

16th Annual Invasive Species Workshop

Predicting rapid expansion: What are the biological characteristics of Alaska's most invasive plant species?

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The capacity to predict the speed and spatial extent of invasion of a species can greatly promote the effective management of any recent or anticipated introduction. To identify the biological characteristics correlated to the colonization potential of plant species in Alaska, intrinsic population growth rates were calculated for more than 300 plant species documented within, and considered non-native to, the state. Intrinsic growth rate were calculated for each species using residence time and current population size. For more than half of the non-native species, records housed in the Alaska Exotic Plant Clearinghouse (AKEPIC) statewide weed database represent the earliest record of collection; collection information was gleaned from herbaria specimens, regional floras, databased records and literature sources for the remaining species. A hexagon-binning approach applied to the geospatial occurrence data in AKEPIC was used to indicate the current population size of each species. Multivariate ordination was used to identify biological characteristics of species that best indicate intrinsic population growth. Intrinsic growth rates were compared to invasiveness ranking system values to explore the relationship between rate of spread and ecological impacts. This work provides a more complete picture of Alaska's invasion history and may promote the effective mitigation of current and future invasive plant problems to this relatively pristine landscape.

PREDICTING RAPID EXPANSION

What are the
biological
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Alaska Natural Heritage Program
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Lindsey Flagstad, Matt Carlson and Justin Fulkerson
Alaska Invasive Species Conference
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WE HAVE NO CRYSTAL BALL

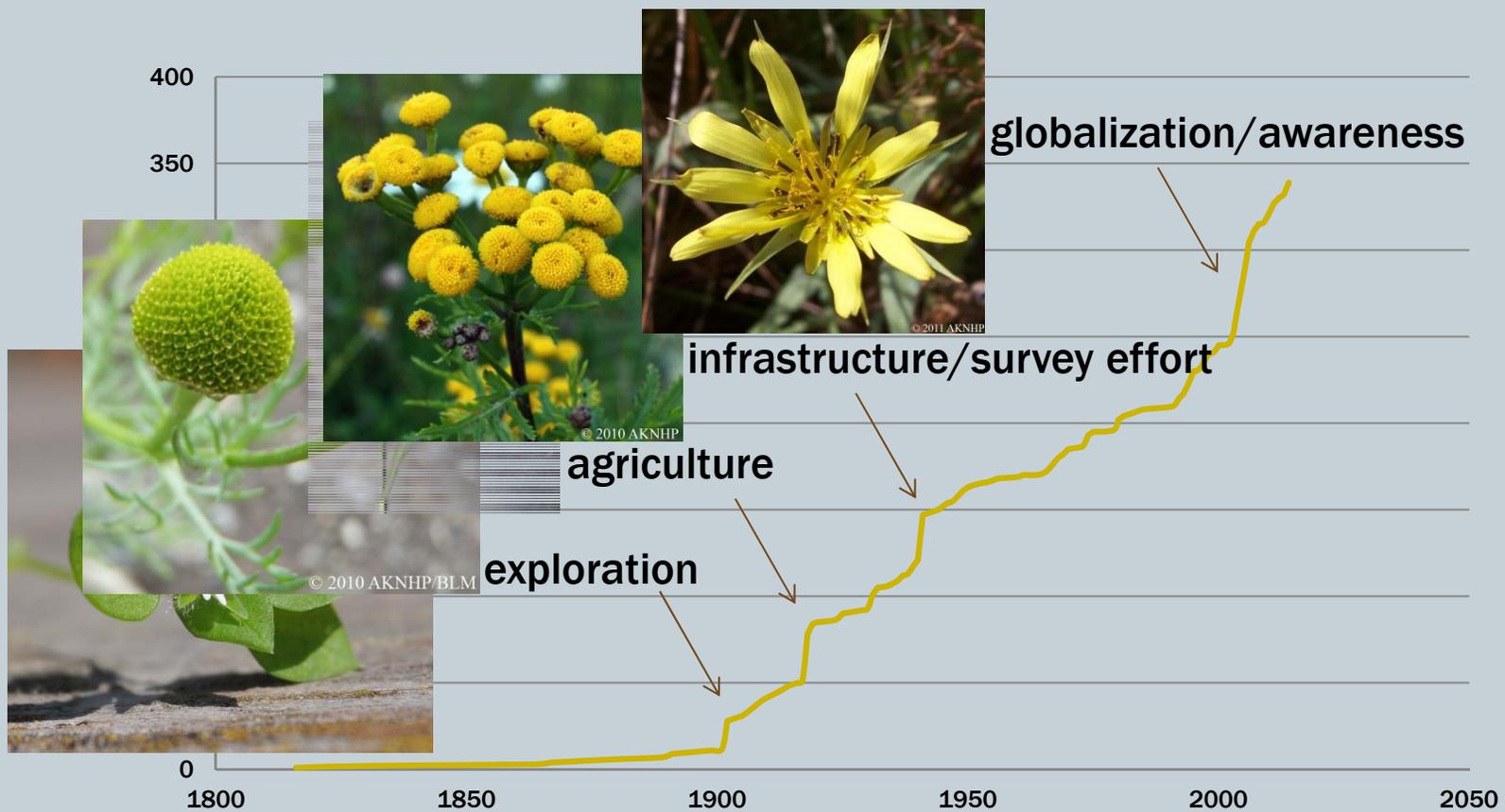
- The ability to predict the expansion of a species from known characteristics promotes effective management



