GardenWise: Invasive Plants Jump the Garden Gate

Sarah Reichard

University of Washington Botanic Gardens

reichard@u.washington.edu

Outline

- Sample impacts
- Pathways of introduction
- Biology and risk assessments
- Propagule pressure
- Lag phase
- Proposed new noxious weed species
- Appropriate disposal
- The human element and voluntary efforts to reduce spread

Invasive Species Defined

"Invasive non-native species are those that can or have spread into native wilderness or managed ecosystems, develop self-sustaining populations, and become dominant or disruptive to those systems"

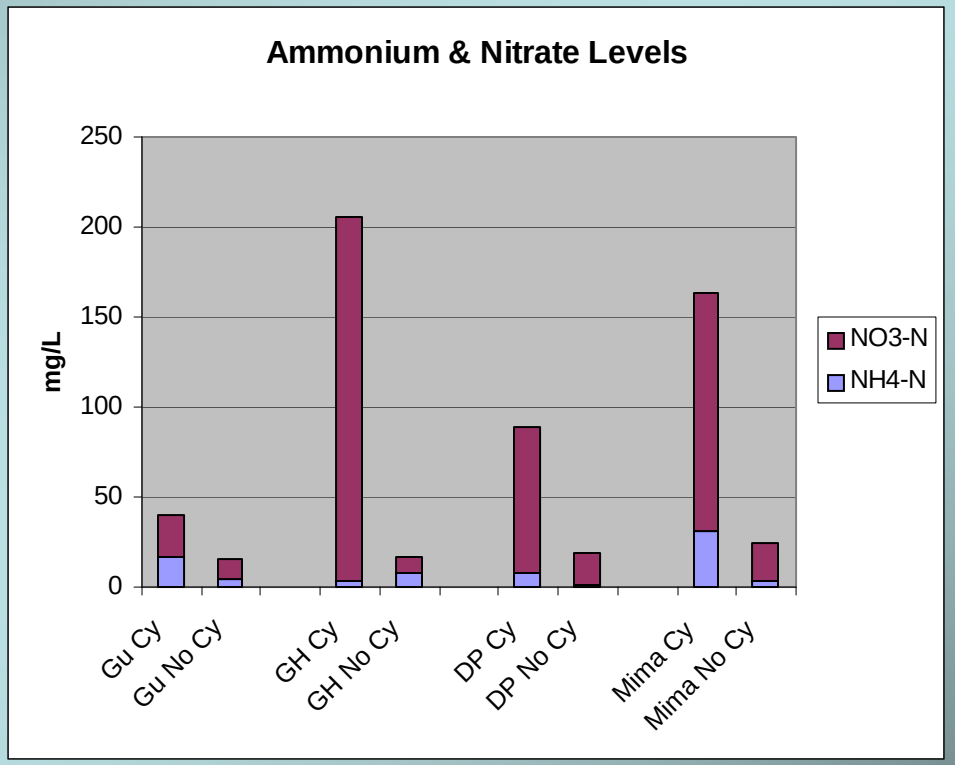
What Do Invasive Species Do?

- Competition for resources –water, light, pollinators, seed dispersers, etc.

What Do Invasive Plants Do?

•Change ecosystem properties – Nitrogen fixation

Cystisus scoparius



Ulex europaeus – total soil N increased and pH decreased in older stands – Scott 2005

Dougherty and Reichard 2004

What Do Invasive Species Do? Changes in Nutrient Flow

- Knotweeds
- Replaces native riparian forest
- Reduces litter input by 70%
- Translocates nitrogen to rhizomes efficiently – 75% vs. 5 (alder)-33 (willow)%

