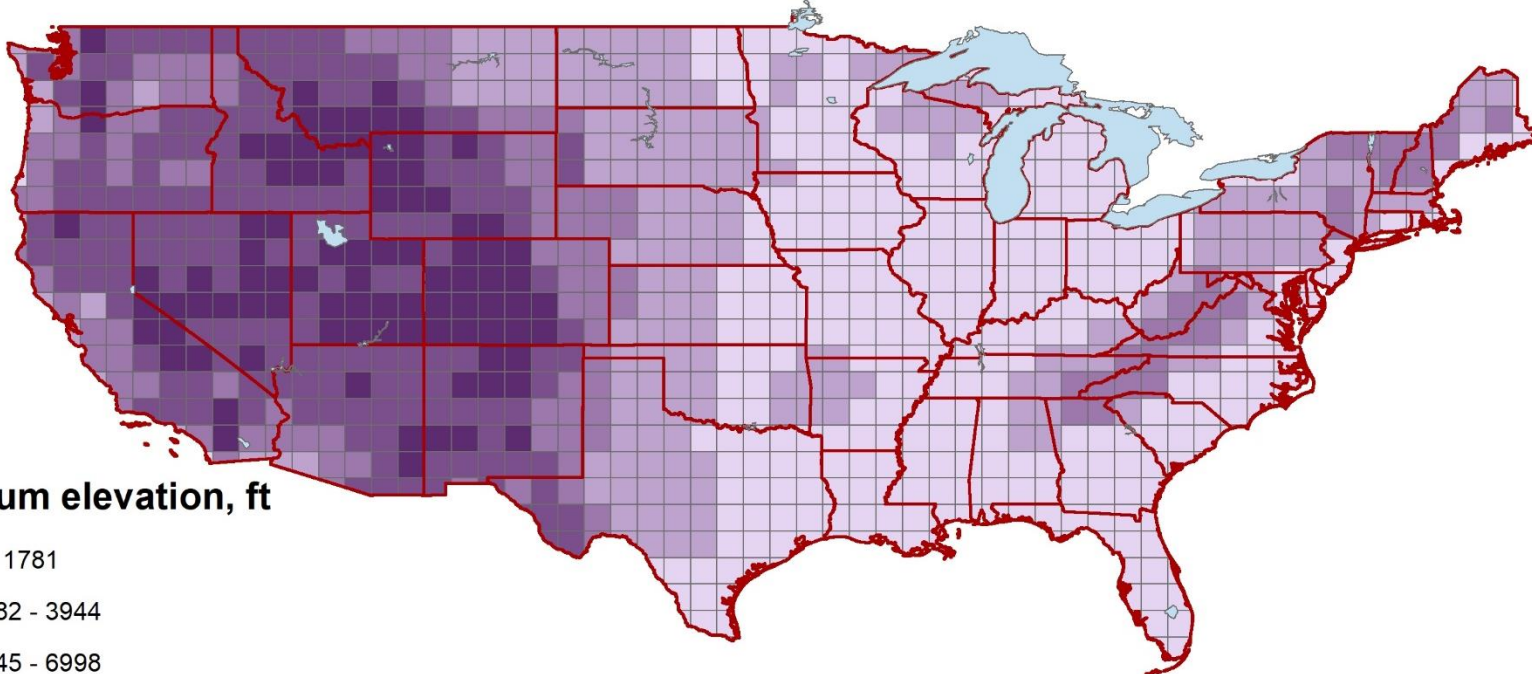
> 200 public datasets

> 5 million images

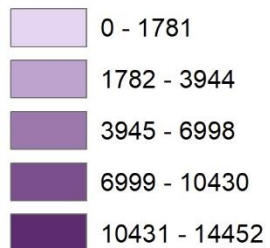
> 4000 new images every day

> 8 petabytes of data

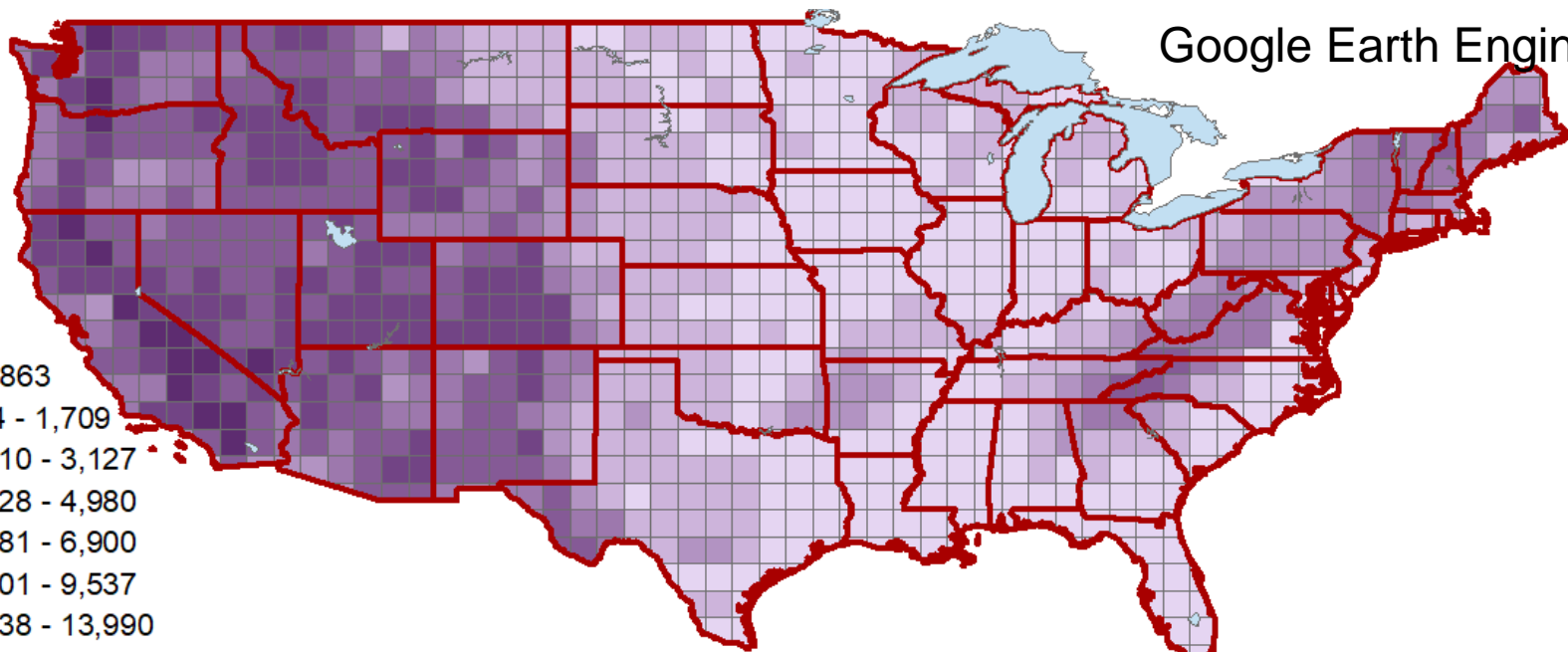
Also: several other national data sets