METHODS

- Calculated intrinsic growth rate $r = \ln\left(\frac{N_t}{N_o}\right) / t$
 - Records of first collection for the 339 species considered non-native to, and documented as occurring in Alaska
 - Quantified current presence from AKEPIC records using a hexagon binning approach
- Compared this intrinsic growth rate to biological characteristics of the species

PATTERNS OF INTRODUCTION



TOP TEN

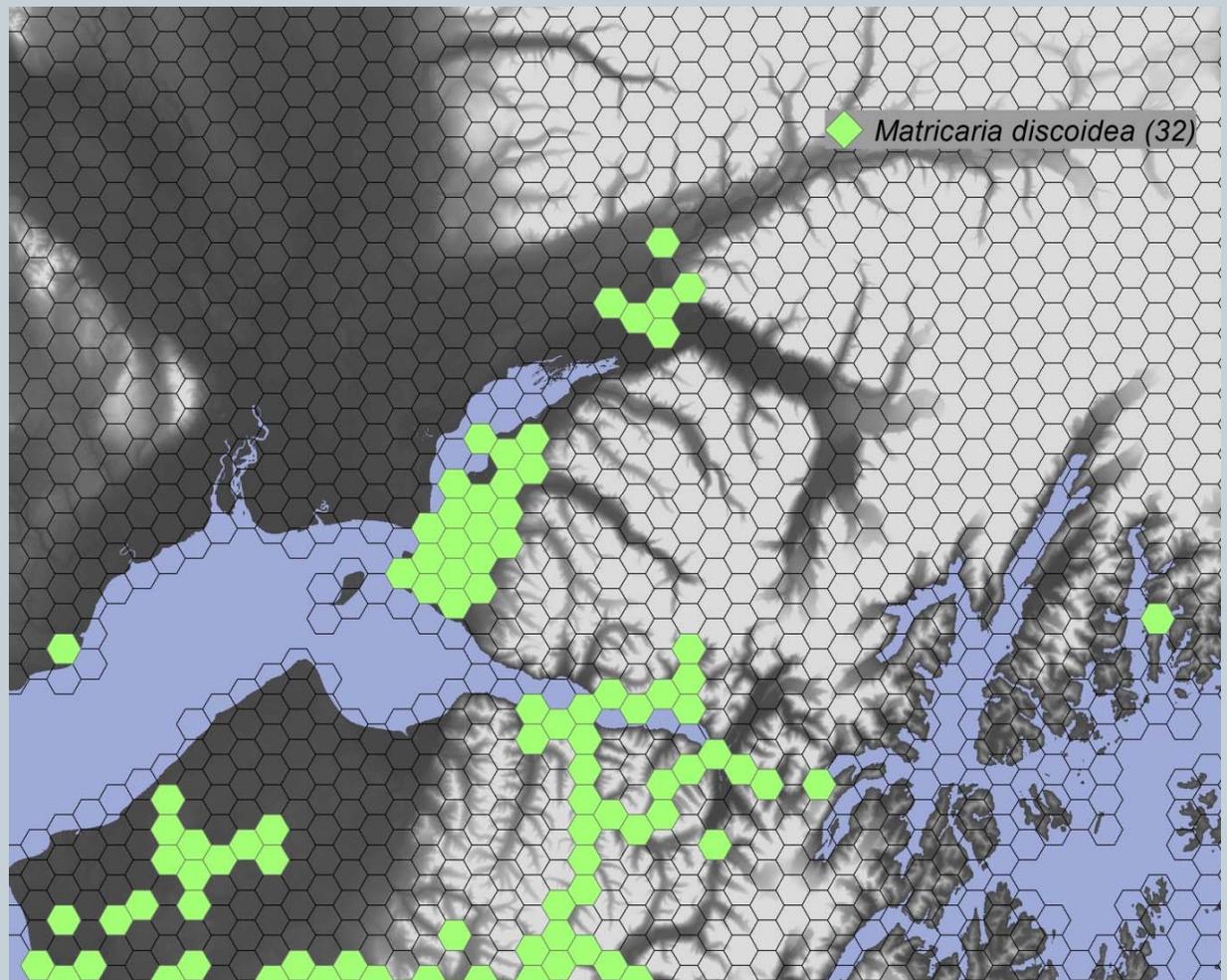
- *Prunus virginiana* chokecherry
- *Campanula rapunculoides* rampion bellflower
- *Sagina procumbens* birdeye pearlwort
- *Mycelis muralis* wall-lettuce
- *Hieracium caespitosum* meadow hawkweed
- *Hieracium murorum* wall hawkweed
- *Centaurea montana* perennial cornflower
- *Falliopia xbohemica* Bohemian knotweed
- *Alchemilla mollis* lady's mantle

