



Effect of anthropogenic invasion pressure on invasive plant distribution in urban forests

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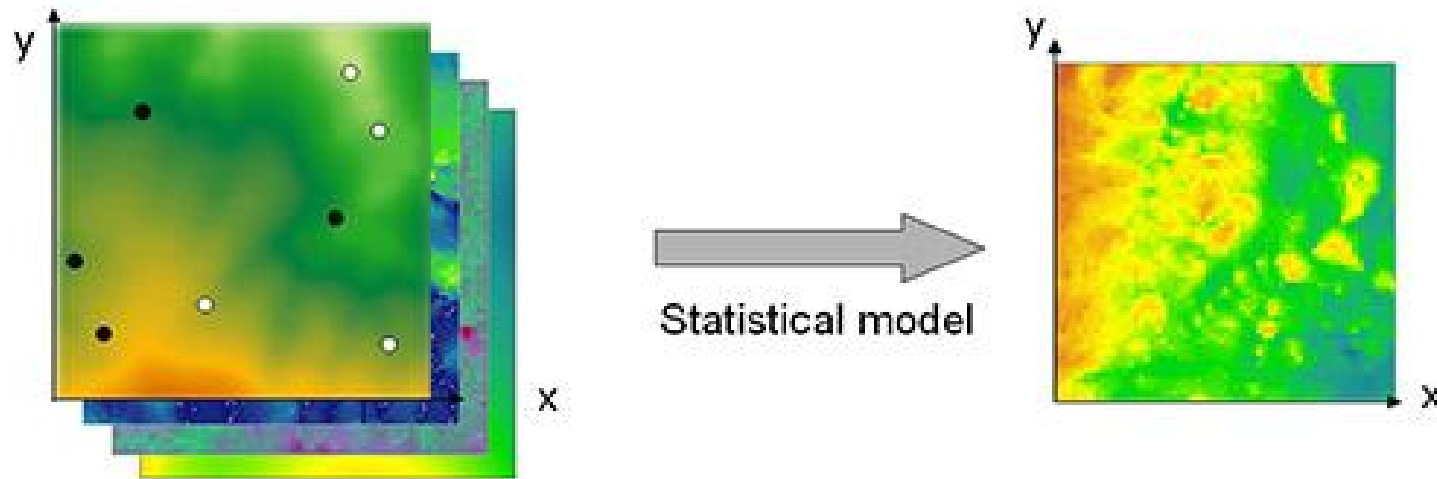
Exotic shrub invasions

- Prevalent along the eastern seaboard
- Threaten biodiversity
- Inhibit forest regeneration
- form dense thickets
 - displace native species
 - local extinctions
 - impaired provisioning of ecosystem services



Chinese privet (*Ligustrum sinense*)

Species Distribution Models (SDMs):



Field records and maps of environment

Map of probability species is present

- Habitat suitability used to predict likelihood of presence
- More accurate for narrow habitat requirements
- Little data on effects of anthropogenic invasion pressure, yet residences likely use invasive species

Anthropogenic invasion pressure

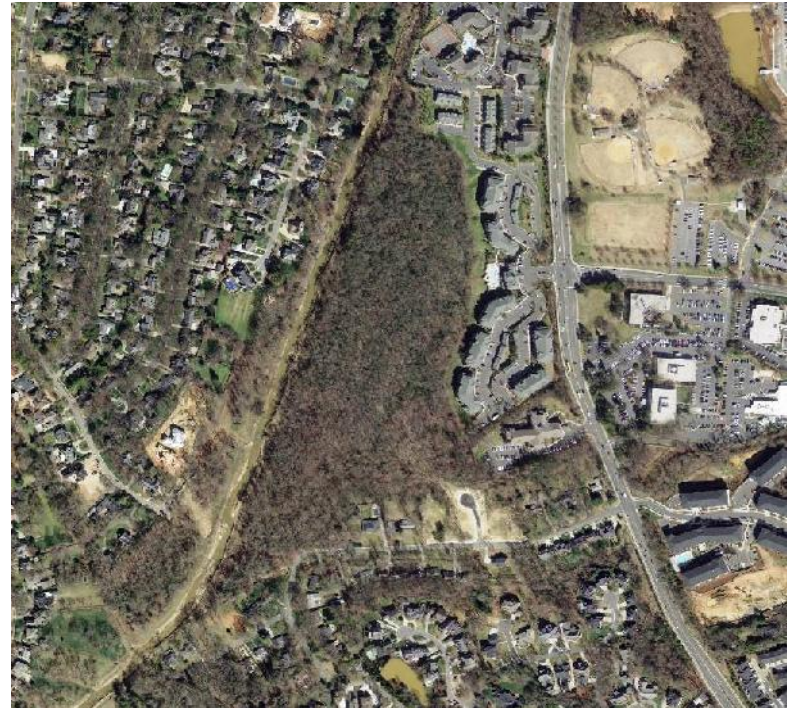
- Introduction effort
- Worst forest invaders have their origins in the nursery trade
- Spread from homes via birds and wildlife to forests



