Fireweed

Orange hawkweed

The Spread of Invasive Exotic Plants in Alaska

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Introduction-1

- Botanizing in AK for the last 100 years. First comprehensive flora done in 1941
- 1968 Major update with ‘dot maps’
- Online UAF Herbarium now available
- AK Exotic Plant Information Clearinghouse (patterned after SWEPIC)

  state-wide database now with >37,000 records

Fall dandelion

Introduction-2

- Pathways Ag/Hort/equip from lower 48
- Agriculture –slow start in AK. Palmer Colony after WWII
- Slow increase in exotic species, but many taken care of by growers i.e. Canada thistle in Palmer in 1943
- Horticulture –gardening much more popular in last 30 yrs

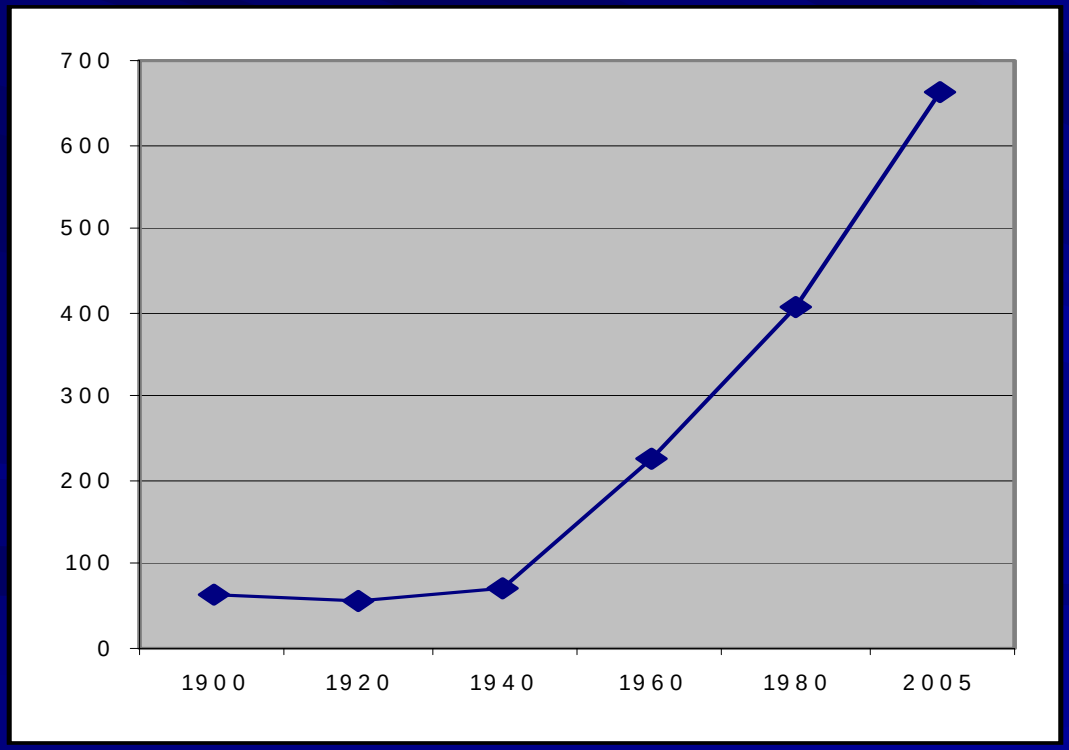
- No weed regulations in Alaska

(except weed seed regs to protect Ag producers)

Bill passed the state house last year that would have added O. hawkweed and P. loosestrife

Hieracium umbellatum

- Population growth in AK really taken off in last four decades
- Concomitant increase in roads (logging, oil, housing etc)
- Increase in exotic plant introductions into AK



Purple loosestrife in a Creek in Anchorage

Introduction–3

- Alaska immune from exotic species invasion?
  - Non-native plants are established to the Arctic Ocean and even in the High Arctic (78ºN) 8-25% of the flora is introduced!
- What is unique in Alaska is that these species have yet to severely alter communities and ecosystem function
- Therefore, it is critical to understand the process and state of the invasion

Introduction–4

- Primary Questions:

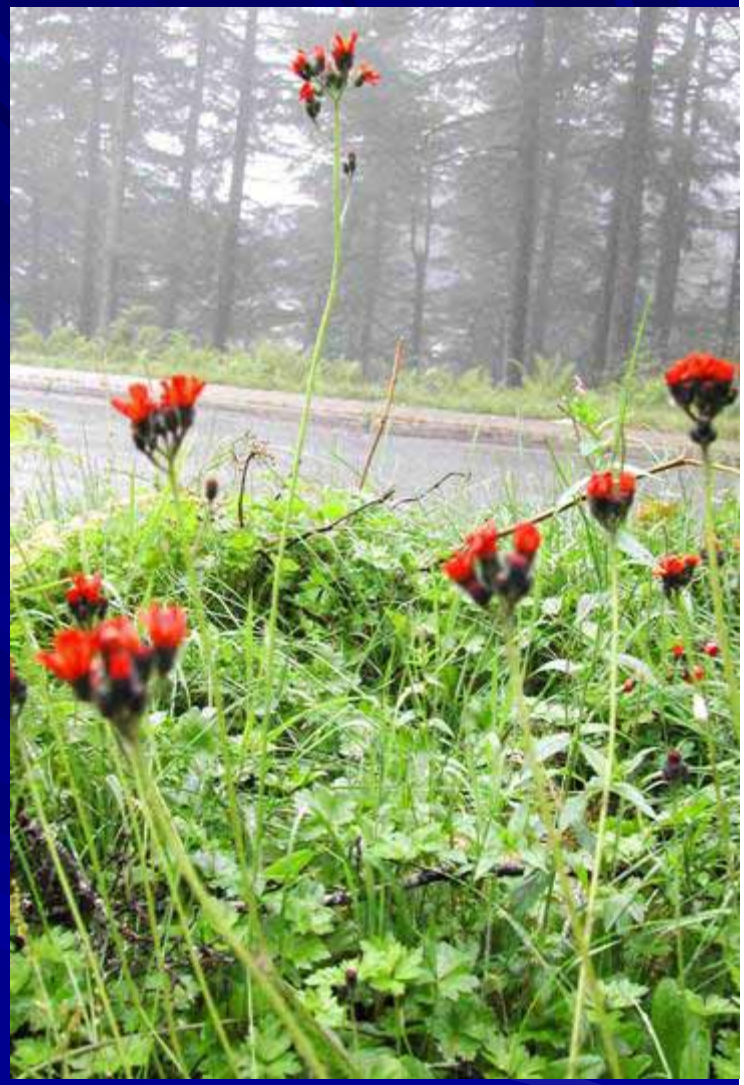
1. What are the basic patterns of exotic plant establishment in Alaska (temporally and spatially)?
   (How does this compare with PNW states?)
2. Have most species been established for a long time?
3. Are all exotics expanding rapidly?
4. Where are they expanding?
5. And why?