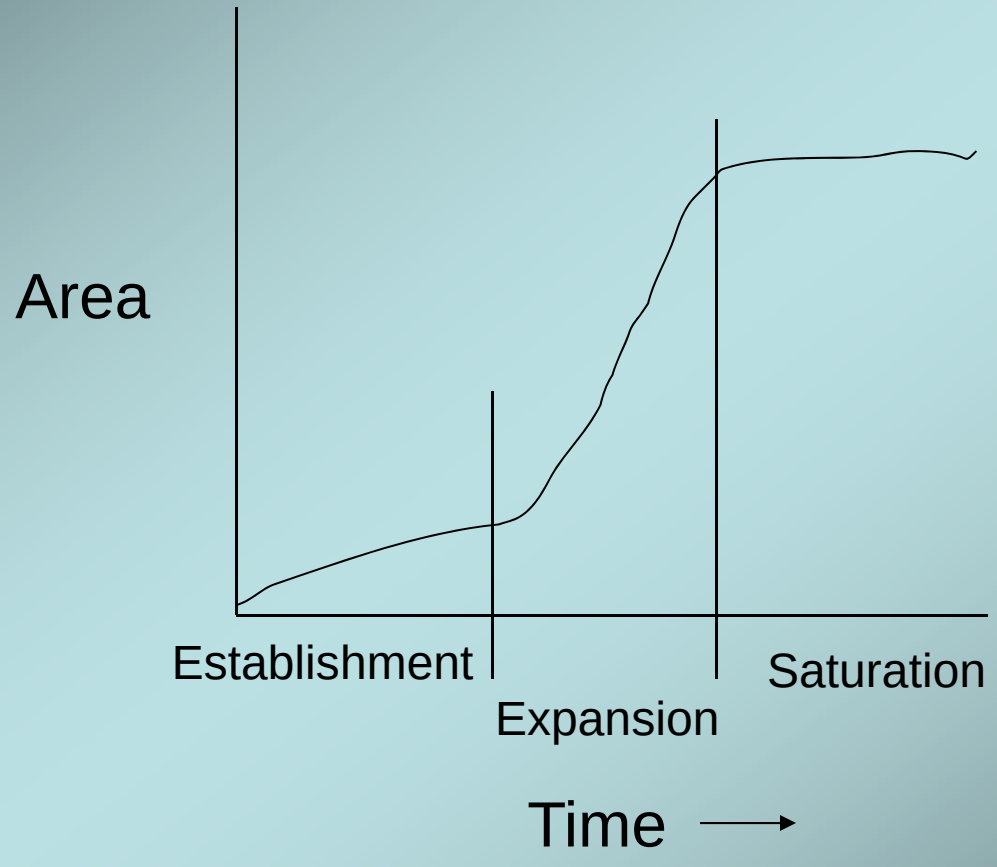
Urgenson, Reichard, and Halpern 2009