BOTTOM TEN

- *Sinapis arvensis* charlock mustard
- *Phalaris canariensis* annual canarygrass
- *Papaver rhoeas* corn poppy
- *Amaranthus retroflexus* redroot amaranth
- *Sisymbrium altissimum* tall tumbled mustard
- *Plantago lanceolata* narrowleaf plantain
- *Neslia paniculata* ball mustard
- *Atriplex patula* spear saltbush
- *Agropyron cristatum* crested wheatgrass
- *Silene vulgaris* bladder campion

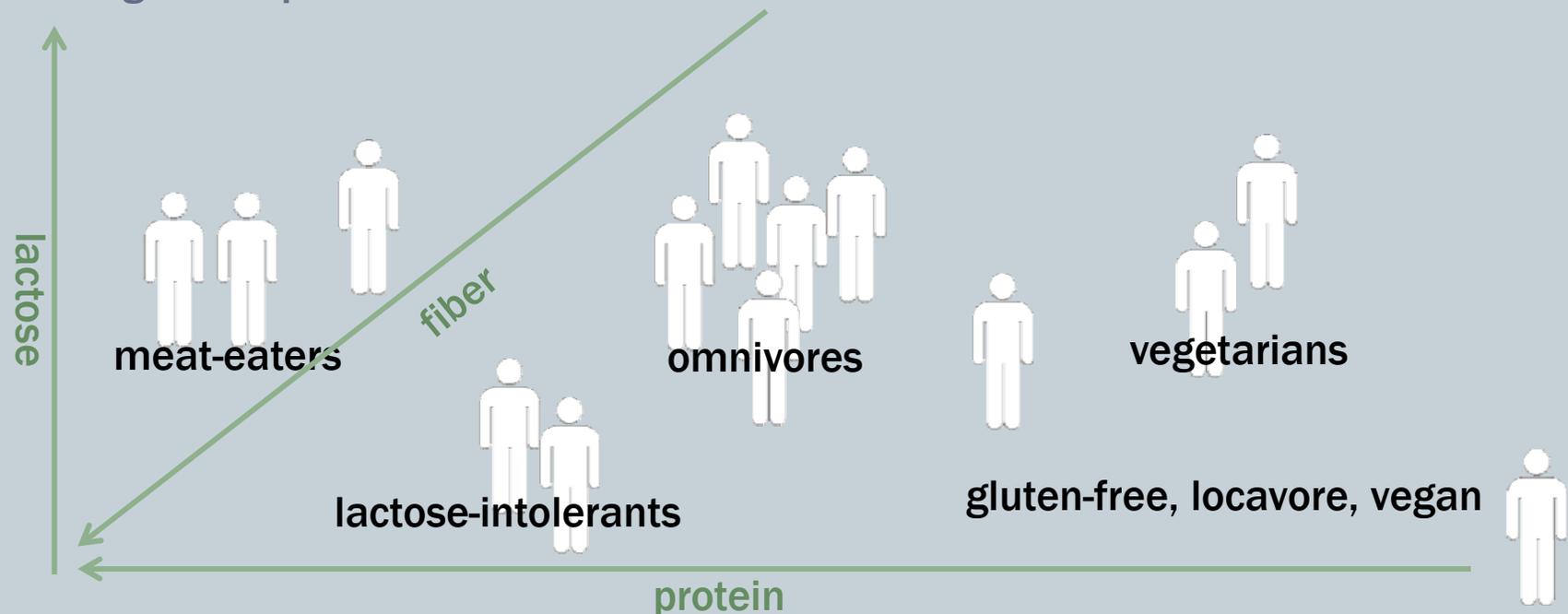
PRESENCE BY HEXAGON BINNING

- Why bin?
- Why hexagons?