White sweetclover on the Stikine River in SE Alaska

Methods

- Use the location information from Hulten 1941, 1968, and ALA database
- One of key features is that Hulten reports on all species collected including all weed species
- Use the location information from the AKEPIC database

Inventory data – filtered through 25 mile grid to make it comparable with herbarium records

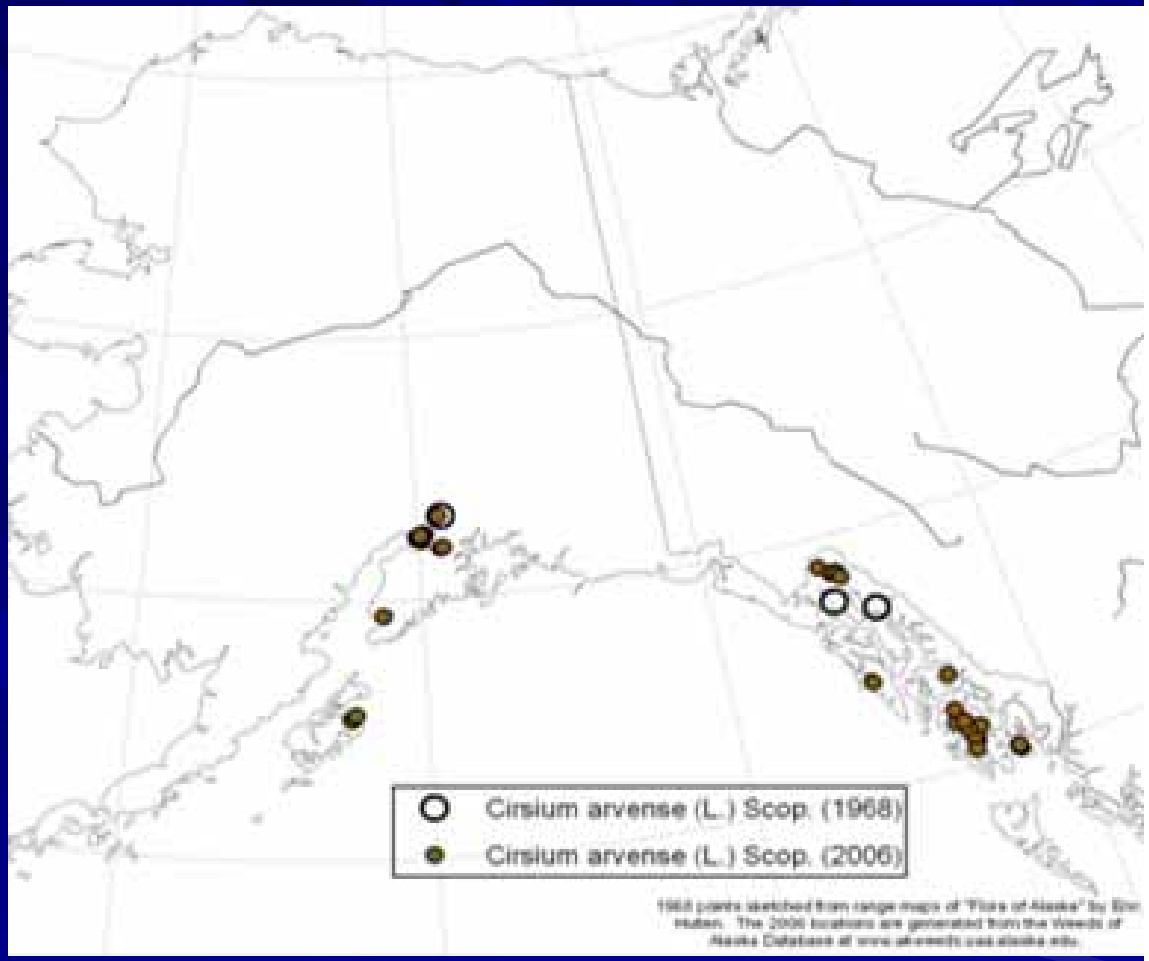


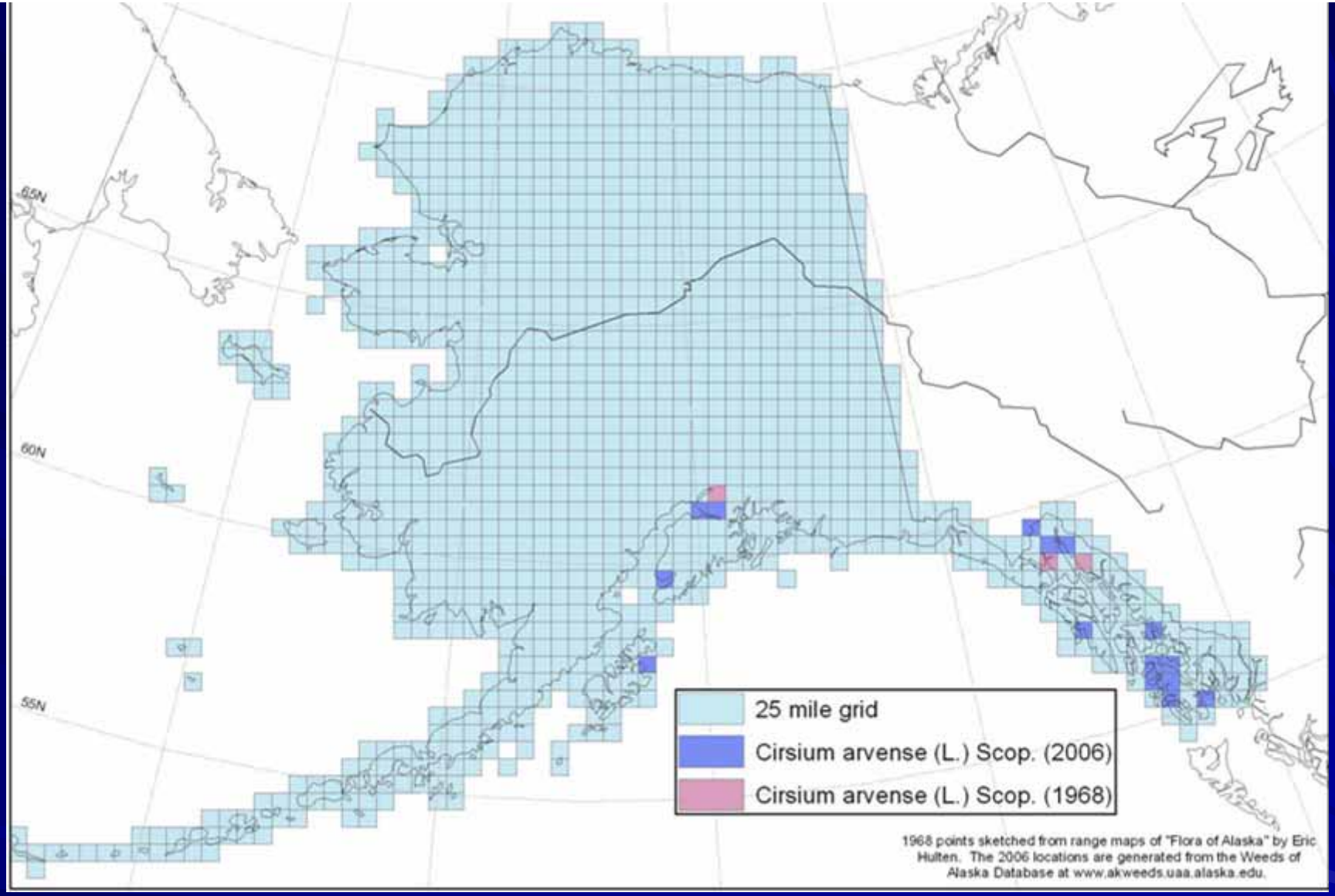
Orange Hawkweed in Juneau, AK

Methods-2

- For example

209 current points for *Cirsium arvense* within AKEPIC, but most are from Anchorage and Haines, so filtered there are 16 sites – which are then comparable with herbarium data.



