**Terrestrial Invasive Plant Watch List: New York State**

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**Summary**

Species distributions are expected to shift with climate change. These range shifts may mean that terrestrial invasive plants currently within United States borders could expand into new states. We created models of current distribution for 896 terrestrial invasive plants in the continental United States and projected their potential distribution with climate change. From these projections, we identified 34 invasive plant species that are not currently present in New York State, but could establish there by 2050 as climate continues to change. From this list of 34 high-risk invasive plants, we have further prioritized 12 species that are already present in nearby states. By highlighting potential for future invasion, geographical analyses can inform state-level watch lists and management prioritization in light of climate change.

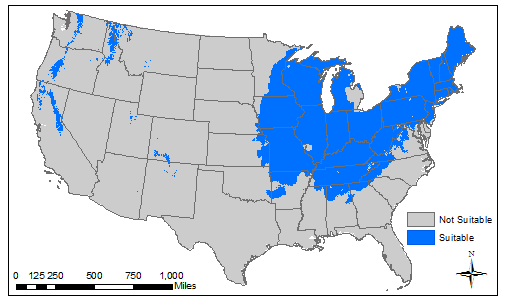
**Invasive Species Range Shifts**

Invasive species are one of the greatest threats facing natural systems (Wilcove et al., 1998) and can interfere with regeneration of valuable timber species (Fagan and Peart, 2004), negatively impact ecosystem services (Ehrenfeld and Rodriguez, 2010; Vilà et al., 2011), and reduce native species diversity (Vilà et al., 2011). In many cases, land managers and public agencies must assess risks posed by invasive species and make decisions about current and future management plans. The inherent dynamics of invasive species and changes in distribution and abundance due to climate and land use change complicate identification of high risk areas. Management of these problematic species is costly (Bradshaw et al., 2016; Pimentel et al., 2005) and tools are needed to better identify areas of high risk and prioritize potential control targets in a regional context (Allen and Bradley, 2016; Hauser and McCarthy, 2009; McGeoch et al., 2016).

We used species range models to address the geographic components of invasive species risk. For each of nearly 900 terrestrial plants, we identified the climatic conditions that the species could tolerate based on the climatic conditions of every location where the species has been found (Allen and Bradley, 2016). We use these data to predict the geographic areas where the species is likely to survive. An example range map produced from our models is provided for Japanese barberry (*Berberis thunbergii*) (Figure 1) and maps for all species in our study are available from [UMass Scholar Works (doi: 10.7275/R5FF3Q9X)](http://scholarworks.umass.edu/eco_datasets/4/).

Using the relationships discovered between climate and each species’ geographic locations, we projected future ranges based on climate from 13 general circulation models (GCMs) for mid-century (2050). GCMs are models that characterize the exchange of energy and matter between the earth’s surface and the atmosphere and between different components of the atmosphere, where each GCM represents complex processes in different ways. No one model is correct for all climate characteristics in all parts of the world, so we typically use many to bracket the range of future possible changes in climate. If projections from many models agree, we have higher confidence that the projected event will occur.

Relative Concentration Pathways (RCPs) describe possible trajectories of greenhouse gas emissions (Pachauri and Meyer, 2015) and are used for projecting future climate with GCMs. The analysis we present used RCP 4.5 to represent an intermediate future emissions scenario among 4 possible RCPs.



**Figure 1**: Potential range of Japanese barberry (*Berberis thunbergii*) with current climate.

**Listing Criteria**

We applied the following criteria to the range maps produced from our analysis in order to include a species on the New York State watch list:

1. Species is not on the current state invasive plant list or federal noxious weed list.
2. Species has not been observed in the state
3. Current climate model does not predict occurrence in the state
4. At least 85% agreement among climate change models that the species will have suitable climate in the state by 2050 under RCP 4.5.

**Watch List**

Thirty-four species were identified as potential range expanders into New York State with climate change by mid-century (Table 1). Of those 34 species, 35% (12 species) are present in nearby states (**bold** in Table 1) and are the species most likely to establish new populations in New York State by 2050.