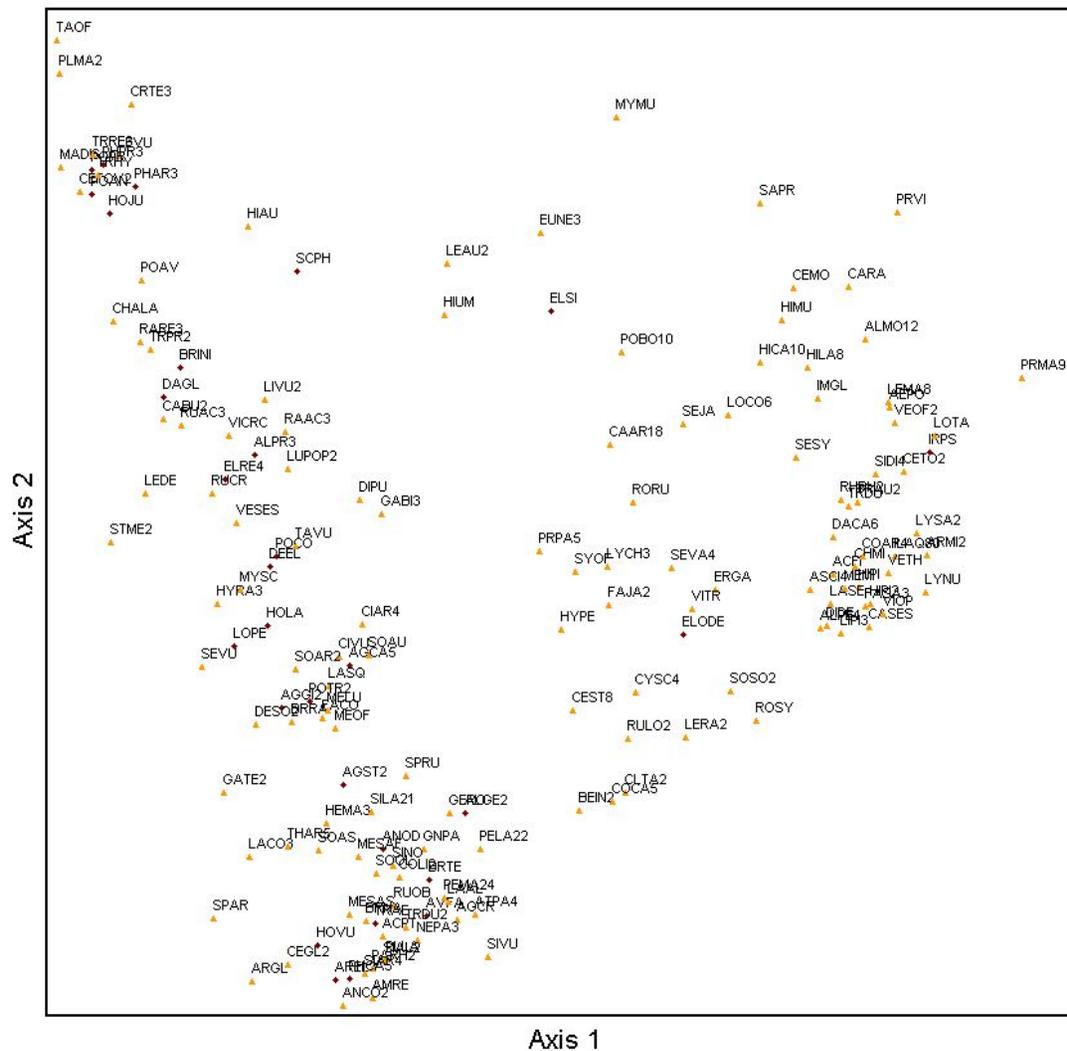


WHY MULTIVARIATE ORDINATION?

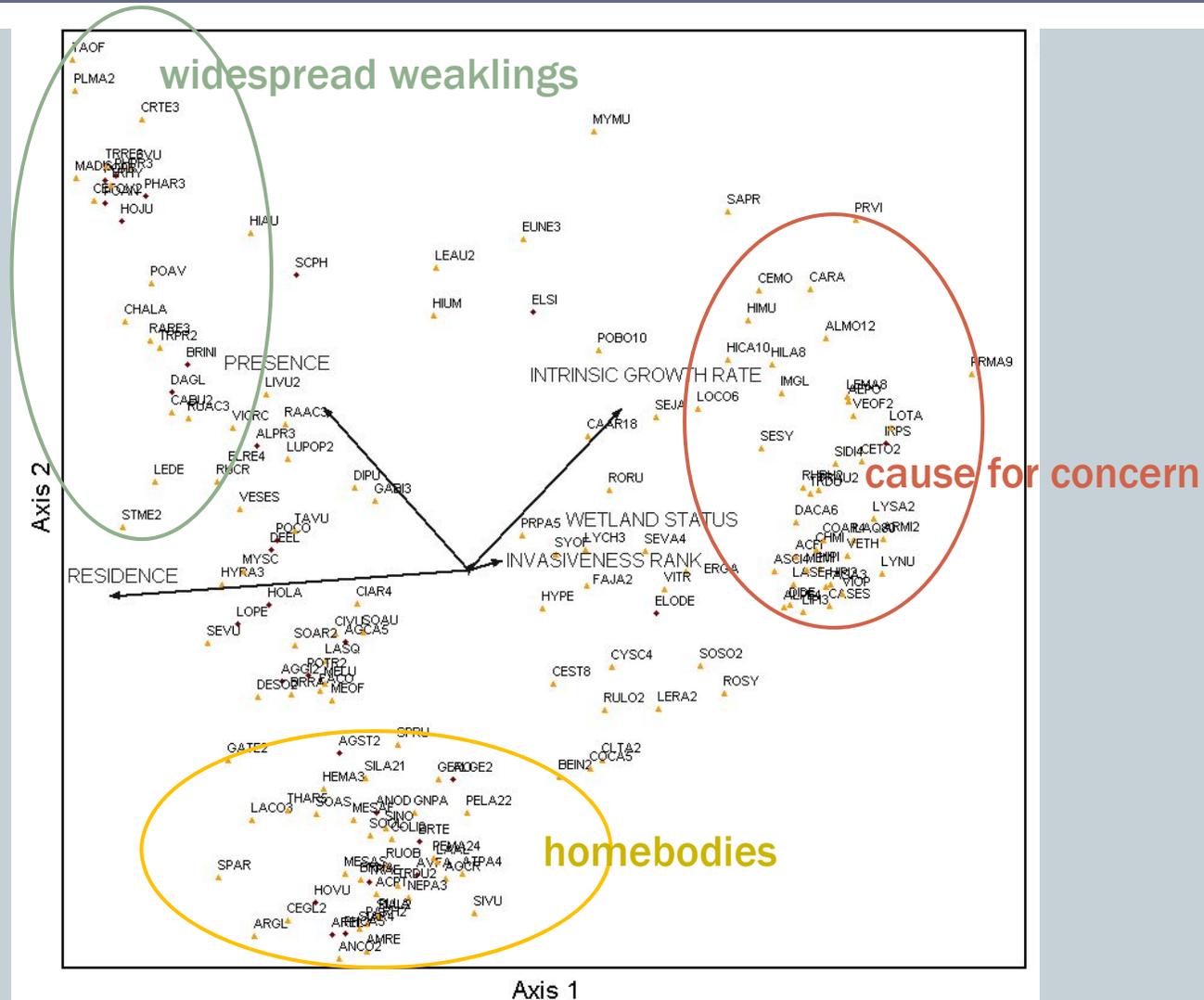
- Because the real world is messy!
 - Multiple, interdependent variables
- Ordination allows us to visualize sample units in three dimensional space
 - e.g. food preferences