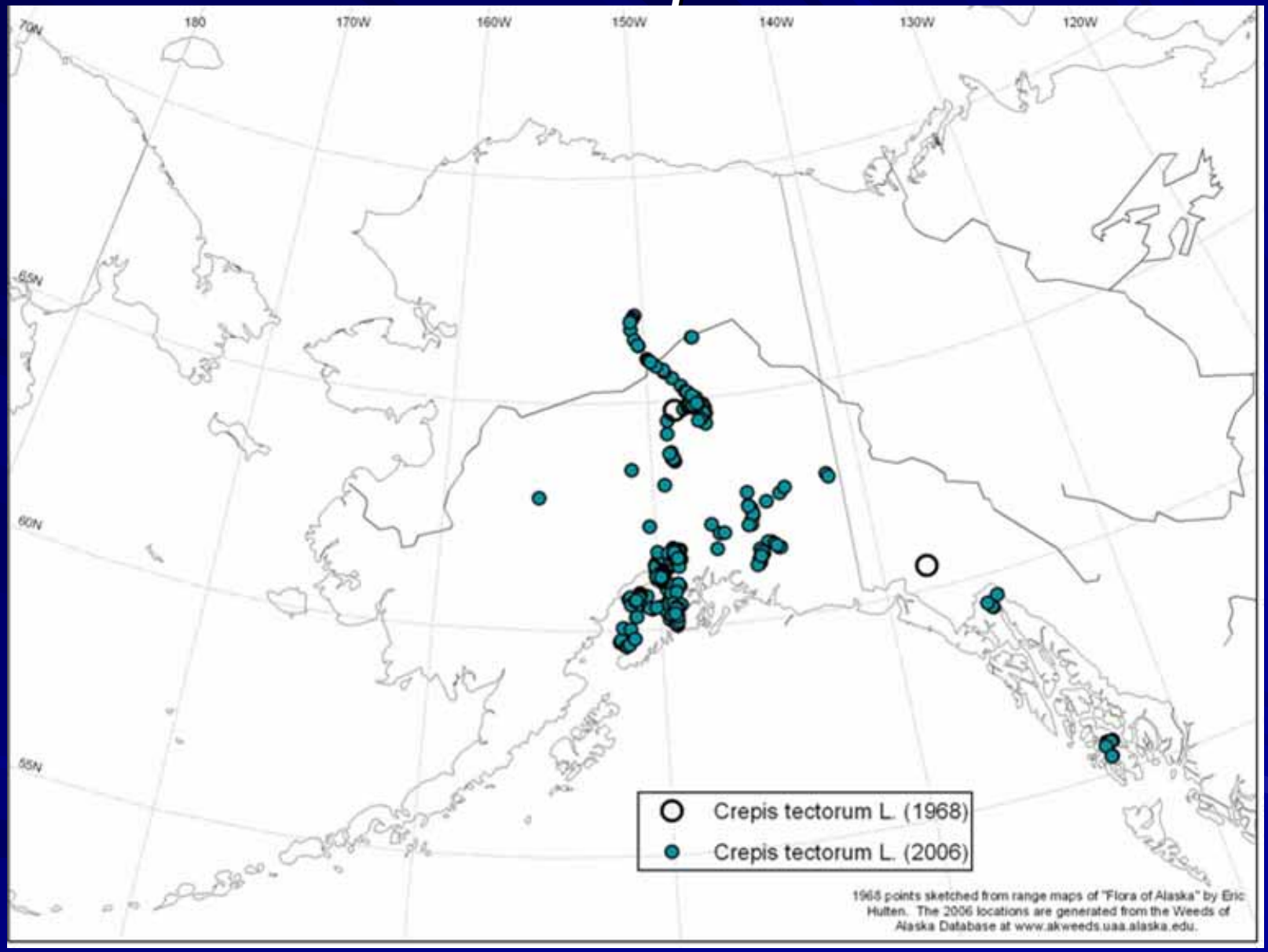

65N
60N
55N
25 mile grid
Cirsium arvense (L.) Scop. (2006)
Cirsium arvense (L.) Scop. (1968)
1968 points sketched from range maps of "Flora of Alaska" by Eric Hulten. The 2006 locations are generated from the Weeds of Alaska Database at www.akweeds.uaa.alaska.edu.

- Examine 15 exotic and native species pairs
- Look at the spatial and temporal patterns of 36 exotic plant taxa

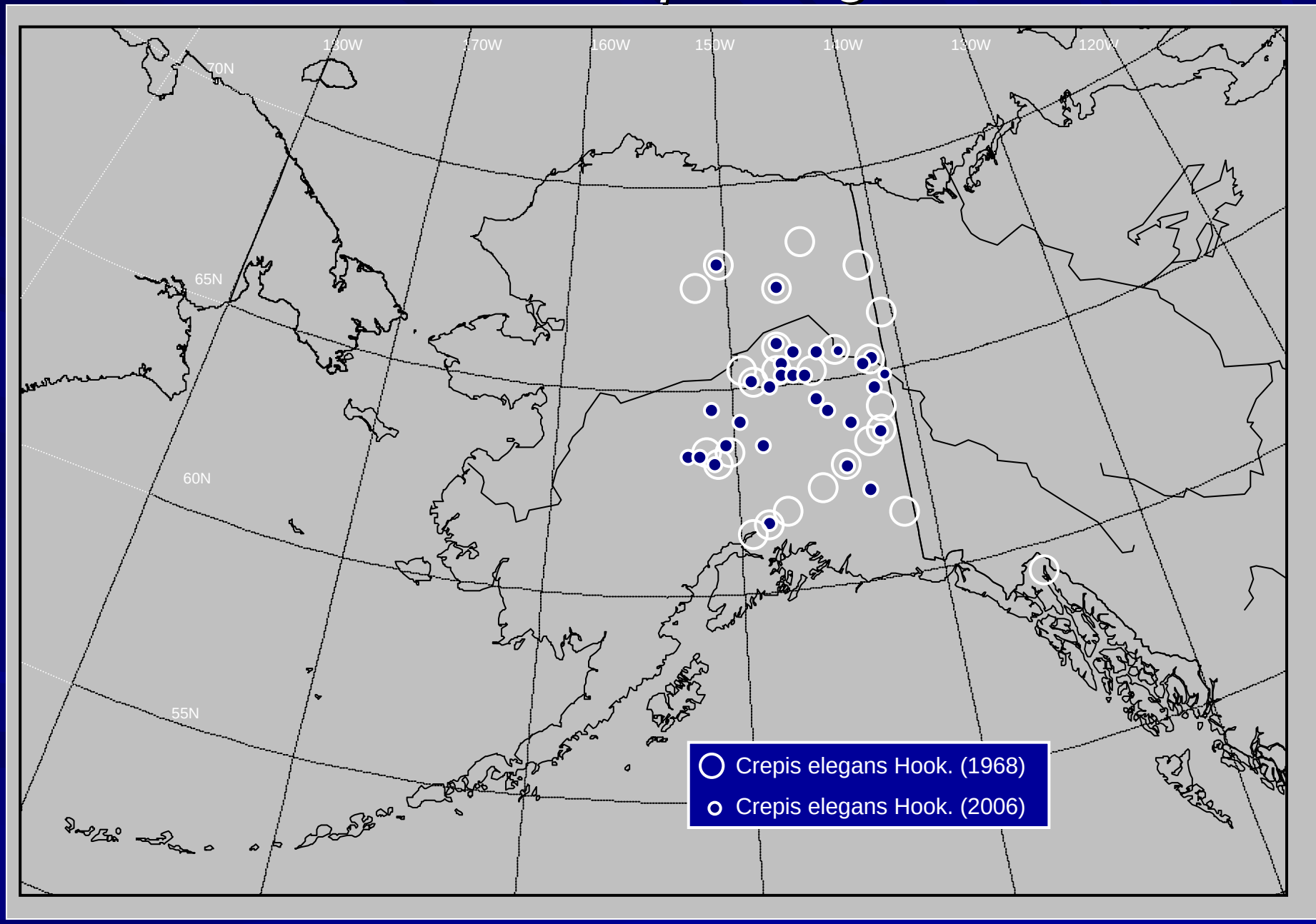
Compare 15 different native and exotic taxa

- Paired species: exotic and closest native relative (phylogenetically and ecogeographically) to control for collection effort
- Have exotic species been collected at the same rate as native species, or is there an increase in the establishment and spread of exotic species in AK resulting in a greater number of collections.