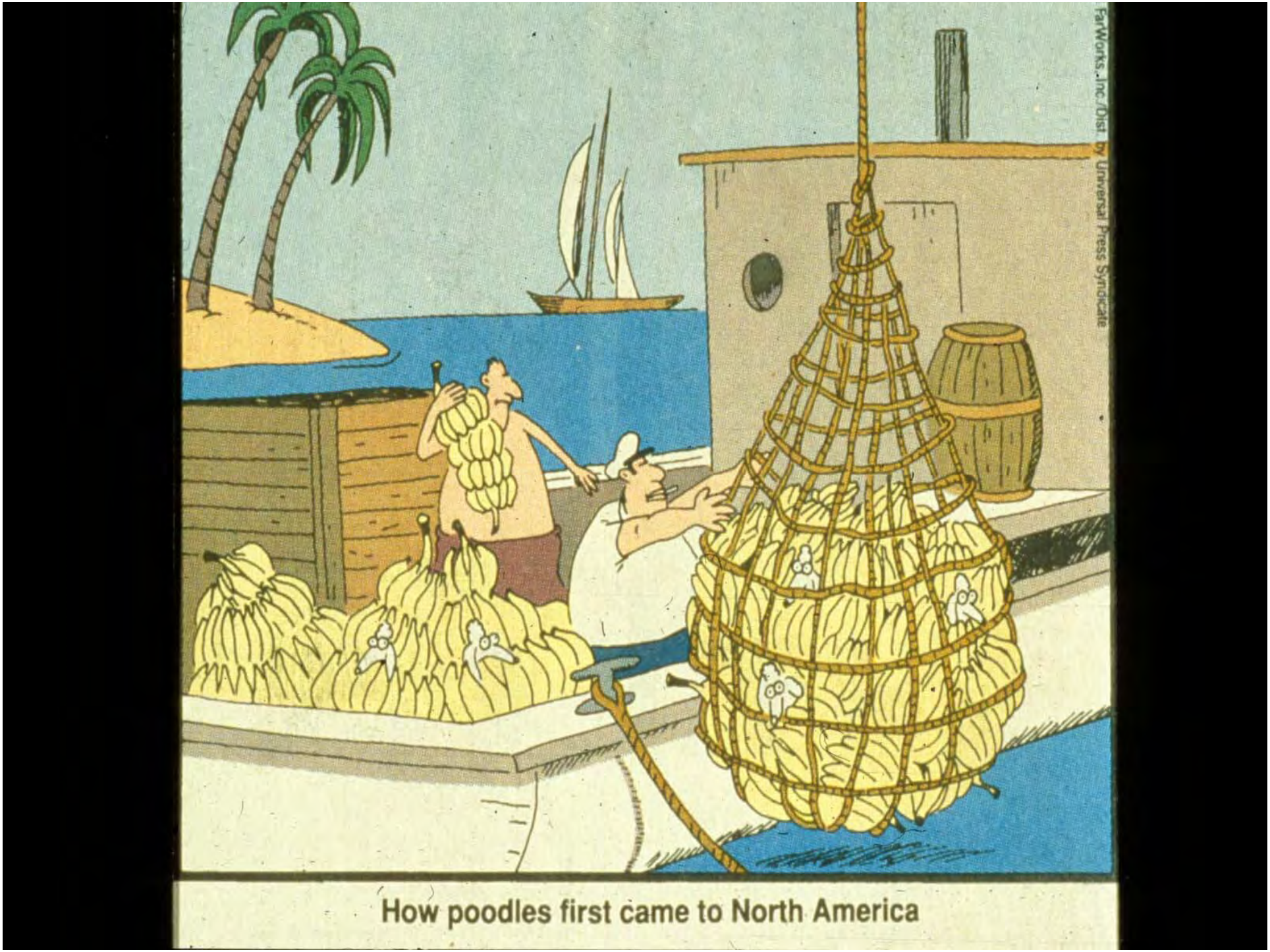
What Do Invasive Species Do?

- Human health concerns

Solution?