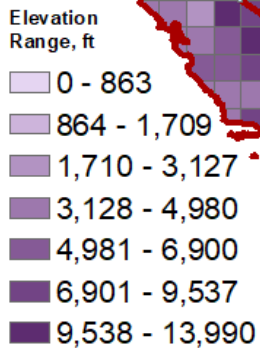
Maximum elevation, ft

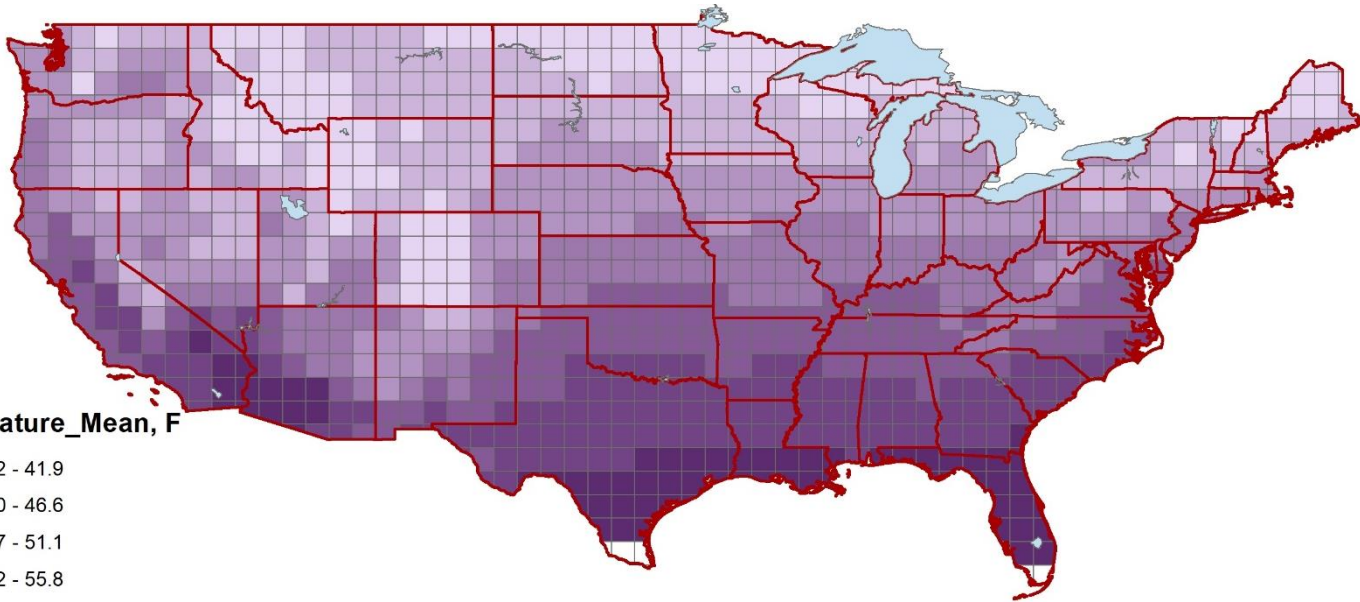


Shuttle Radar Topography Mission (SRTM)
digital elevation

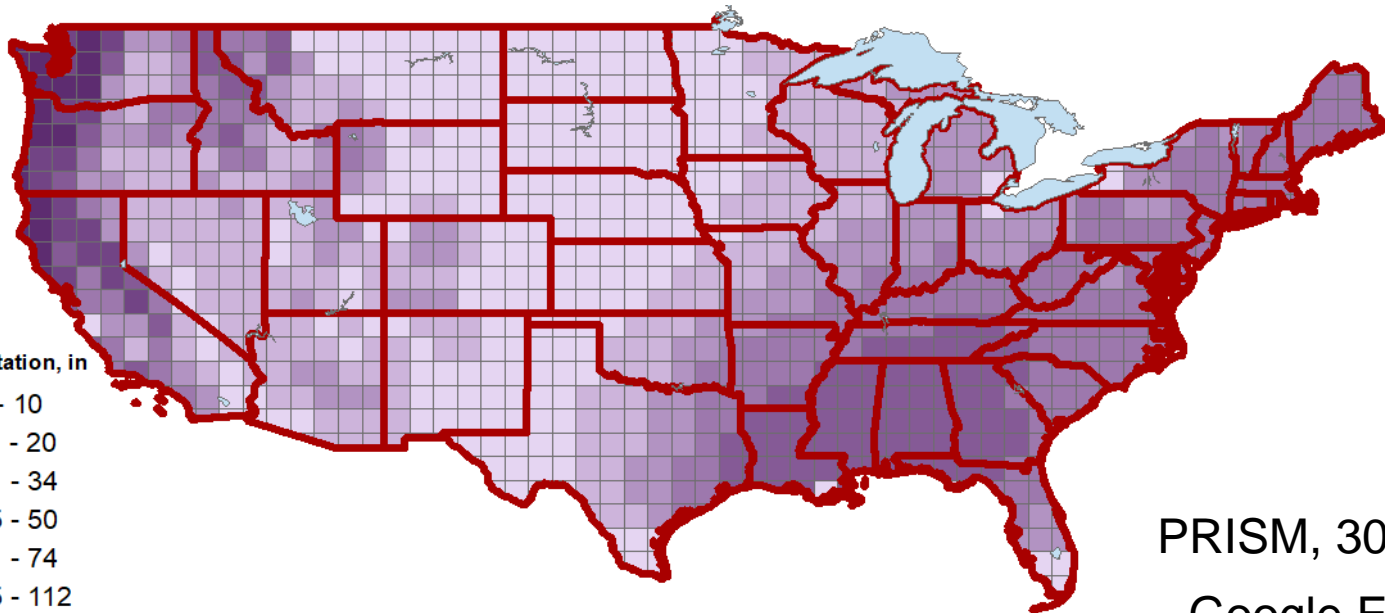
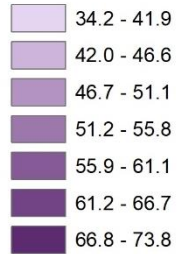