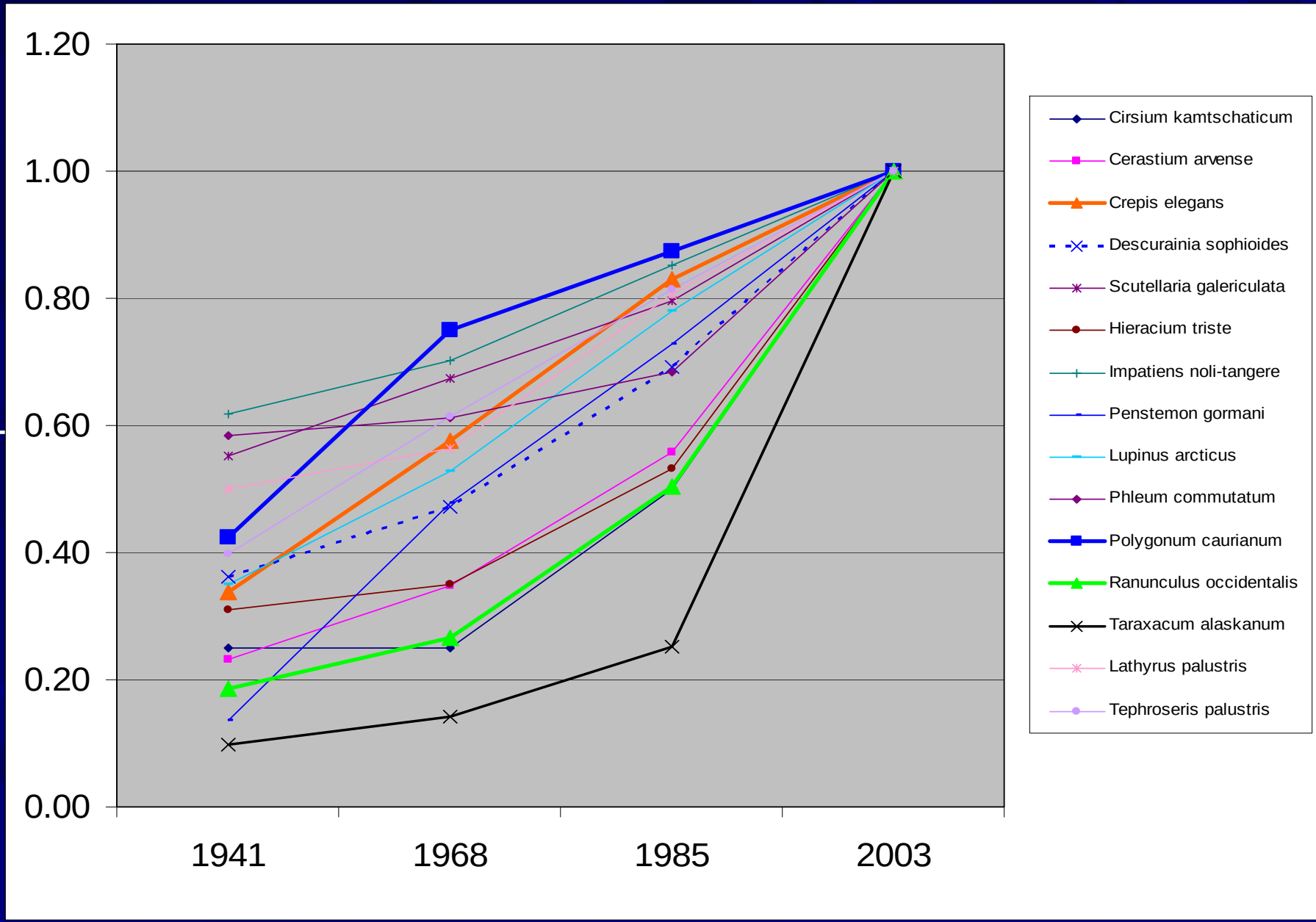
Exotic – Crepis tectorum



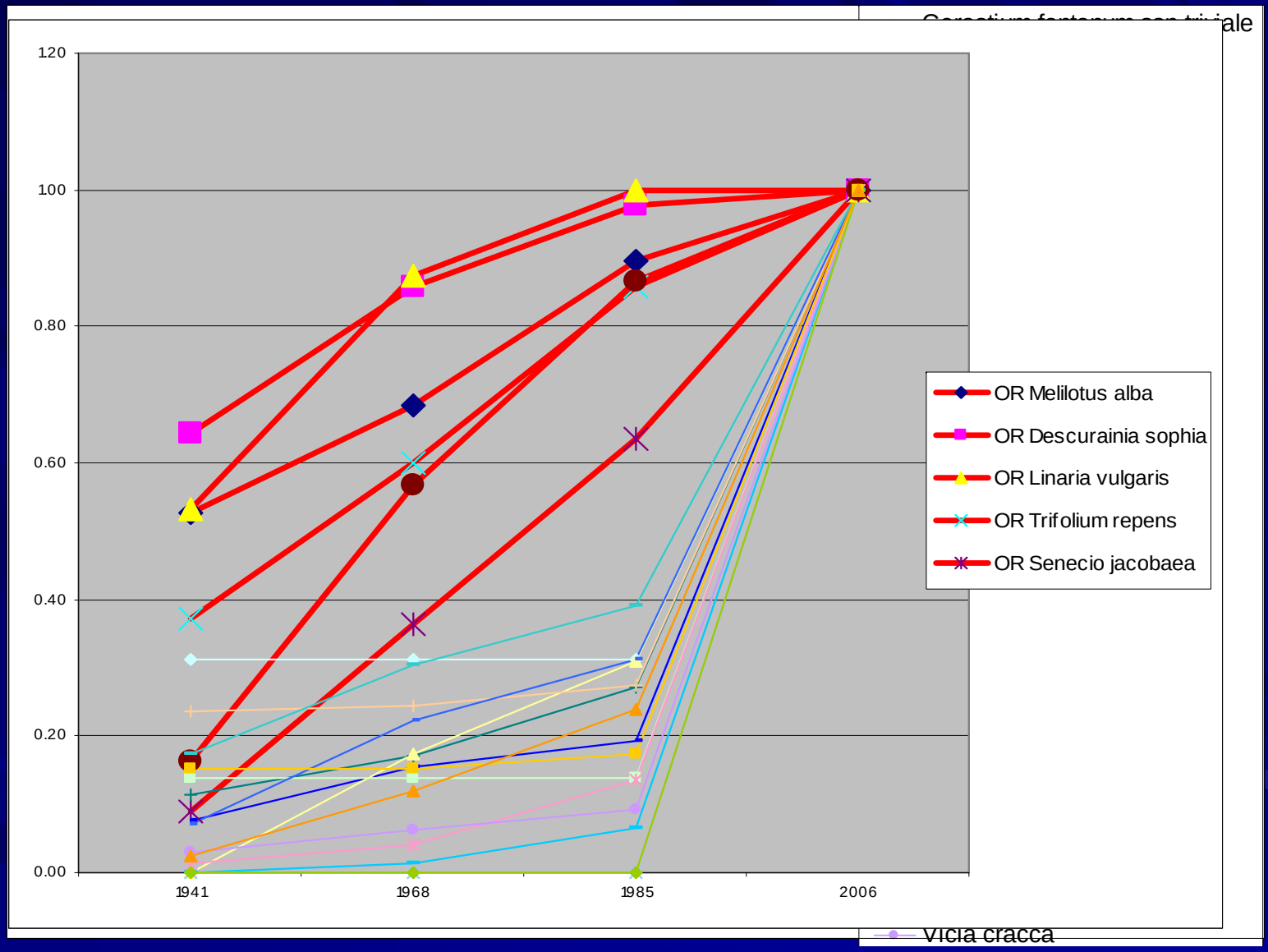
Native – Crepis elegans



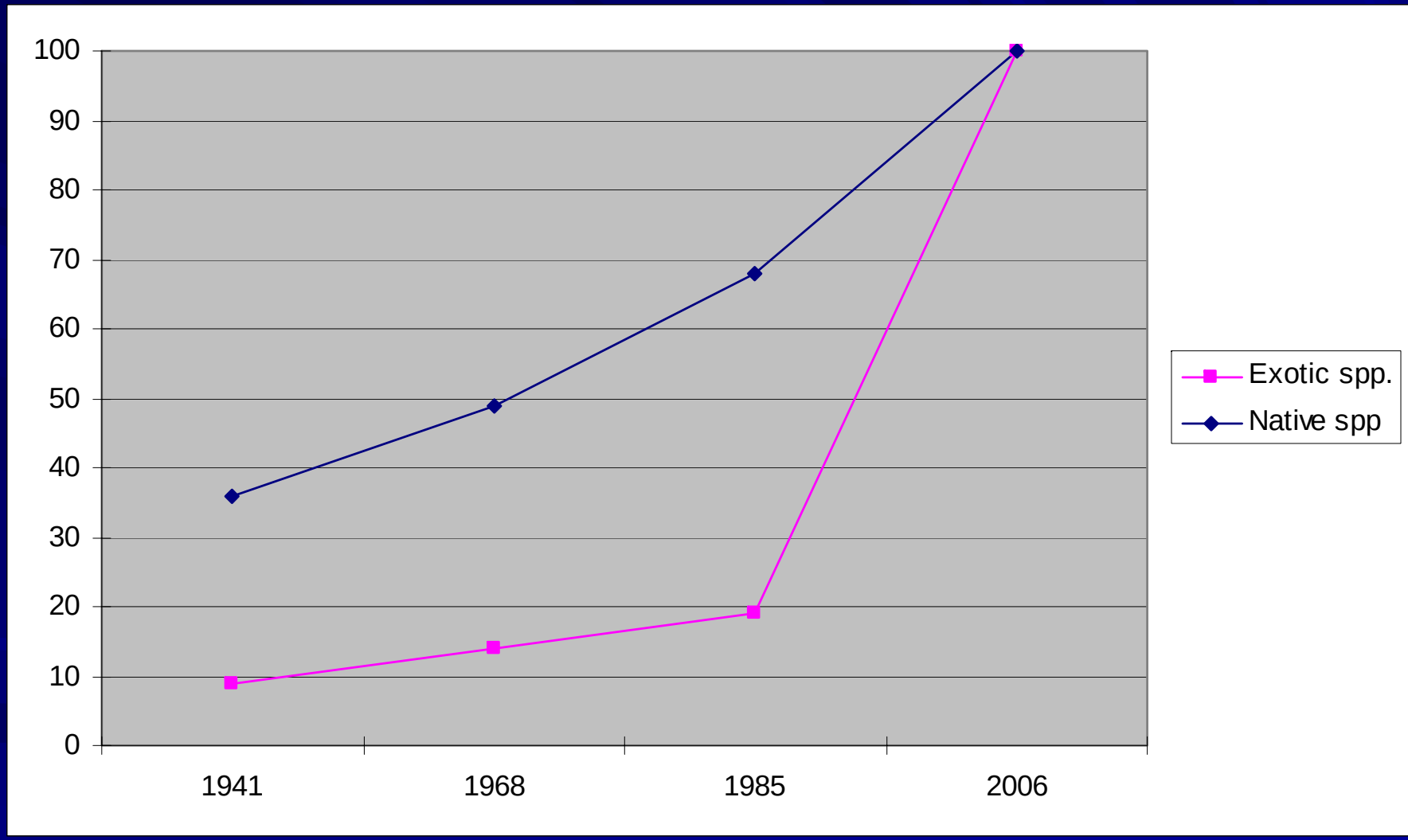
15 native taxa



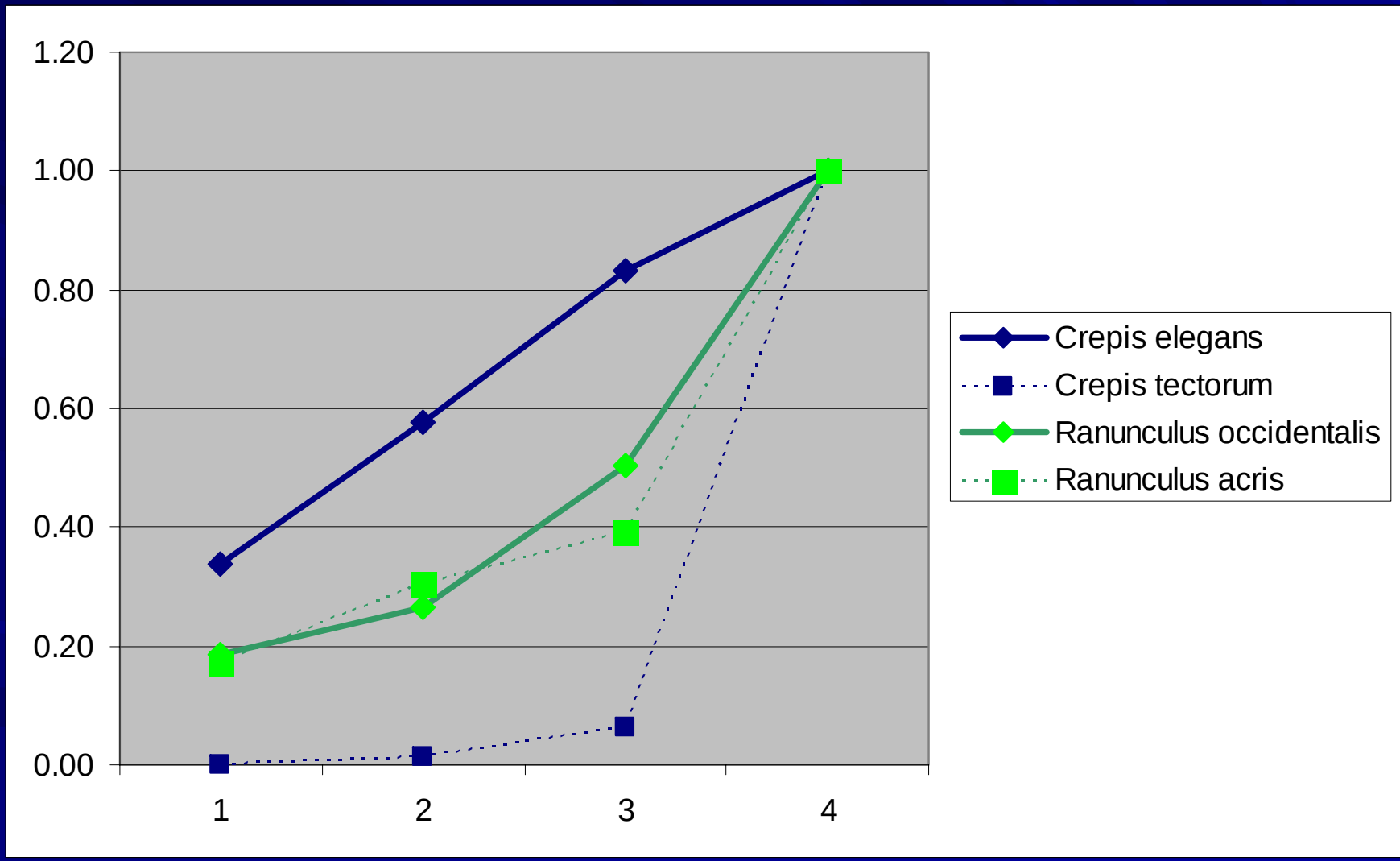
15 paired exotic taxa & AK vs. OR

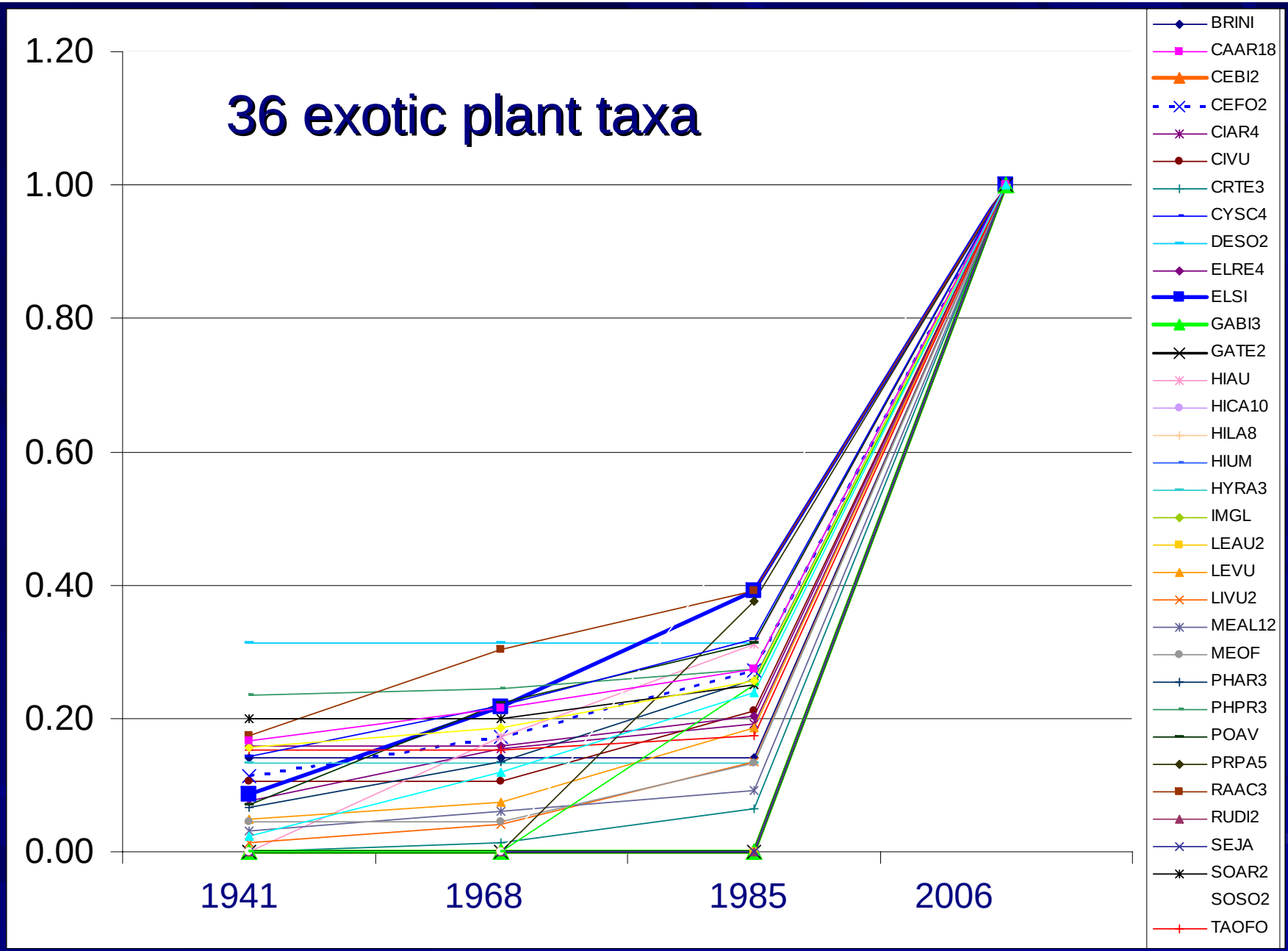


Average proportion of native vs. exotic species collected