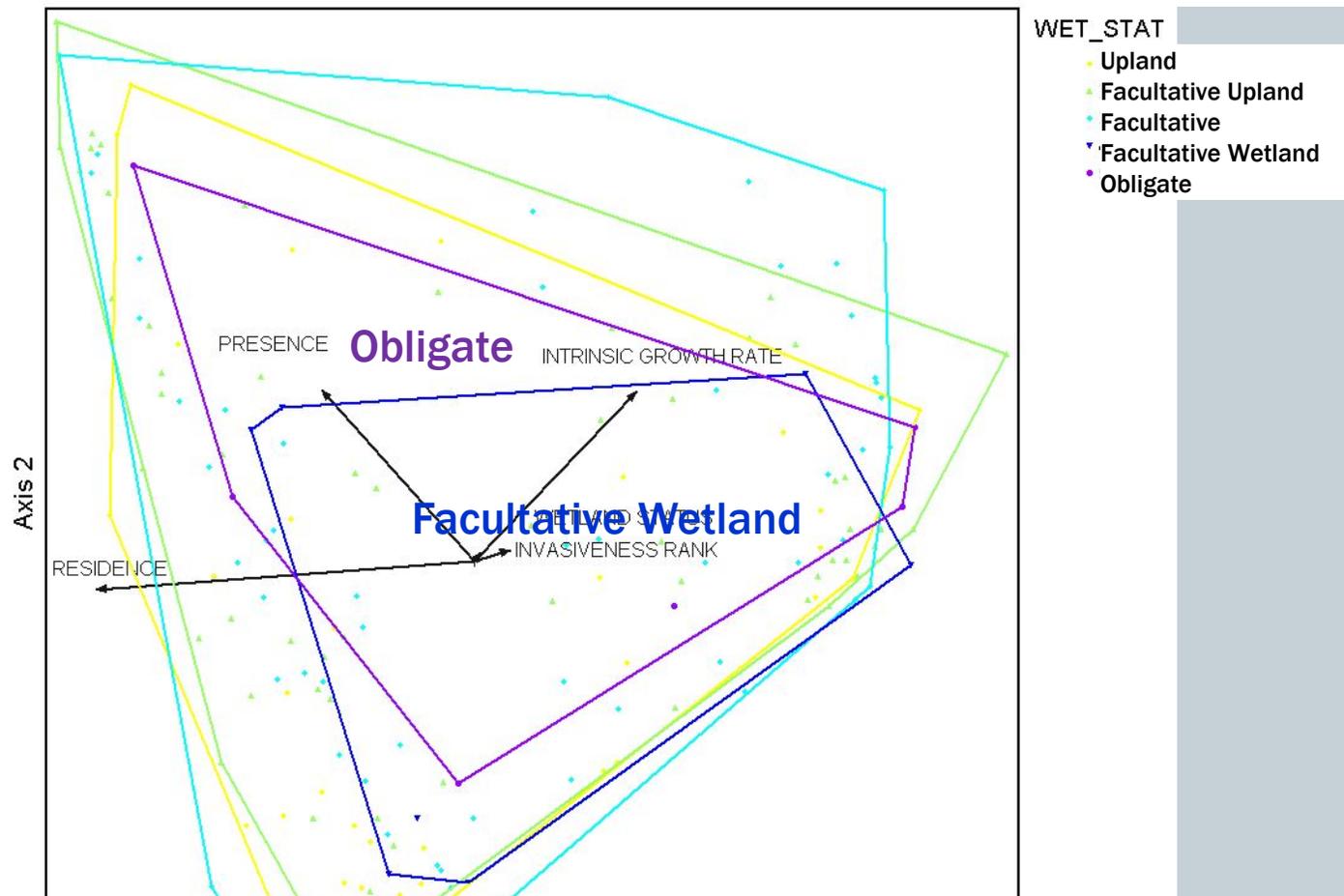
PRINCIPAL COMPONENT ANALYSIS



EXPLANATORY VARIABLES

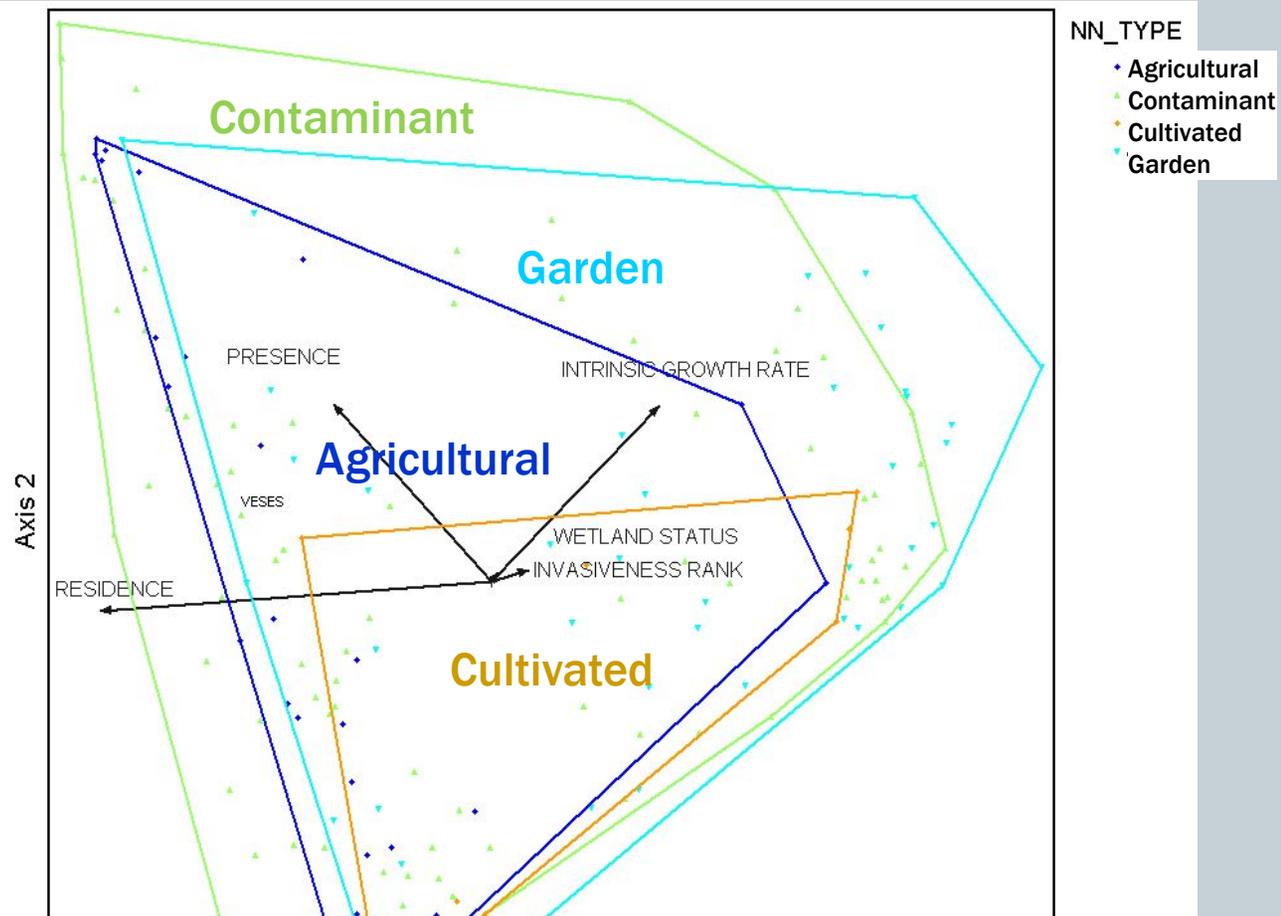