Phases of Invasion

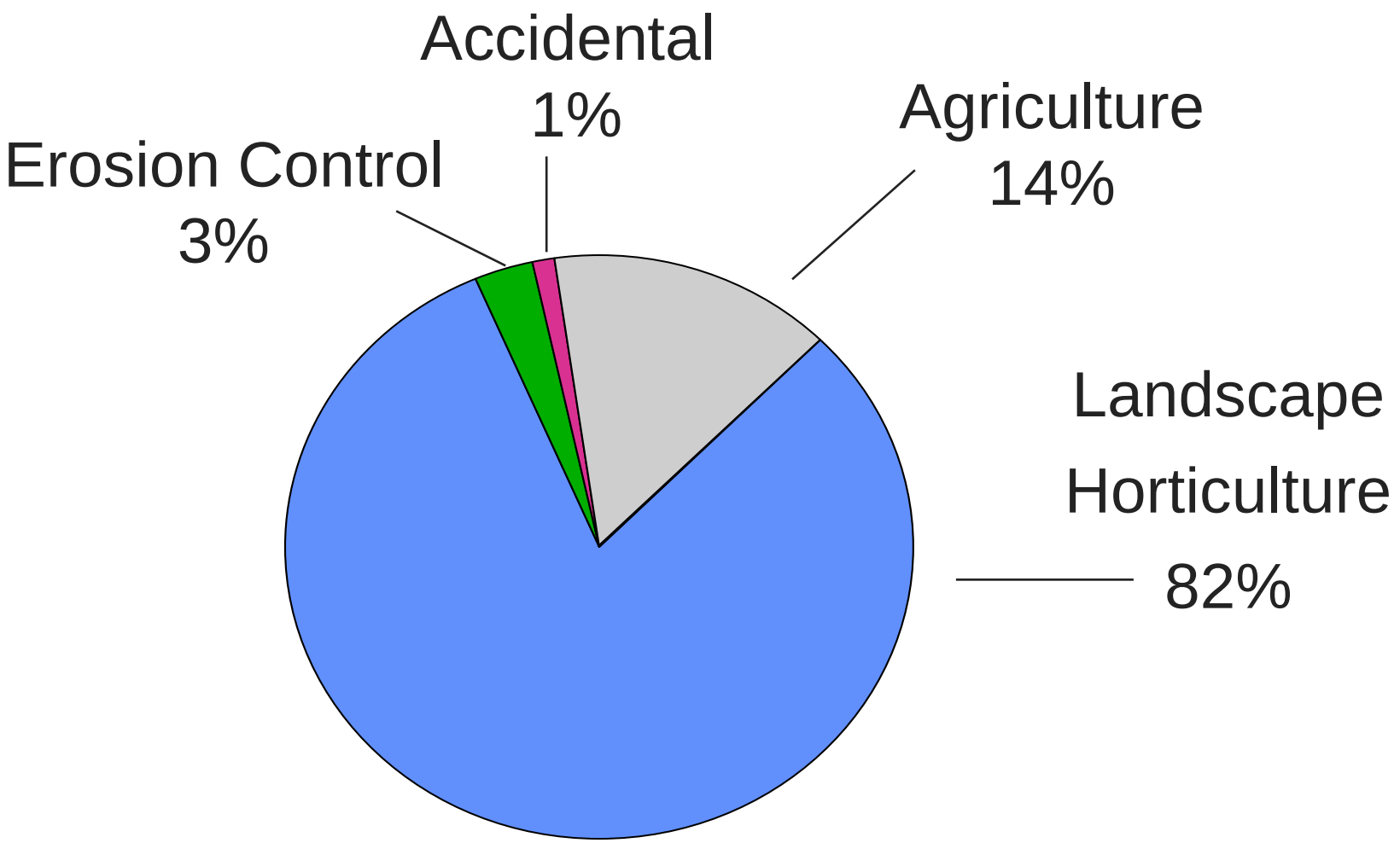




How poodles first came to North America

Woody Plant Introductions

North America n=235



Overall: ~ 65% of invasive plants introduced for horticulture

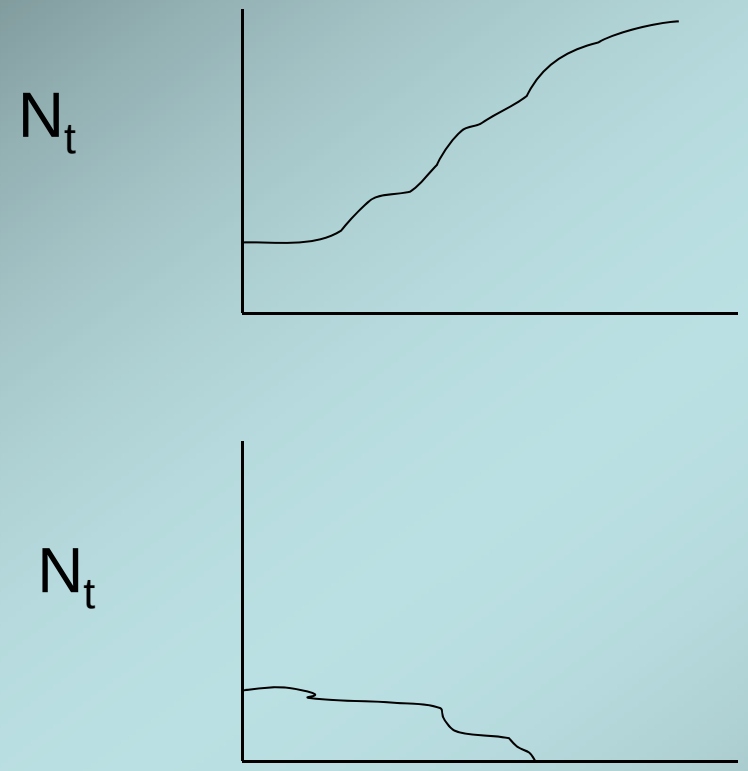
Basic Model of Population Dynamics

$$N_{t+1} = N_t + B - D + I - E$$