-For the 15 species pairs only the *Ranuculus* pair mirror each other.
-Most exotic spp of pair are more similar to *Crepis*
-Why is *Ranunculus* doing something different than *Crepis*?

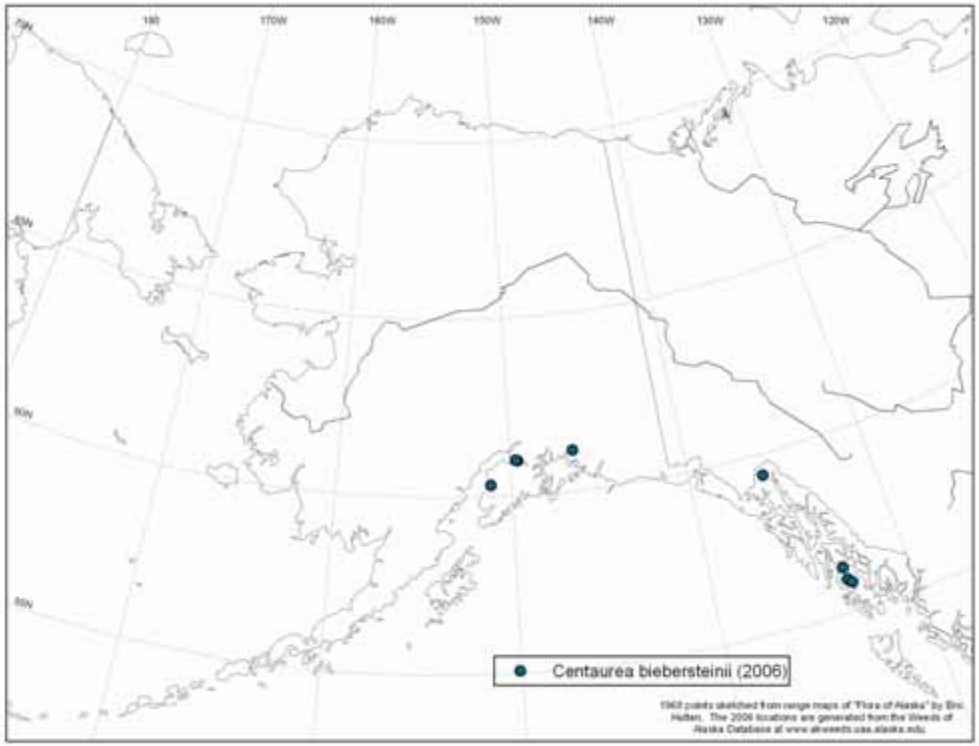



36 exotic plant taxa
1.20
1.00
0.80
0.60
0.40
0.20
0.00
1941
1968
1985
2006
BRINI
CAAR18
CEBI2
CEFO2
CIAR4
CIVU
CRTE3
CYSC4
DESO2
ELRE4
ELSI
GABI3
GATE2
HIAU
HICA10
HILA8
HIUM
HYRA3
IMGL
LEAU2
LEVU
LIVU2
MEAL12
MEOF
PHAR3
PHPR3
POAV
PRPA5
RAAC3
RUDI2
SEJA
SOAR2
SOSO2
TAOFO

- 36 exotic plant taxa examined

- Several different categories
  - New invaders [1/3 of these spp. have only been collected since 1985]
  - Common disturbed site spp – infilling
  - Those initially given helping hand, now becoming visual dominants
  - Those that went through a ‘lag’ phase