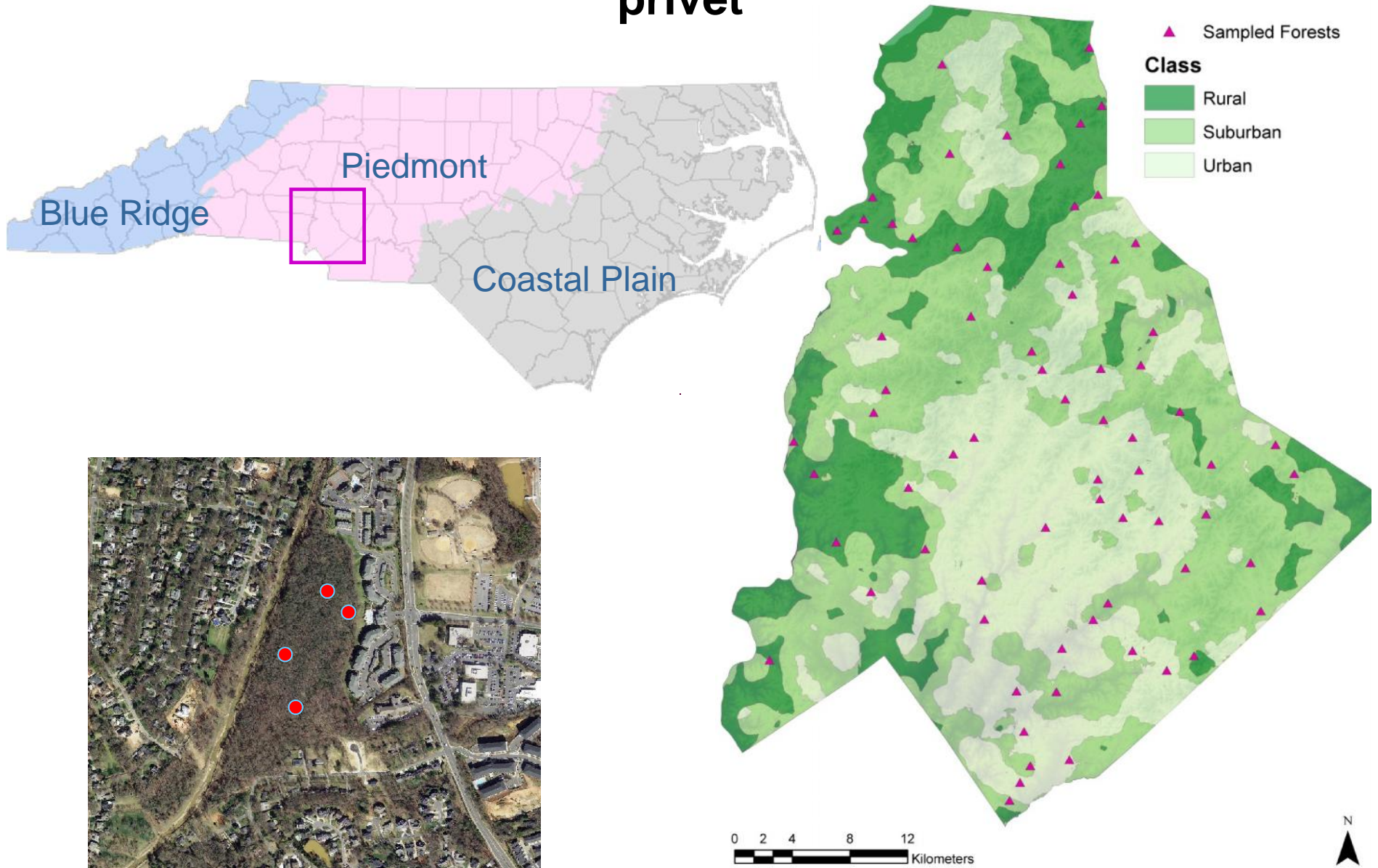
Mahonia planted near a house (left), *Mahonia* growing in a nearby forest (right)

Research Question

- 1) Does anthropogenic invasion pressure influence the distribution of forest invaders in urban landscapes?