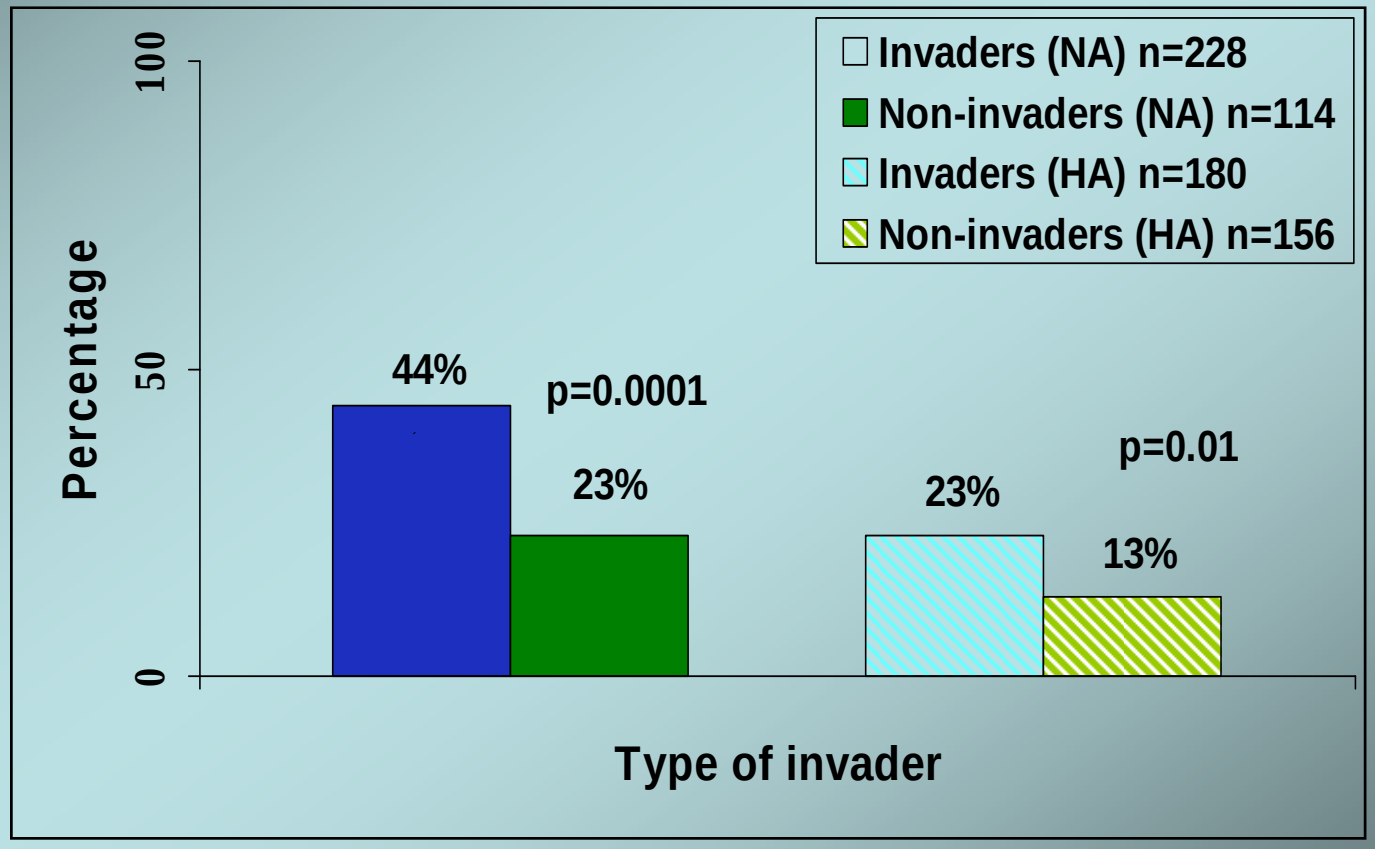
N_t+1 = Size of the population at some time in the future
N_t = Size of the of the baseline population
B = number of births in the population
D = number of deaths in the population
I = number of individuals who immigrate into the population
E = number of individuals who emigrate out of the population