New Invaders

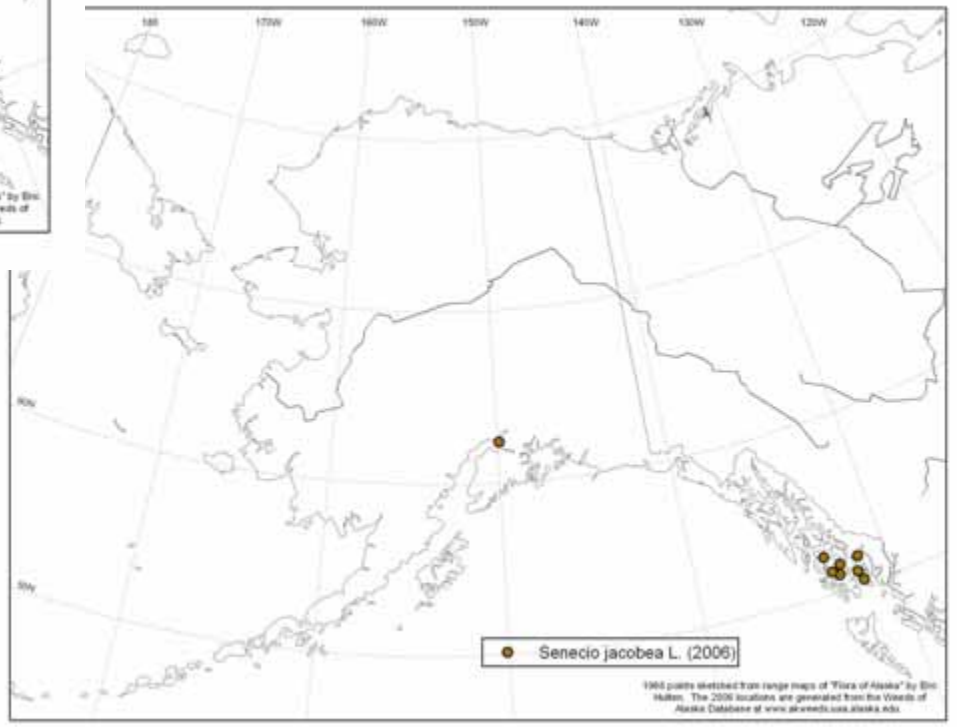


Centaurea biebersteinii

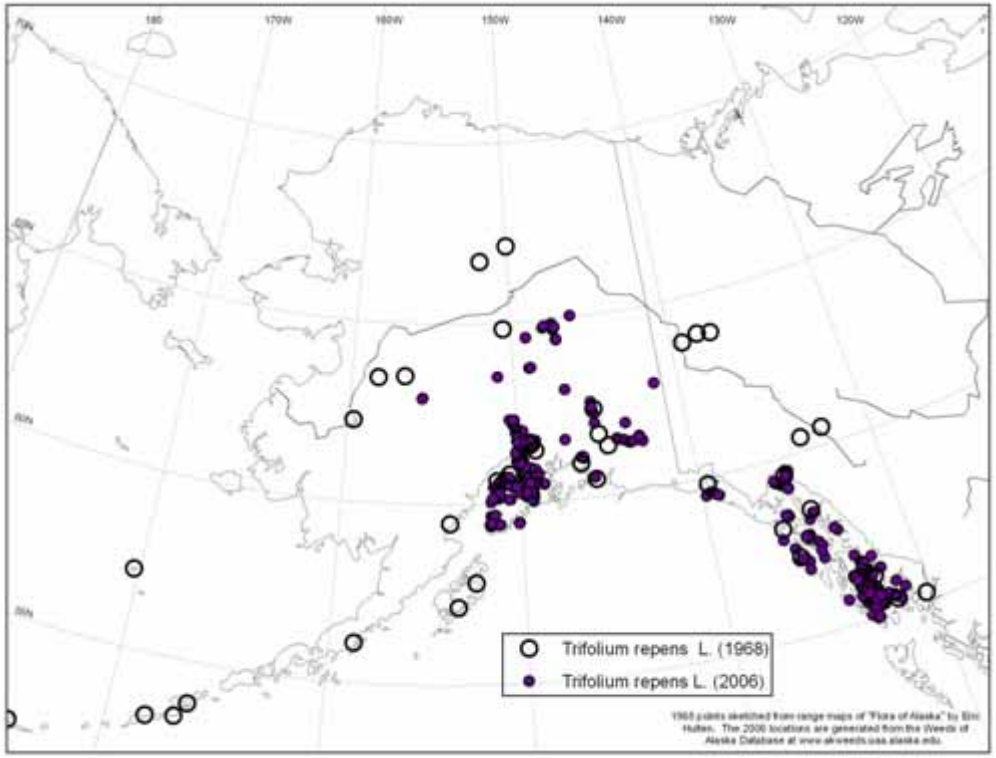
Other new invaders include:

Hieracium caespitosum
Hieracium lachenalii
Impatiens glandulifera
Leontodon autumnalis