Google Earth Engine

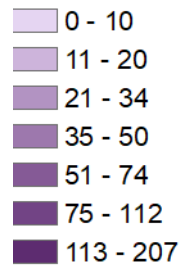




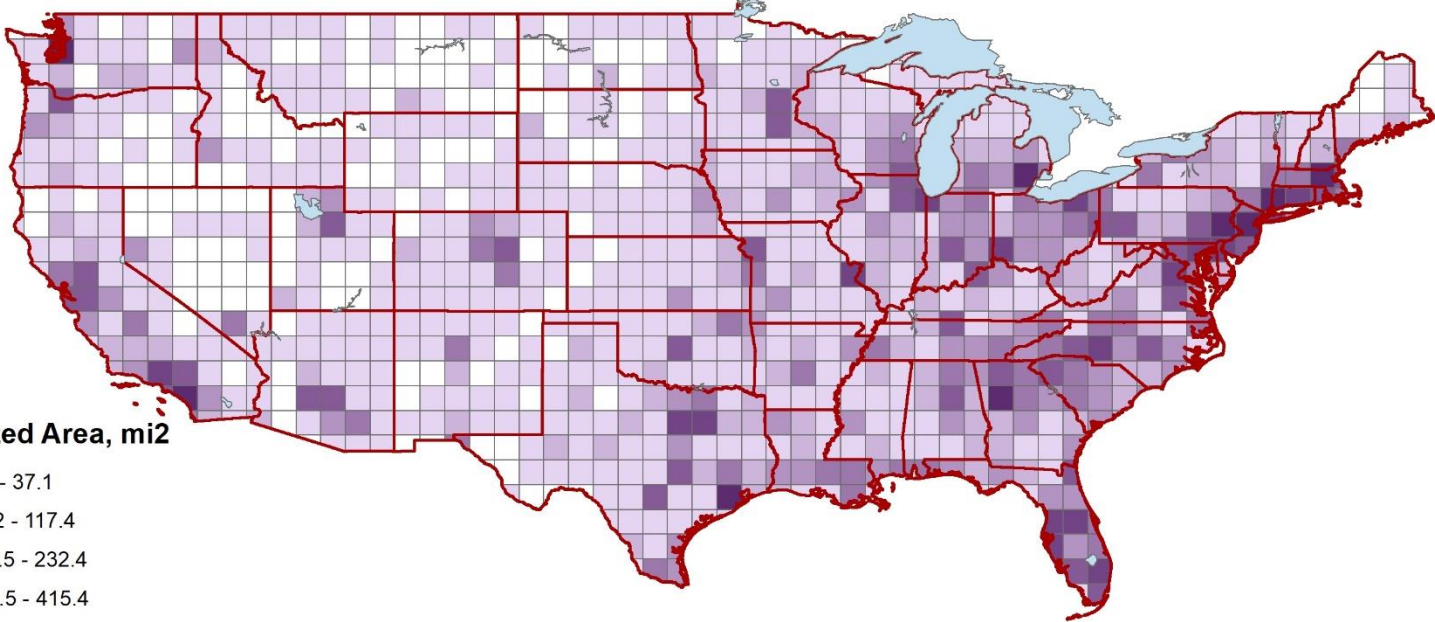
Temperature_Mean, F



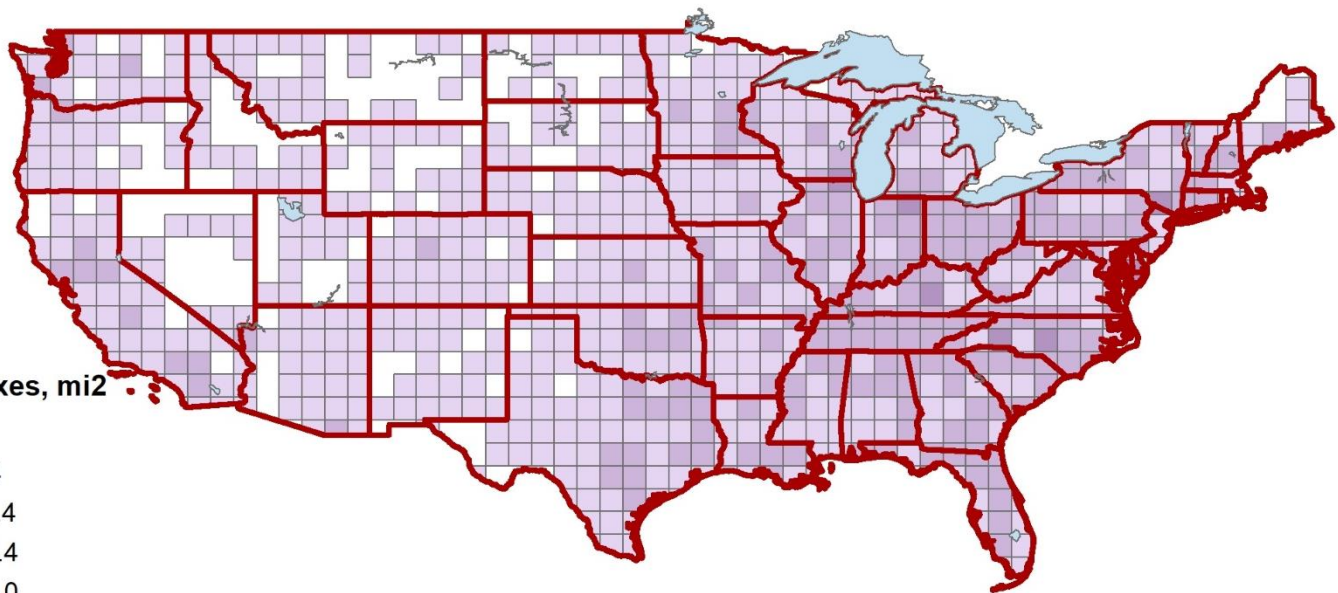
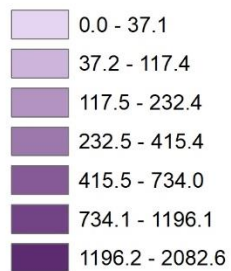
Annual
Precipitation, in



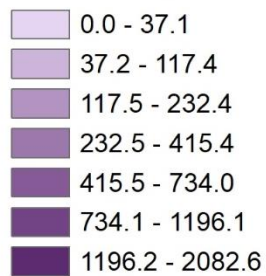
PRISM, 30 yr normals
Google Earth Engine

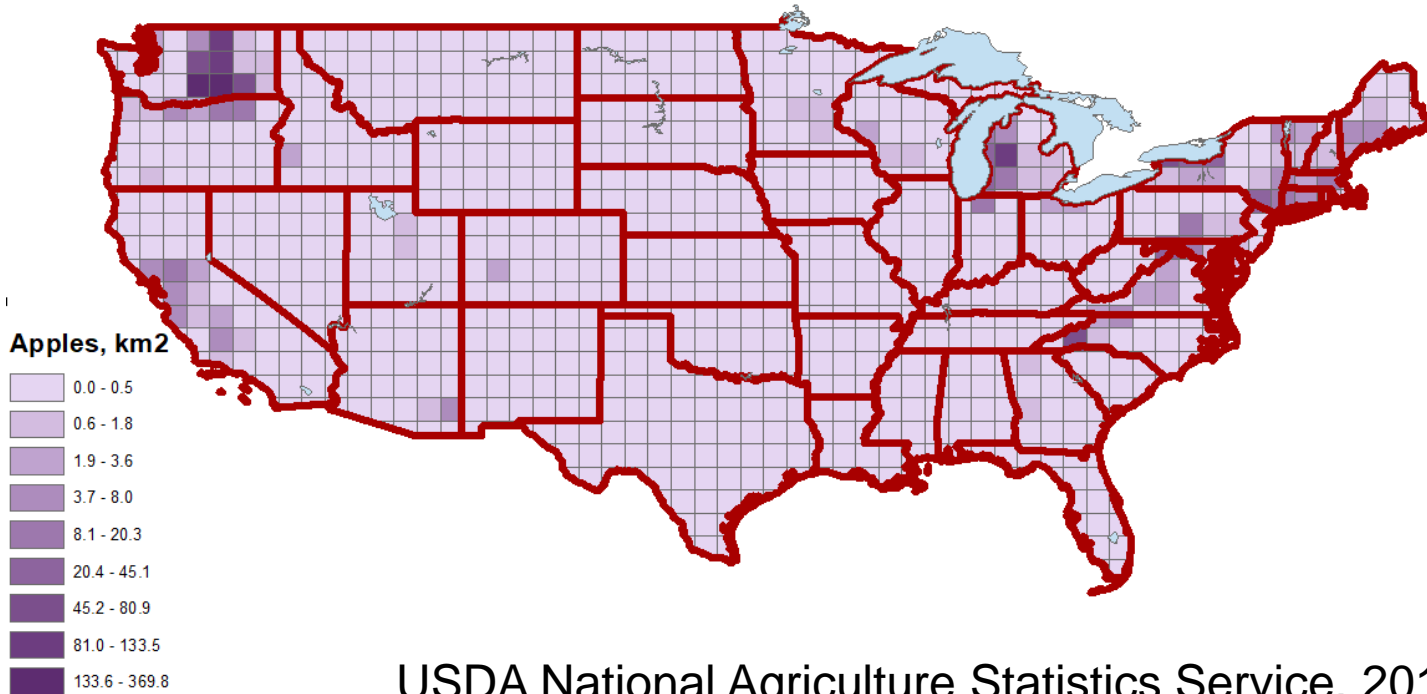
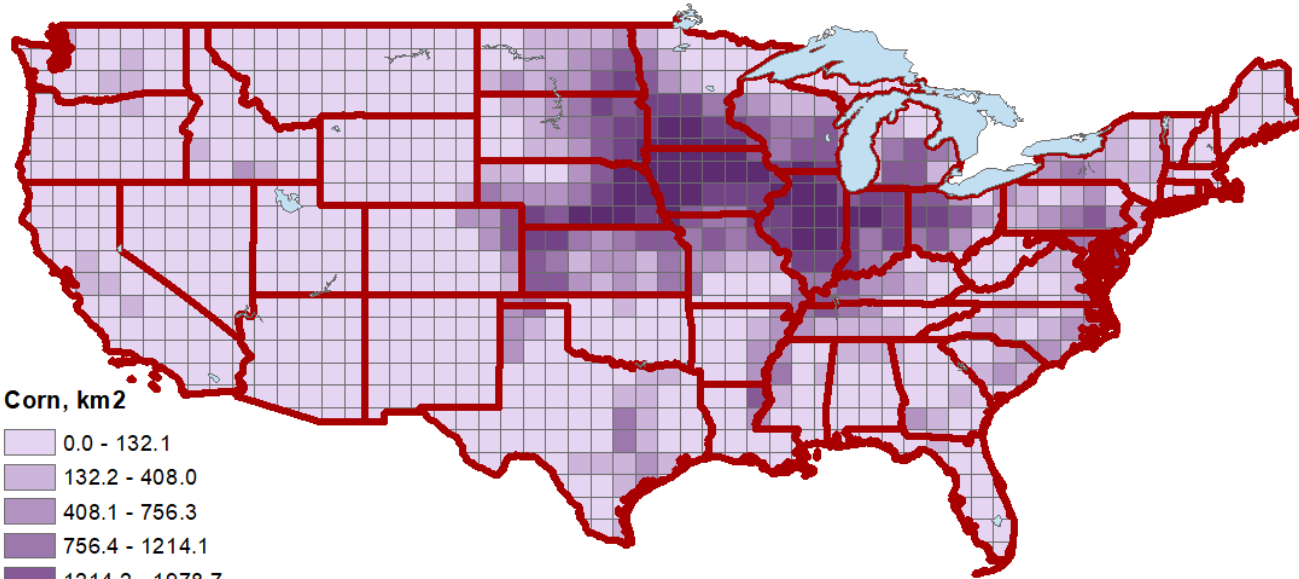