This preliminary analysis highlights the utility of geographic modeling for informing state-level watch lists of invasive species. Our methods are a starting point for how species could be prioritized geographically. But, these geographical decisions need to be refined with input of invasive species managers. For example, our current list includes only species absent from New York State, but we could instead choose to include species present in only a small portion of the state and expanding with climate change. Additionally, geographic analyses could be combined with an evaluation of invasive species impact (e.g., via literature reviews using consistent metrics of impact such as the new EICAT framework; Hawkins et al., 2015) and information about likelihood of species dispersal into New York State in order to improve species prioritization. This watch list provides an important illustration of how geographic modeling can inform invasive species prioritization.

**Table 1**: Invasive plant species likely to expand their range into New York State by 2050 with climate change. Species in **bold** are already present in nearby states.

|  |  |  |  |
| --- | --- | --- | --- |
| Scientific Name | Common Name | USDA Code | Growth Form |
| *Araujia* *sericifera* | *white bladderflower* | ARSE8 | vine |
| *Ardisia* *elliptica* | *shoebutton* | AREL4 | shrub, tree |
| ***Arundo* *donax*** | ***giant reed*** | **ARDO4** | **graminoid, shrub, subshrub** |
| *Asclepias* *curassavica* | *bloodflower* | ASCU | forb/herb, subshrub |
| ***Avena* *barbata*** | ***slender oat*** | **AVBA** | **graminoid** |
| *Bellardia* *trixago* | *Mediterranean linseed* | BETR | forb/herb |
| ***Brachypodium* *distachyon*** | ***purple false brome*** | **BRDI2** | **graminoid** |
| *Buddleja* *lindleyana* | *Lindley's butterflybush* | BULI | shrub |
| *Canna* *indica* | *indian shot* | CAIN19 | forb/herb |
| ***Carthamus* *lanatus*** | ***woolly distaff thistle*** | **CALA20** | **forb/herb** |
| *Cestrum* *diurnum* | *day jessamine* | CEDI6 | shrub/tree |
| ***Conyza* *bonariensis*** | ***asthmaweed*** | **COBO** | **forb/herb** |
| ***Cortaderia* *selloana*** | ***Uraguayan pampas grass*** | **COSE4** | **graminoid** |
| ***Crotalaria* *spectabilis*** | ***showy rattlebox*** | **CRSP2** | **forb/herb** |
| *Ehrharta* *erecta* | *panic veldtgrass* | EHER | graminoid |
| *Firmiana* *simplex* | *Chinese parasoltree* | FISI2 | shrub, tree |
| *Hedera* *helix spp. canariensis* | *Algerian ivy* | HEHEC | vine |
| *Hemarthria* *altissima* | *limpograss* | HEAL5 | graminoid |
| *Hibiscus* *tiliaceus* | *sea hibiscus* | HITI | shrub, tree |
| *Jasminum* *multiflorum* | *star jasmine* | JAMU2 | shrub, vine |
| *Lagerstroemia* *indica* | *crapemyrtl* | LAIN | shrub, tree |
| *Ligustrum* *japonicum* | *Japanese privet* | LIJA | shrub, tree |
| *Liriope* *spicata* | *creeping liriope* | LISP10 | forb/herb |
| ***Mosla* *dianthera*** | ***miniature beefsteakplant*** | **MODI4** | **forb/herb** |
| ***Nandina* *domestica*** | ***sacred bamboo*** | **NADO** | **shrub** |
| *Nerium* *oleander* | *oleander* | NEOL | shrub, tree |
| ***Paspalum* *urvillei*** | ***Vasey's grass*** | **PAUR2** | **graminoid** |
| *Peganum* *harmala* | *harmal peganum* | PEHA | forb/herb |
| *Persea* *americana* | *avocado* | PEAM3 | tree |
| ***Phyllanthus* *tenellus*** | ***Mascarene Island leaf-flower*** | **PHTE5** | **forb/herb** |
| *Polypogon* *viridis* | *beardless rabbitsfoot* | POVI9 | graminoid |
| ***Sesbania* *punicea*** | ***rattlebox*** | **SEPU7** | **forb/herb, subshrub** |
| *Tamarix* *aphylla* | *Athel tamarisk* | TAAP | shrub, tree |
| *Tamarix* *chinensis* | *five-stamen tamarisk* | TACH2 | shrub, tree |

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