Collected presence/absence data on Chinese privet



Model Building

- Divide data 70/30 for training/testing
- Constructed niche (environment-only) models investigating :
 - **Light availability** (canopy closure, solar radiation, aspect)
 - **Moisture** (TMI, soil wetness capacity, relative slope position)
 - **Edaphic factors** (soil class, geology)
 - **Landscape structure** (patch area, edge, perimeter to area ratio, distance to forest edge)
- Best niche model:
 - Privet = solar radiation + canopy closure + relative slope position
- Evaluate contribution of rFOI to model accuracy, while accounting for neighborhood effects

Anthropogenic invasion pressure:

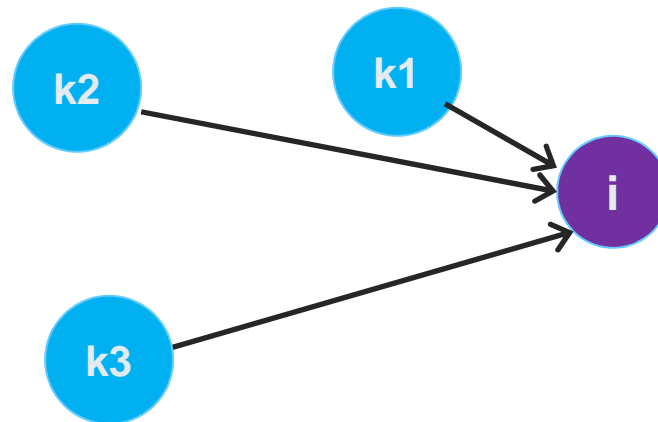
- measured as residential force of invasion (rFOI)