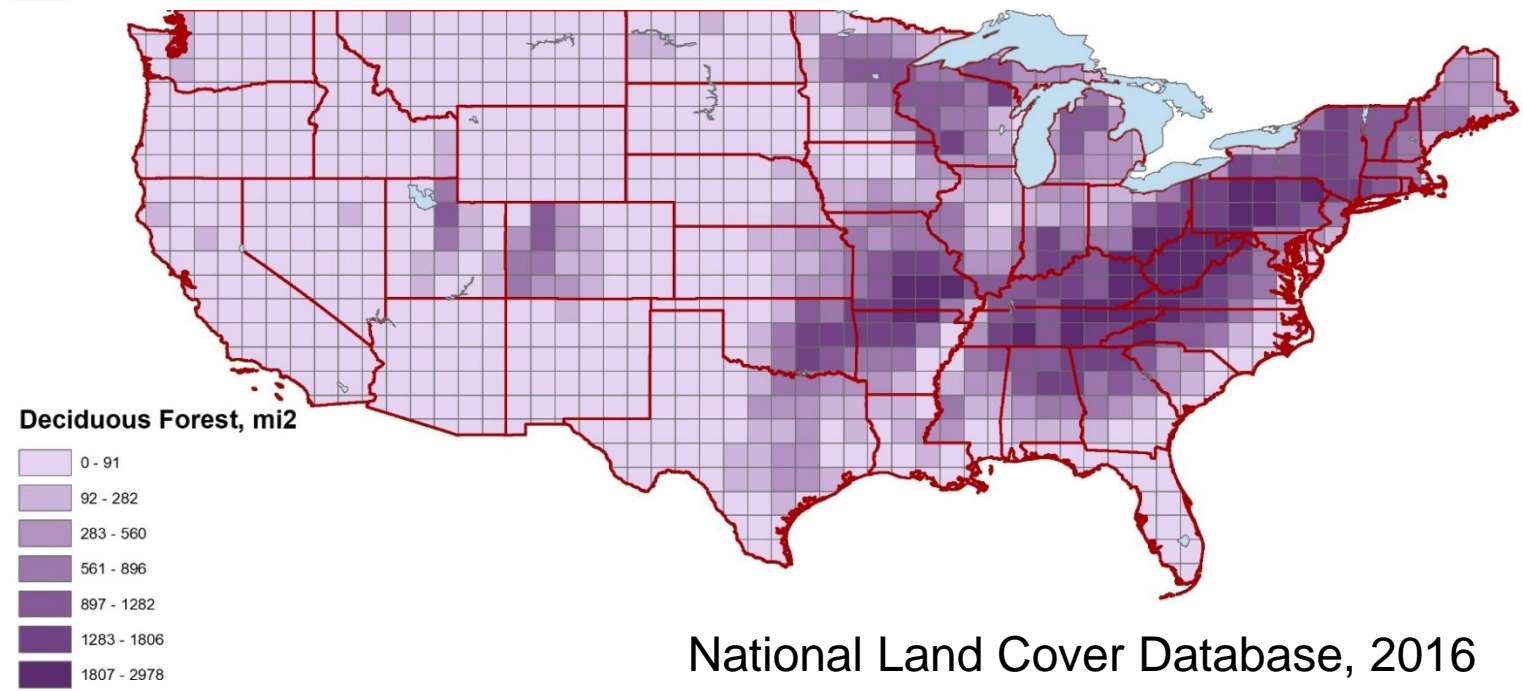
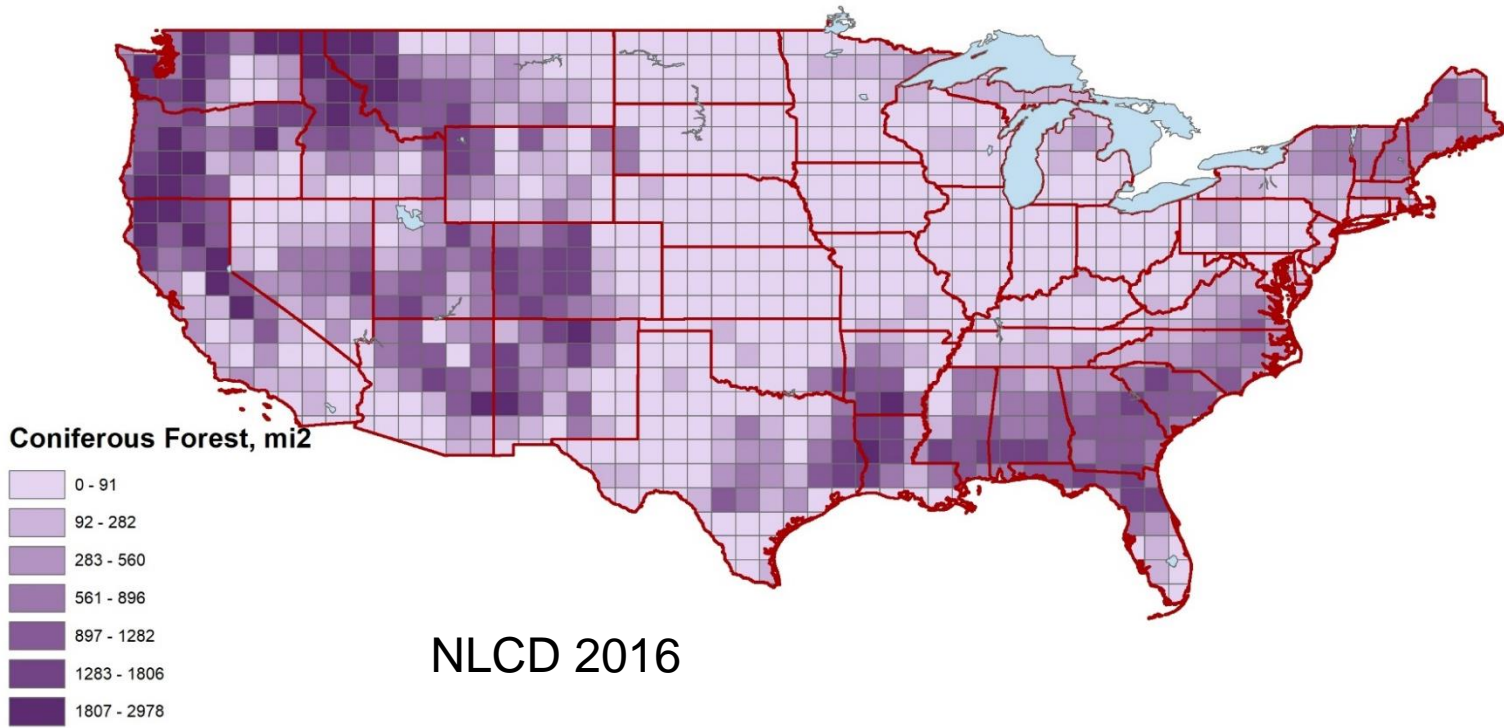
Urbanized Area, mi2