$B+ I > D + E$ = increases in population size

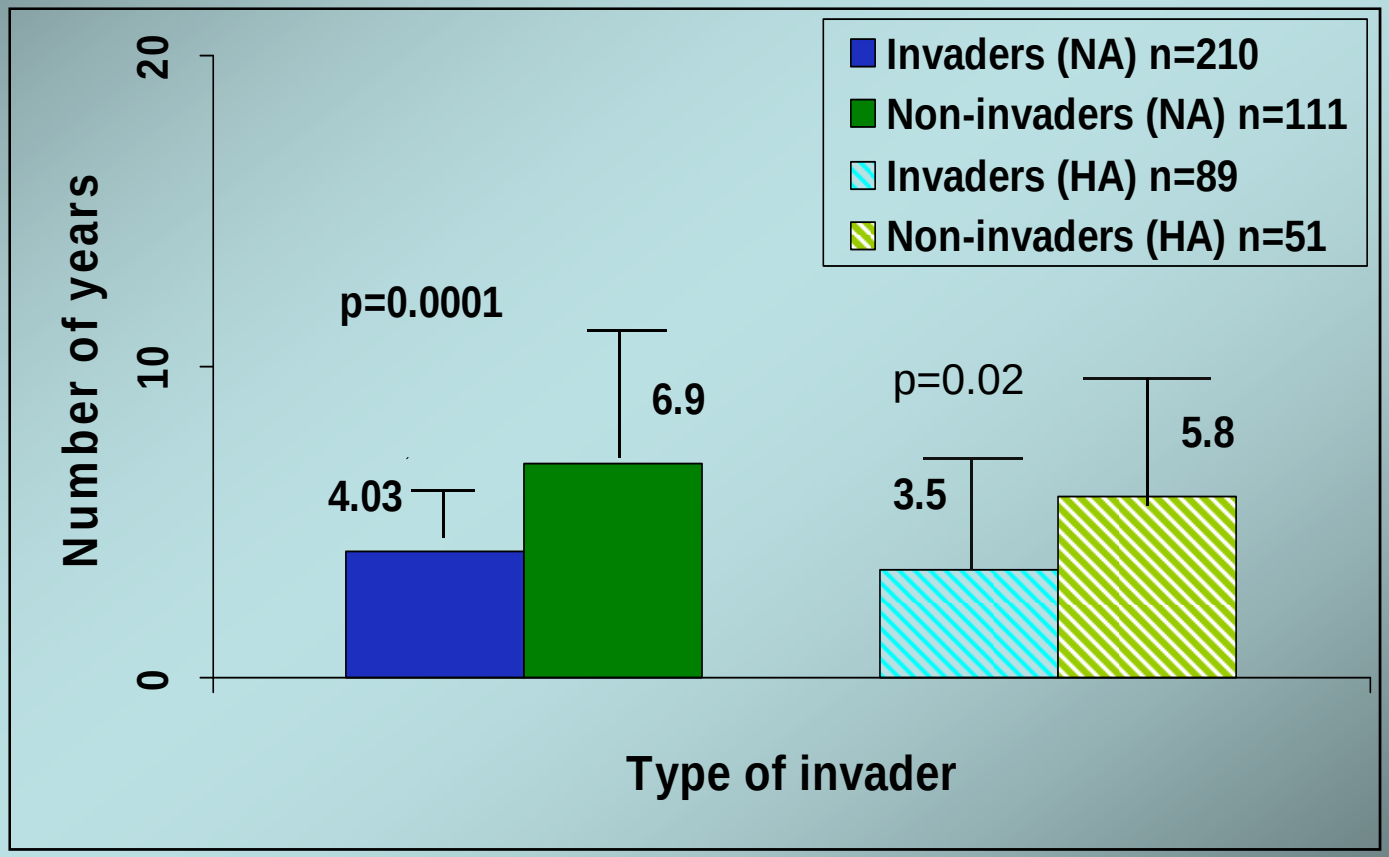
Effect of Intrinsic Growth Rate