$$rFOI_i = \sum_{k=1}^{S_{i,red}} \frac{1}{d_{ik}} W_k$$

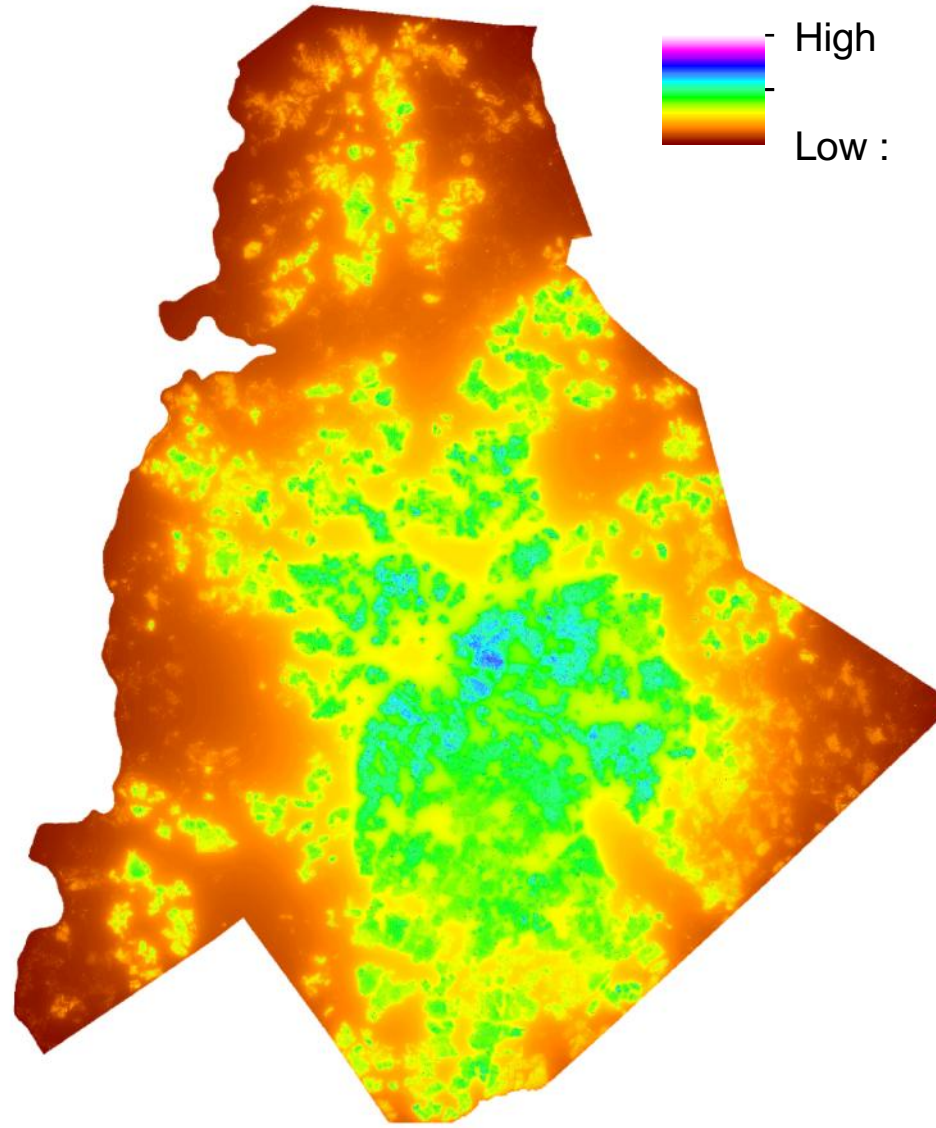
i = 30m² forest grid cell

W = age of residence

D_{ik} = euclidean distance between i and k



Residential force of invasion map



Results

| model | AIC | OM | COM | ACC | AUC |
|-------------------------|--------|------|------|------|------|
| niche | 320.00 | 0.29 | 0.30 | 0.70 | 0.80 |
| niche + rFOI | 293.45 | 0.15 | 0.20 | 0.82 | 0.91 |
| niche +nFOI | 284.97 | 0.24 | 0.24 | 0.76 | 0.87 |
| niche + rFOI + nFOI | 271.78 | 0.15 | 0.14 | 0.86 | 0.94 |
| niche + housing density | 294.59 | 0.18 | 0.19 | 0.82 | 0.89 |

| | | observed | |
|-----------|---------|-------------------------------------|---------------------------------------|
| | | present | absent |
| predicted | present | <i>presence</i> (true positive) | <i>commission</i> (false positive) |
| | absent | <i>omission</i> (false negative) | <i>absence</i> (true negative) |