Urban Complexes, mi2

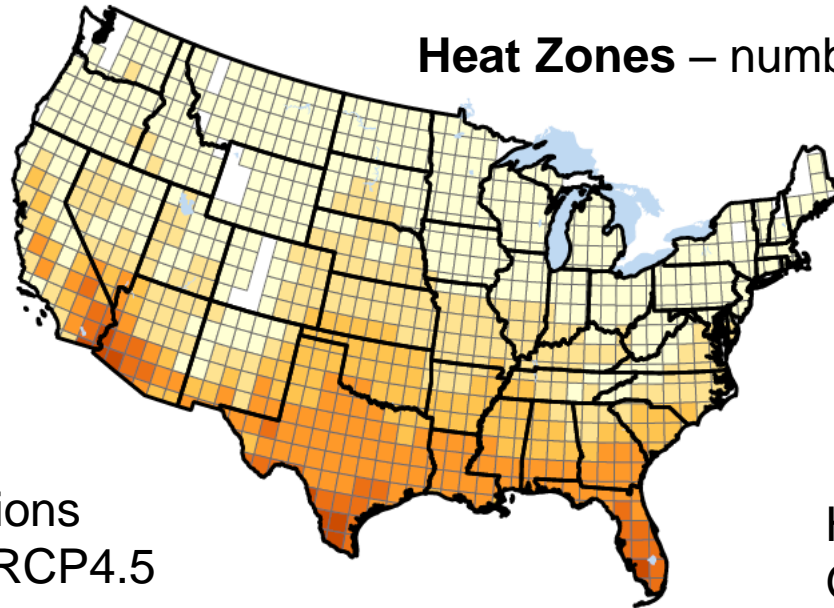




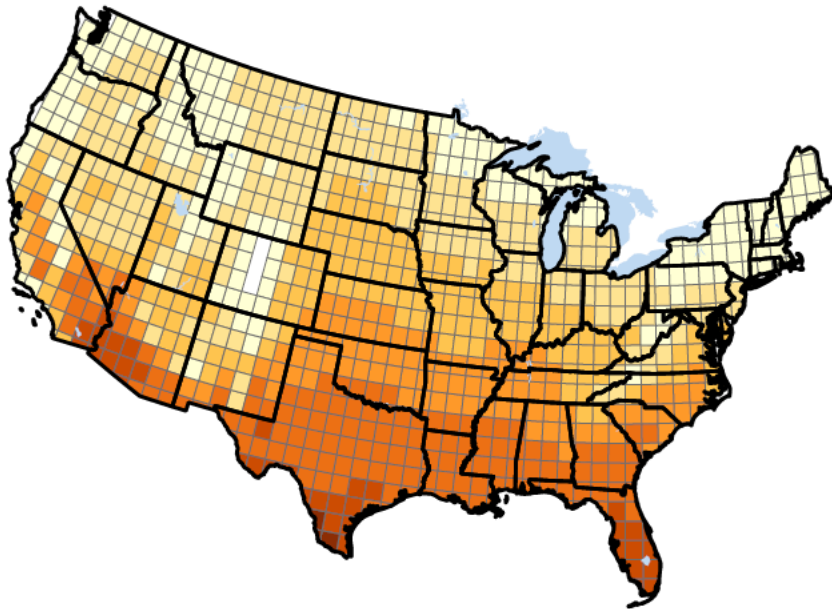


Heat Zones – number of days over 86F (30C)

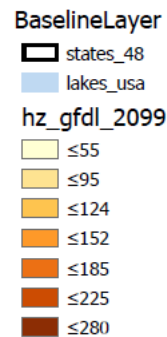
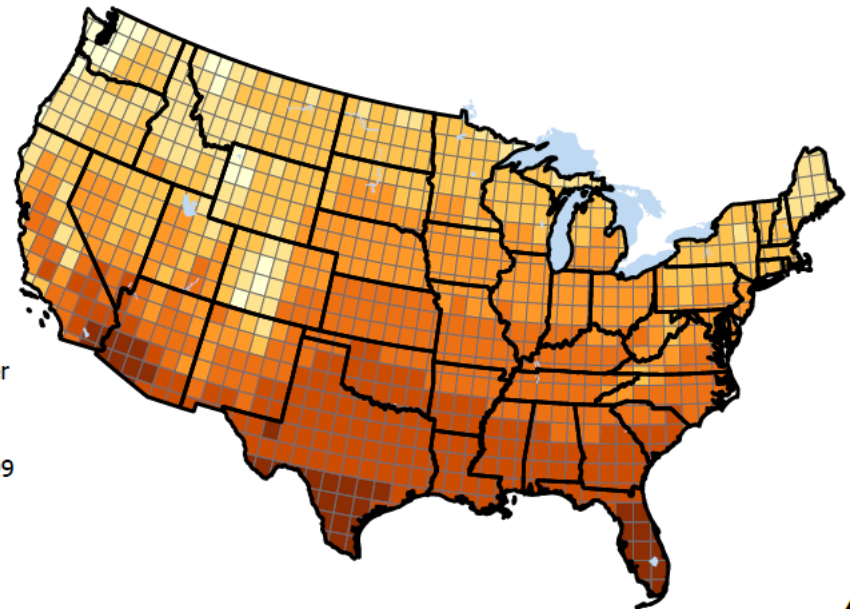
2009 (current)