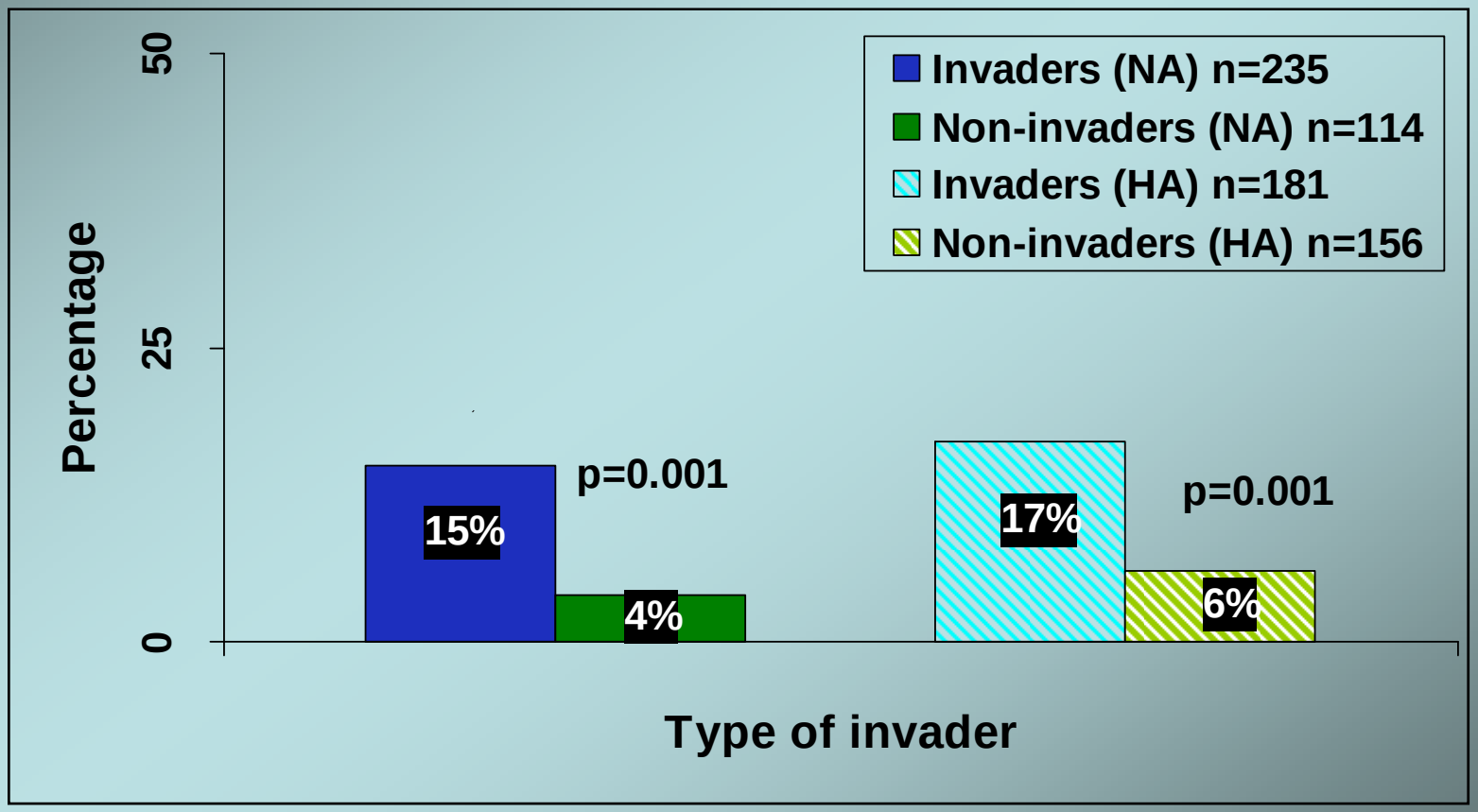
Vegetative Reproduction
North America and Hawaii