HABITAT PREFERENCE



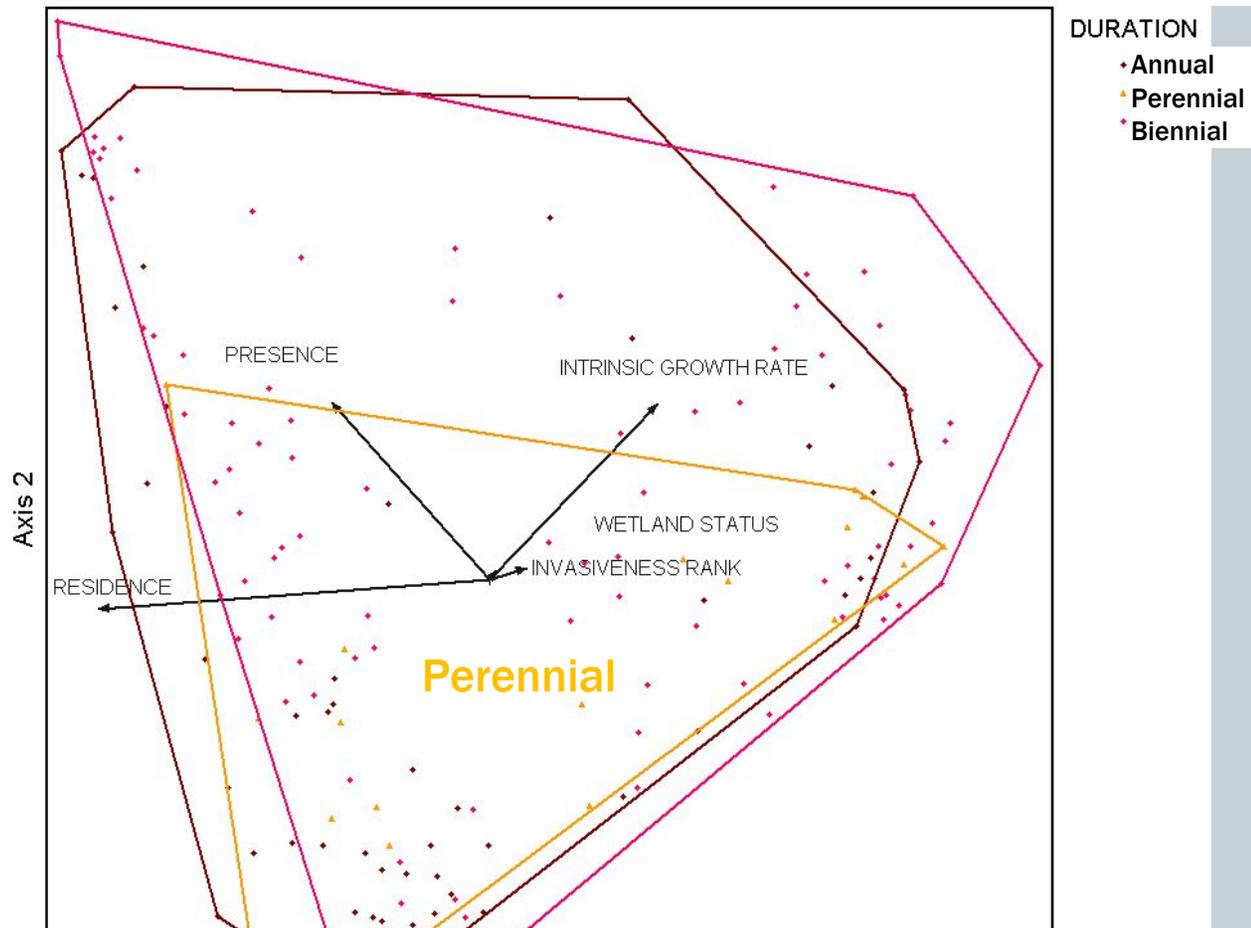
Intrinsic growth rate correlated to wetland specialization?