Low emissions
CCSM4 – RCP4.5



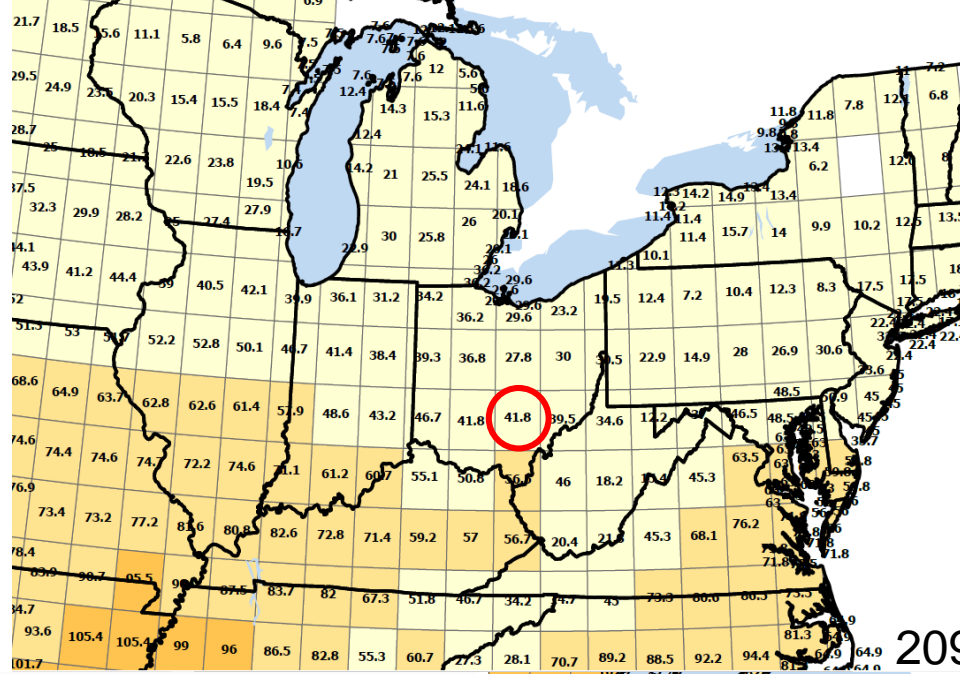
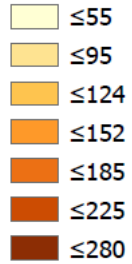
High emissions
GFDL – RCP8.5



2009

Heat Index

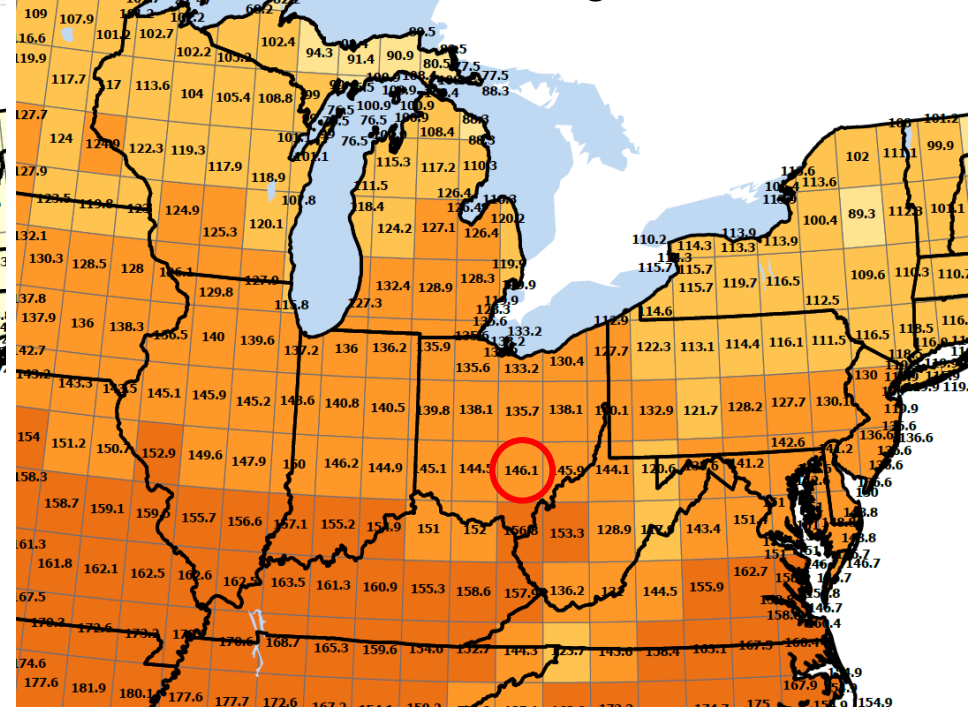
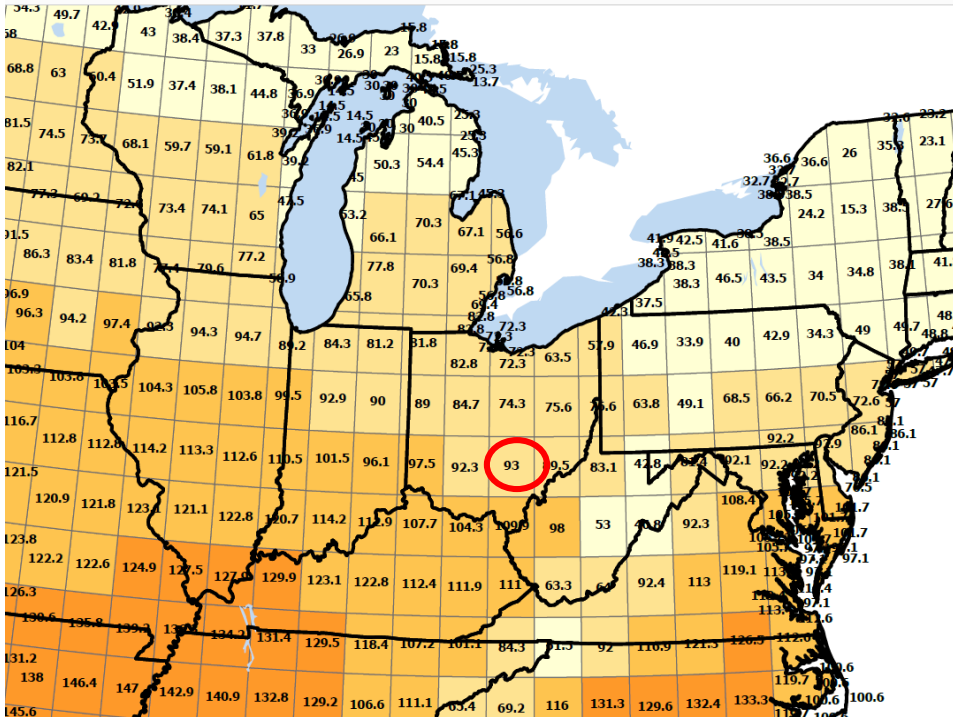
Days over 86F

