Geographic object-based image analysis of unpiloted aerial systems imagery to map understory deciduous forest invasive species using phenology, texture, deep learning, and plant modeling.

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October 4, 2018
Main Question

How do I accurately map the distribution of two nonnative invasive species —
Japanese barberry and multiflora rose —
with a basic drone and rgb camera?
RESEARCH SITE LOCATIONS
Along the Nipmuck Trail cutting through the UConn Forest
The research plan

1. Plants: **Japanese Barberry & Multiflora Rose**
2. Phenology
3. Drones
4. GEOBIA + Texture
5. Deep Learning
6. Plant Modeling
UConn Forest:
A Short Movie
TWO PLANTS
Japanese Barberry
(Berberis thunbergii)
MULTIFLORA ROSE
(Rose multiflora)
Phenology
(Temporal Signatures)
Tracking Invasives by Temporal Signature

Barberry

March 31st

April 3rd

Rose

March 31st

April 3rd
TWO DRONES
The Drones or Unpiloted Aerial Systems (UAS)

DJI Mavic Pro: RGB

DJI Phantom 3 4K: RBG
# Late Winter-Early Spring Flight Flights

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<th>FEBRUARY 2018</th>
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## Statistics

- **10,836 Images**
- **600 Ground Control Points**
- **101 Flights**
- **29 Days**

**All Flights**

- Altitude: 50 m
- Winds: 10 mph
- Temp: 32° F
ONE GIANT LIMITING FACTOR: 

**Double-leader white pine snag**
(great for wildlife, bad for drones)
RED-GREEN-BLUE IMAGERY (RGB)
The Chemical and Structural Characteristics of Plants Reflect Highest in the Green part of the Spectrum
Pixels contain **Red-Green-Blue** values
Comparing 4 Methods

a. GEOBIA + Texture
b. GEOBIA + Deep Learning
c. Deep Learning
d. Deep Learning + Plant Modeling
Geographic Object-Based Image Analysis (GEOBIA)
Geographic Object-Based Image Analysis (GEOBIA)

Drone image

Segmentation of Drone Image

Greenness Index + Segmentation
Classifying Patterns

Differences in textural patterns, leaf size, and leaf shape...
Separating one pattern from another...

Rose  Barberry
Setting up Training Sets: Slicing UAV images in Adobe Photoshop

128 x 128 pixels
PLANT MODELING
(AUGMENTING THE DATASET)
The Sacrificial Shrub

Measured every stem, 23 in total.
Plant Modeling -
adding synthetic data to improve deep learning performance
Next Steps

- Finish training and testing datasets
- Check accuracy of data
- Capture images of multiflora rose during the months of October & November
- Create accurate invasive species occurrence maps distinguishing species