WEED TYPE



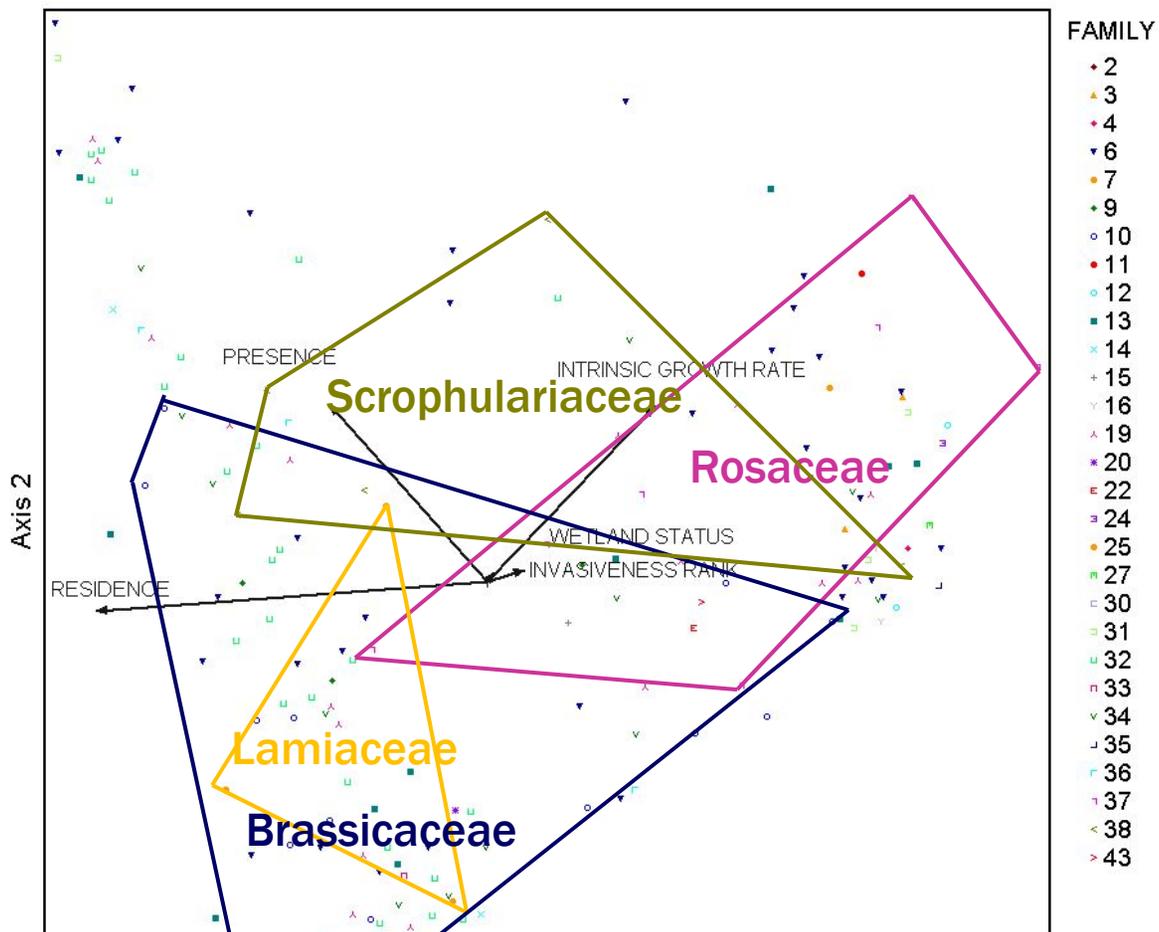
Intrinsic growth rate not strongly associated with cultivated or agricultural types?