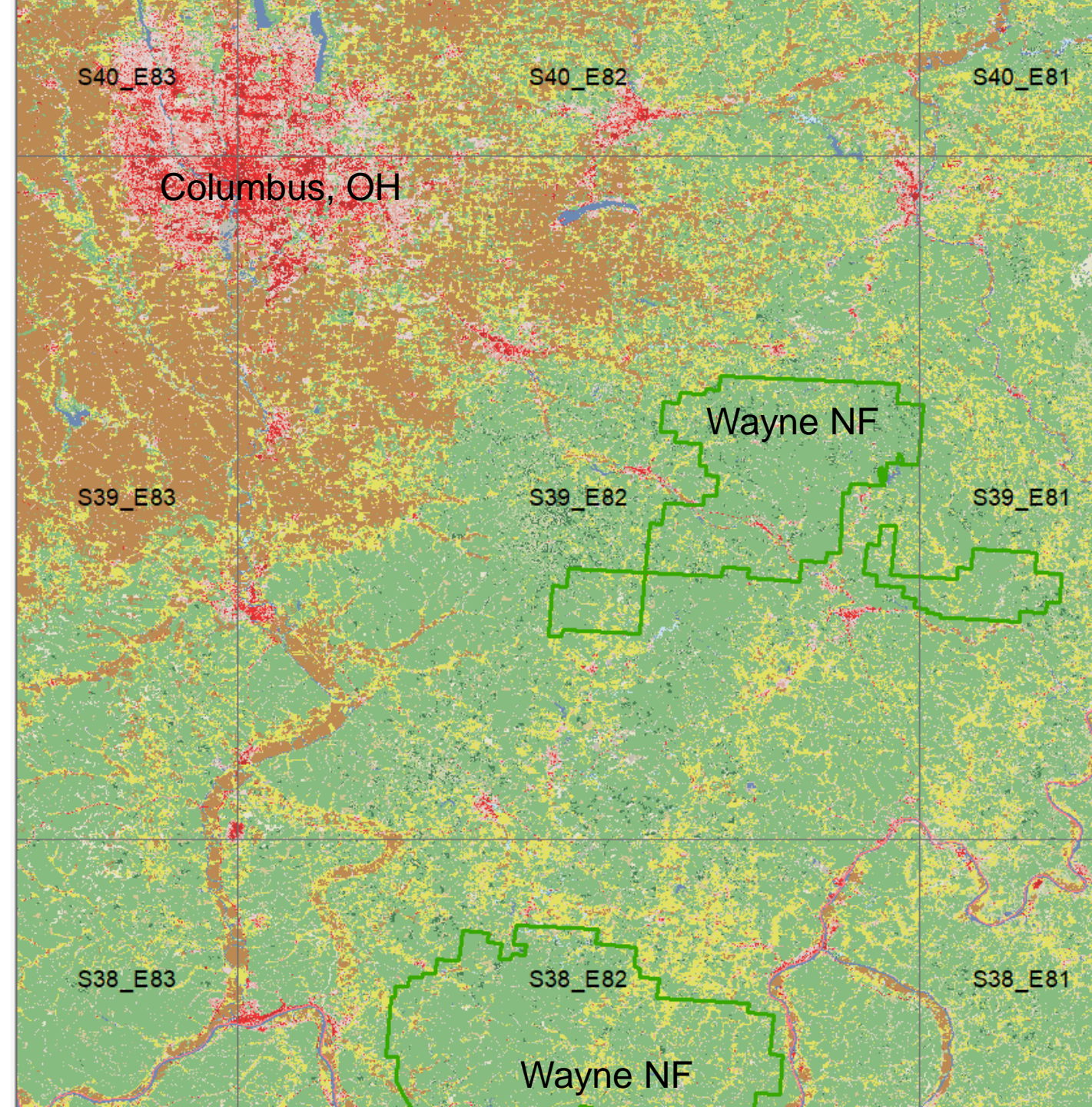


S39_E82

2099-low emissions

2099-high emissions





Heat Zones, Days over 86F

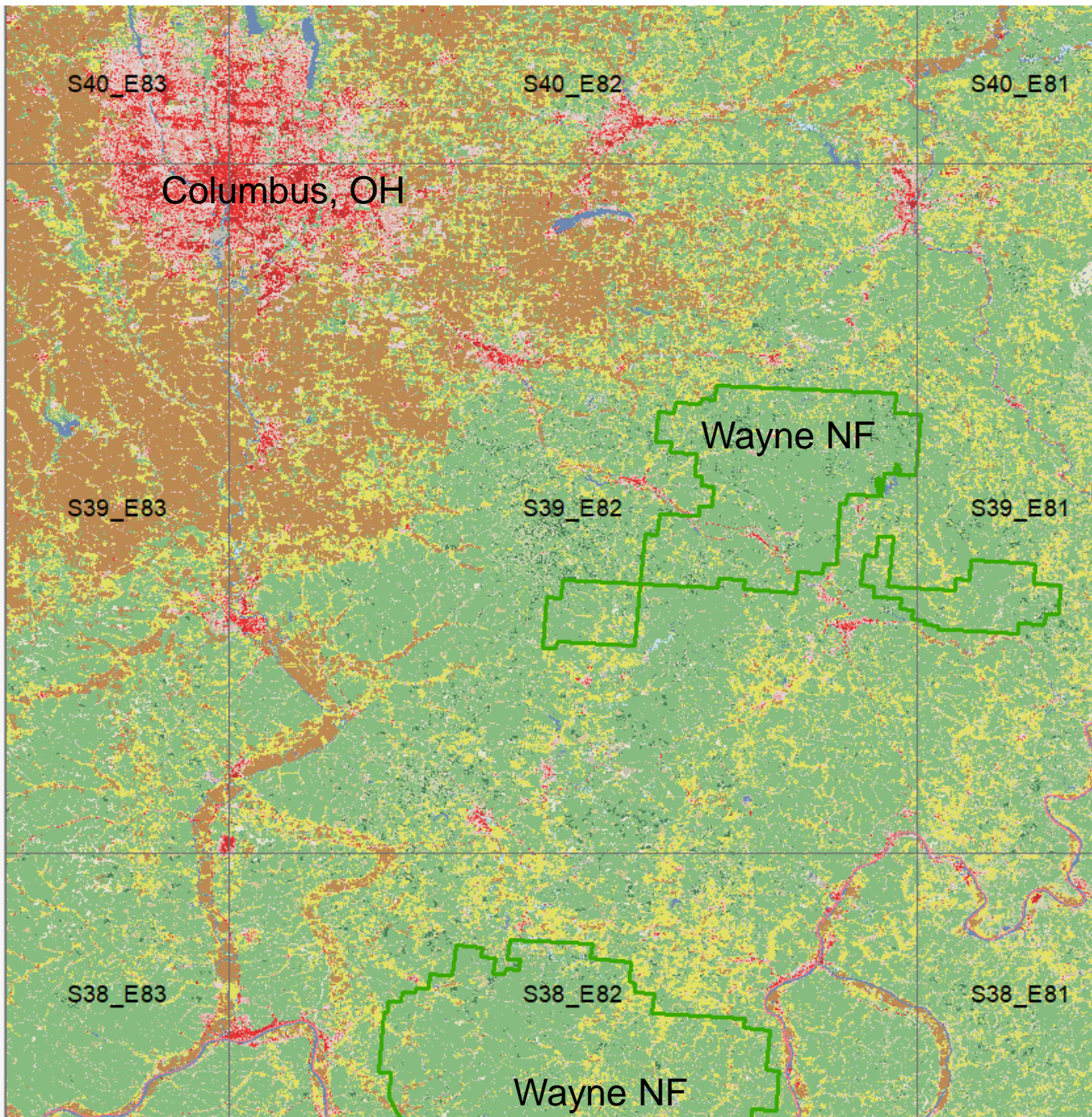
| NAME | km2 |
|-------------|-------|
| hz_ccsm2009 | 41.7 |
| hz_ccsm2039 | 66.7 |
| hz_ccsm2069 | 88.2 |
| hz_ccsm2099 | 93.0 |
| hz_gfdl2039 | 84.7 |
| hz_gfdl2069 | 118.2 |
| hz_gfdl2099 | 146.1 |