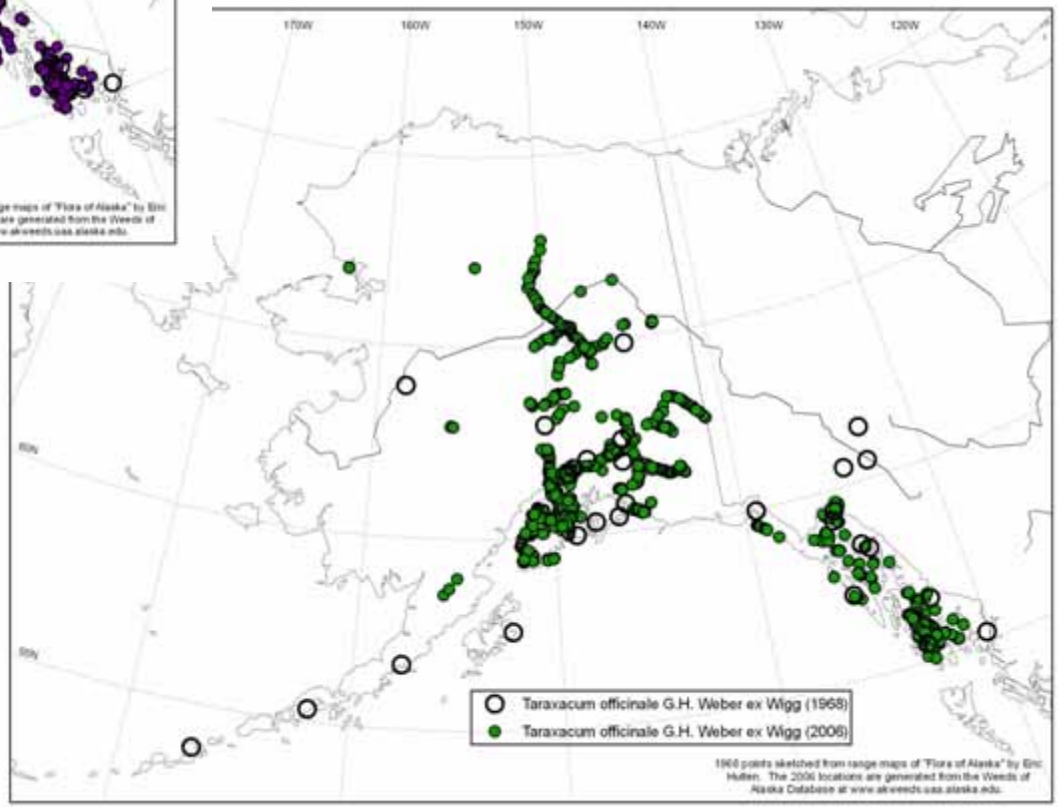
Senecio jacobaea



Common exotics - infilling



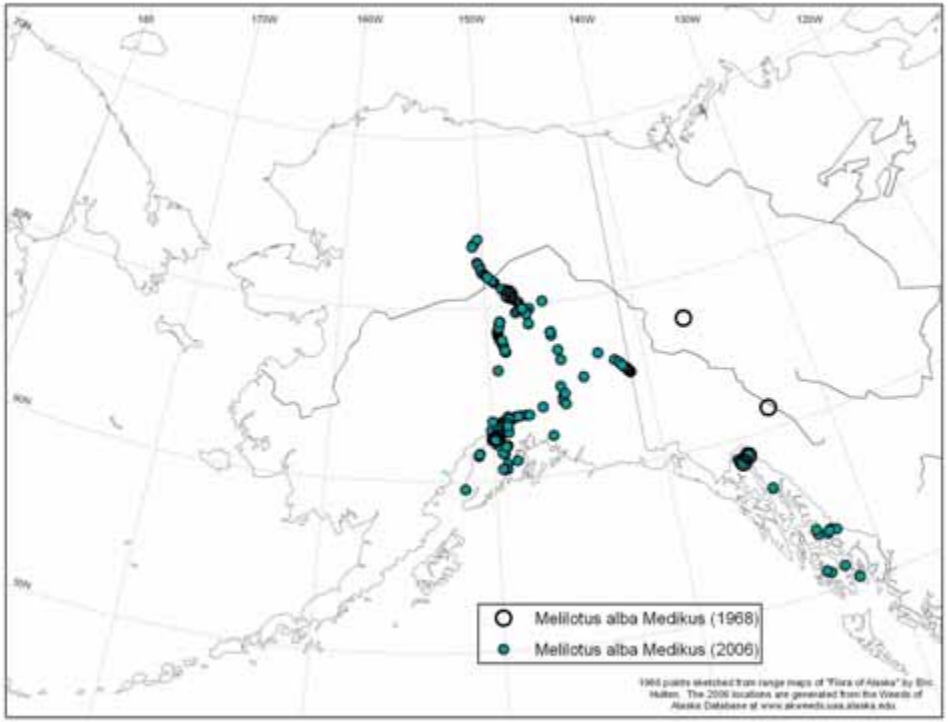
Taraxacum officinale



Trifolium repens

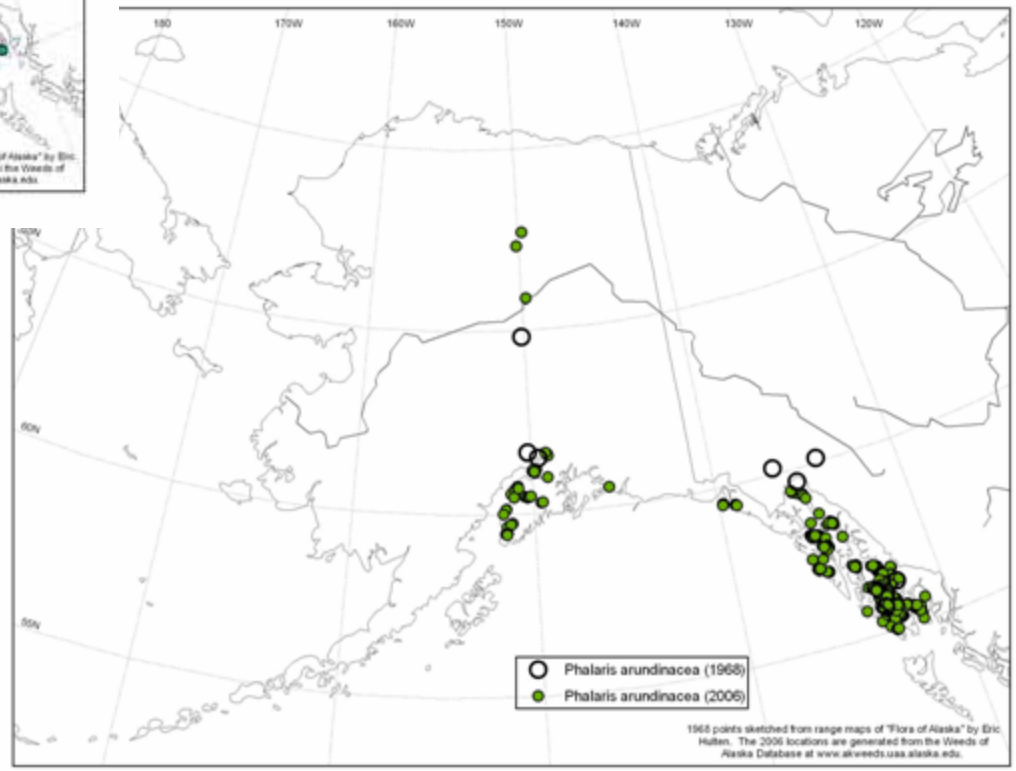
Others:

- Polygonum aviculare
- Phleum pratense
- Trifolium hybridum



Exotic visual dominants – now rapidly expanding

Phalaris arundinacea



Melilotus alba

Used for:

Agricultural plant (green fertilizer & Forage)

- White sweetclover
- Bird vetch

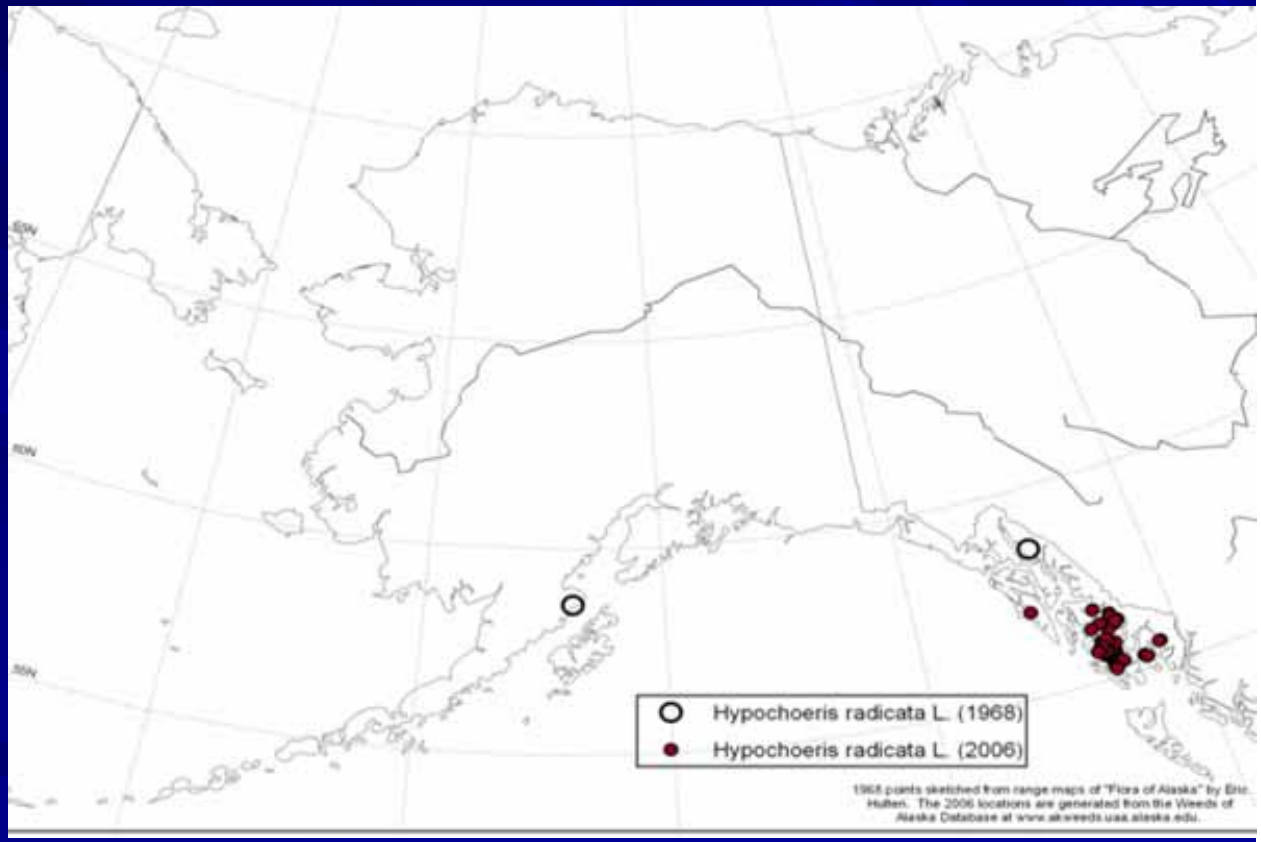
Erosion control

- Reed canarygrass

‘Lag’ phase species

Hypochaeris radicata

-recorded in Hulten 1941 but not again until the last few years. Now dominates roadsides on Prince of Wales Island



Done with
‘Lag phase”
Now exploding ??

Sonchus arvensis
Also displays same pattern

Conclusions

- Primary Questions:

1. What are the basic patterns -Temporal View

Obviously many species are at early establishment and exponential growth phases – contrasts sharply with preliminary OSU herbarium data for the same species

Others seem to have gone through a lag period and are now expanding rapidly

However, some have been around for a long time and don't seem to be increasing (no diff from natives)

Ranunculs acris and Descurainia sophia

why are they doing what they're doing????

Stochastic nature of establishment and survival (disturbed area large enough? Too much competition with other spp?)

Conclusions

- Primary Questions:

1. What are the basic patterns

Spatial patterns indicate, most of the increase in these species is in SE Alaska and South-Central and where Hulten first found them

- Ecologically adapted species from PNW = most common route? Collection intensity??

- Human density is not that high in SE (however, it was relatively high compared to other regions in the past)

– Road building in the last 50 years due to logging is extensive

- some species are interior adapted and expanding rapidly

- Range-filling by others (e.g., *Trifolium*)

- Hard to know what is going on off of the road system

Conclusions

- Primary Questions:

1. What are the basic patterns

   Variation among exotic spp establishment

Have most species been established for a long time?

-Many species are very new invaders into the state

-Not all have followed the same expansion pattern. Some appear to explode upon arrival other appear to display ‘lag phase’ others show no explosive growth to date.

-Most species are found along roadsides and other human disturbed sites to date.

-only a few are now invading native plant communities:

M. alba (glacial rivers), *P. arundinacea* (wetlands), *Hieracium aurantiacum* (forb meadows), and *Sonchus arvensis* (beach meadows)

It is critical to understand the process and state of the invasion and alert the public and decision makers that significant ecological changes will begin shortly unless eradication and control actions begin now.