LIFE CYCLE



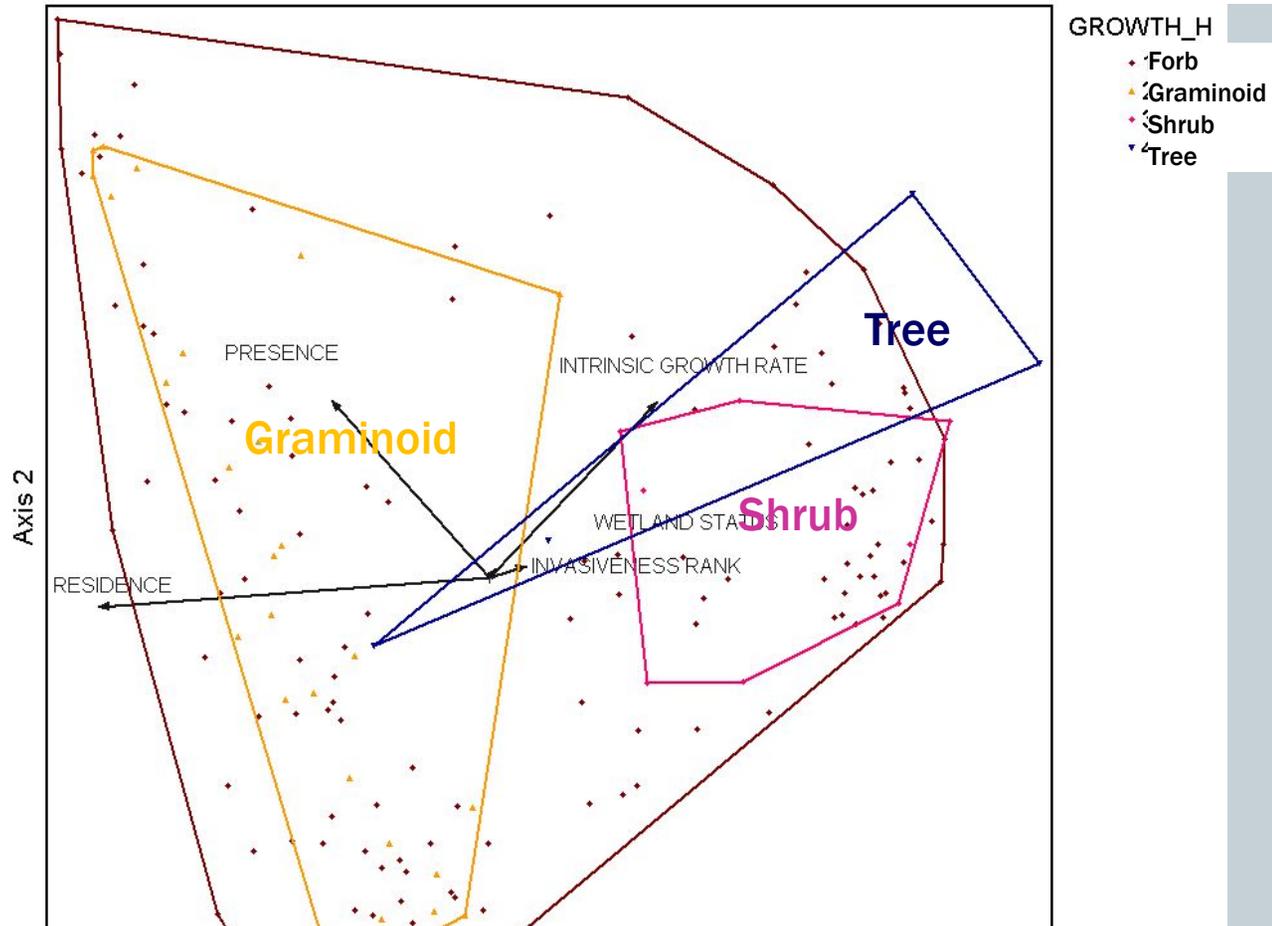
Intrinsic growth rate not promoted by perennial life cycle?

FAMILY



Intrinsic growth rate promoted by family membership?

GROWTH HABIT



Intrinsic growth rate promoted by woodiness?

TAKE HOME MESSAGES

So, what are the (potential) characteristics of our most rapidly expanding non-native species?

- Not agricultural species
- Not characterized by a perennial life cycle
- membership to the Rosaceae family
- woodiness
- unaccounted for variables

What is invasiveness?

invasiveness = expansion + impact

IDEAS? QUESTIONS?