Growing Degree Days > 5C

| NAME | GDD |
|----------------|------|
| gdd_45_2009 | 3003 |
| gdd_45_2099 | 3648 |
| gdd_45_2099dif | 645 |
| gdd_85_2099 | 4780 |
| gdd_85_2099dif | 1836 |

Plant Hardiness Zones, Min C

| NAME | Min Temp, C |
|----------------|-------------|
| phz_45_2009 | -20.44 |
| phz_45_2099 | -16.03 |
| phz_45_2099dif | 4.41 |
| phz_85_2099 | -12.58 |
| phz_85_2099dif | 7.25 |



| NLCD 2016 Landcover | |
|---------------------|---------------|
| NAME | km2 |
| UNCLASSIFI_km2 | 0.0 |
| OPEN_WATER | 71.1 |
| PERENNIAL_ | 0.0 |
| DEVELOPED_ | 538.2 |
| DEVELOPED1 | 269.1 |
| DEVELOPE_1 | 146.0 |
| DEVELOPE_2 | 67.7 |
| BARREN_LAN | 22.4 |
| <u>DECIDUOUS_</u> | <u>4796.8</u> |
| EVERGREEN_ | 142.4 |
| MIXED_FORE | 346.5 |
| SHRUB_SCRU | 97.0 |
| HERBACEUOU | 56.8 |
| <u>HAY_PASTUR</u> | <u>1465.6</u> |
| <u>CULTIVATED</u> | <u>1493.0</u> |
| WOODY_WETL | 28.6 |
| EMERGENT_H | 8.0 |

| Federal Ownership | |
|-------------------|-----|
| NAME | km2 |
| DOD_km2 | 9 |
| OTHER_km2 | 0 |
| FS_km2 | 941 |
| NPS_km2 | 2 |
| FWS_km2 | 0 |
| TVA_km2 | 0 |
| BIA_km2 | 0 |
| BLM_km2 | 0 |

2018

S40_E83

S40_E82

S40_E81

Columbus, OH

Wayne NF

S39_E83

S39_E82

S39_E81

S38_E83

S38_E82

S38_E81

Wayne NF

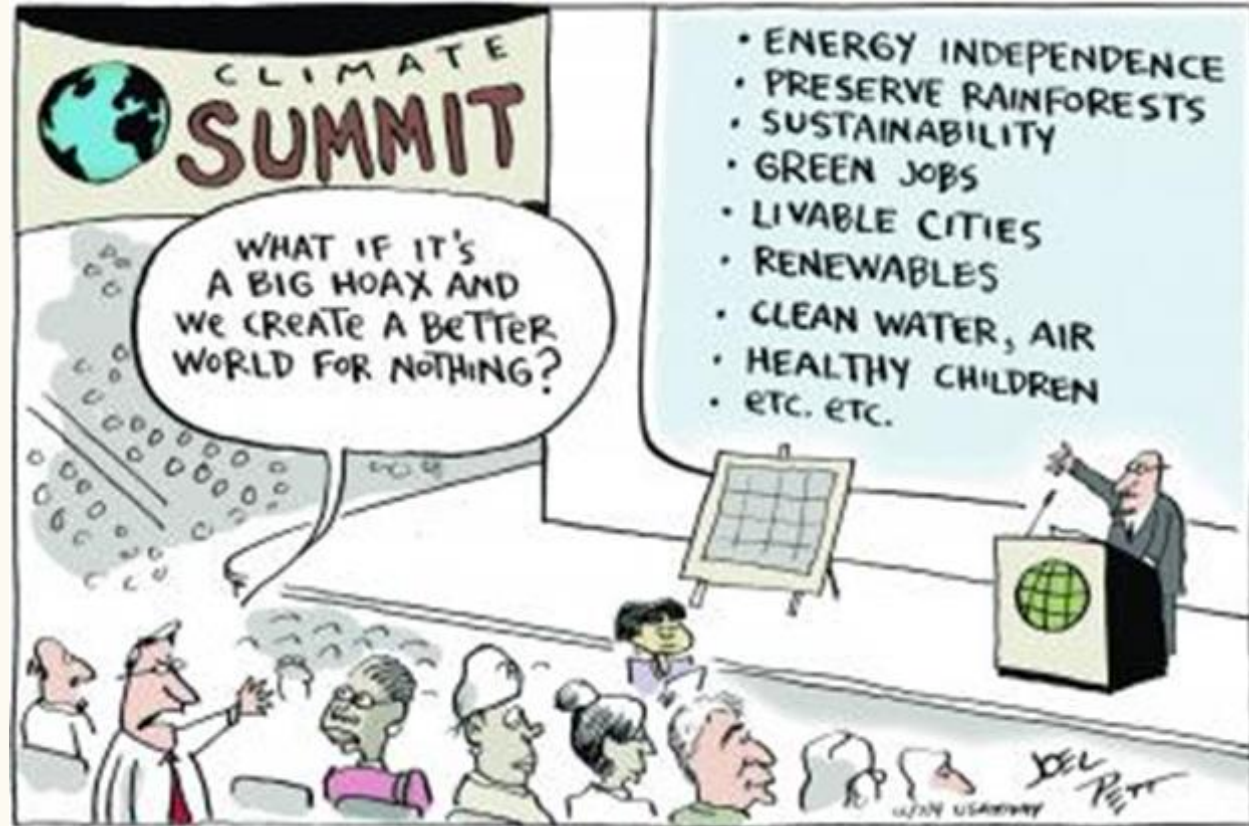
CROPLAND, NASS

| NAME | km2 |
|------------|----------|
| CORN | 681.5619 |
| SORGHUM | 0.0657 |
| SOYBEANS | 773.5014 |
| POP_OR_ORN | 0.9576 |
| BARLEY | 0.0243 |
| WINTER_WHE | 26.7912 |
| DBL_CROP_W | 24.8058 |
| RYE | 0.09 |
| OATS | 0.18 |
| SPELTZ | 0.0351 |
| ALFALFA | 31.896 |
| OTHER_HAY_ | 194.004 |
| DRY_BEANS | 0.0567 |
| CUCUMBERS | 0.0027 |
| CLOVER_WIL | 0.0252 |
| SOD_GRASS_ | 0.1278 |
| FOREST | 11.4147 |
| SHRUBLAND | 50.8032 |
| BARREN | 24.0993 |
| APPLES | 0.3438 |
| CHRISTMAS_ | 0.216 |
| TRITICALE | 0.0072 |
| CARROTS | 0.0009 |
| SQUASH | 0.0009 |
| DBL_CROP_1 | 0.0207 |
| DBL_CROP_L | 0.0396 |
| DBL_CROP_4 | 0.027 |
| DBL_CROP_5 | 0.0207 |
| BLUEBERRIE | 0.0351 |

Conclusions

- DISTRIB-II uses all updated data and a hybrid grid to populate models.
- We provide wall-to-wall, and National Forest buffer outputs of current and potential species habitats, coping capabilities, and migration potentials (other summaries coming soon).
- More richness now and in future in South, but North has more potential for adding new species via migration (assisted or not).
- Impacts are greater with RCP 8.5 (high emissions) scenario.
- The intention is to enable publics and managers, no matter where in the eastern US, to better understand their current and potential future species assemblages.
- Ancillary data will allow information gain on surroundings and spatial comparisons among 1x1 degree grids.
- We are working (with Jim Lootens-White) to make these data available on web, but in meantime, contact us.

Thank
you!



Louis Iverson louis.iverson@usda.gov

All publications available at <http://www.treesearch.fs.fed.us/> or
Google Scholar or Web of Science or ResearchGate: 'louis iverson'

Atlas web site <http://www.nrs.fs.fed.us/atlas>