OM Omission rate

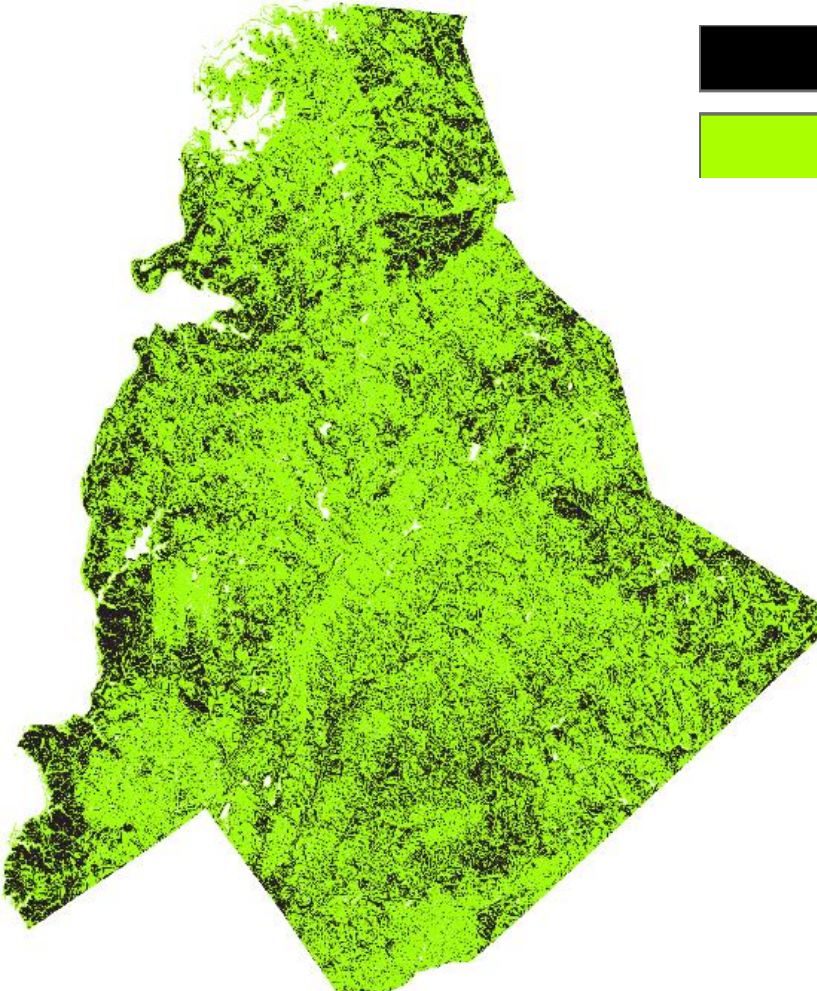
COM Commission rate

ACC Overall accuracy

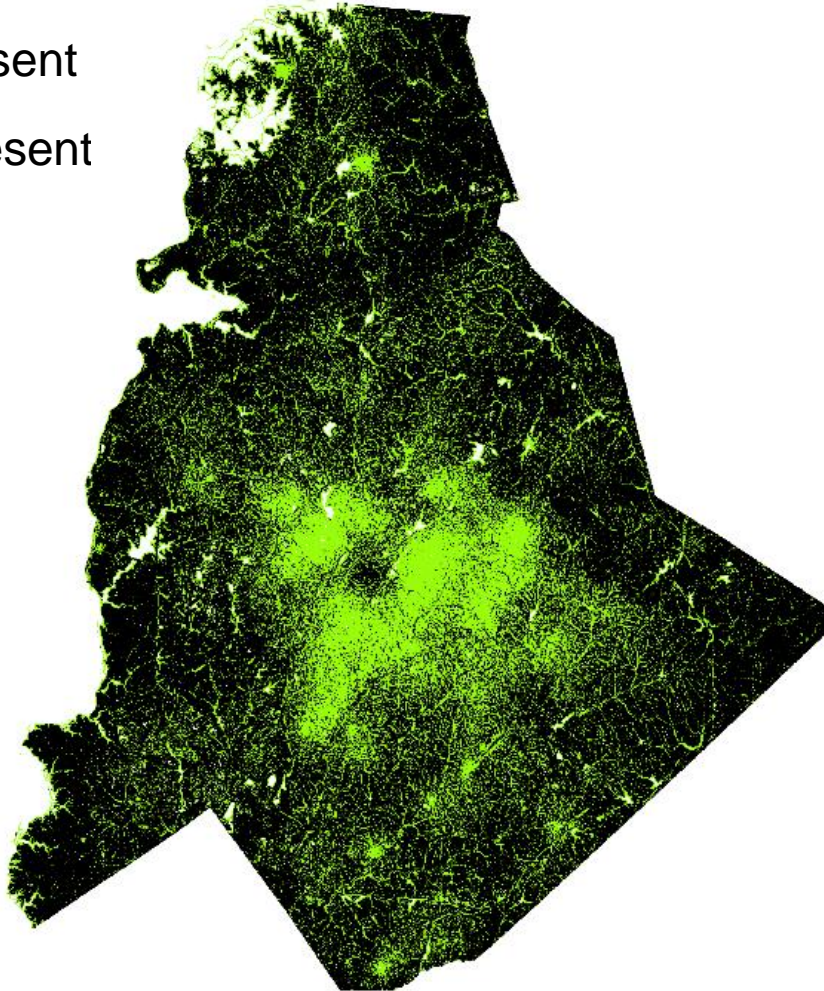
AUC Area under the curve

Binary Risk Maps

absent
present



Niche model



Niche + rFOI + nFOI

Significance

- Model results show that accounting for rFOI and neighborhood effects not improves detection of privet, but eliminates a vast swath land previously identified as high risk of invasion
- Failure to account for rFOI and neighborhood effects in SDMs can lead to both underprediction (false negative) and overprediction (false positive).
- **Conservation/control efforts** can be more accurately and feasibly targeted.



Acknowledgements

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