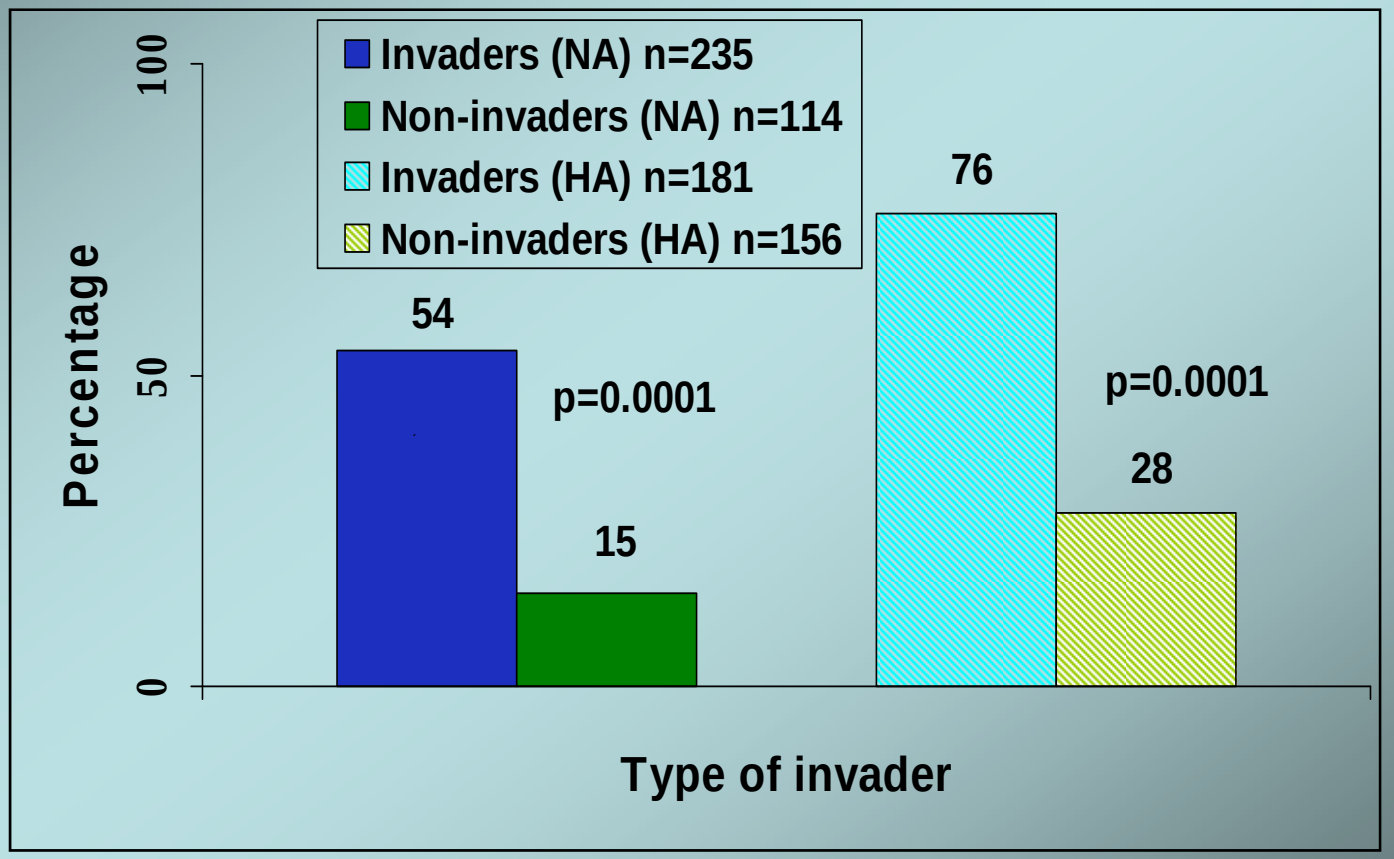
Minimum Juvenile Period
North America and Hawaii



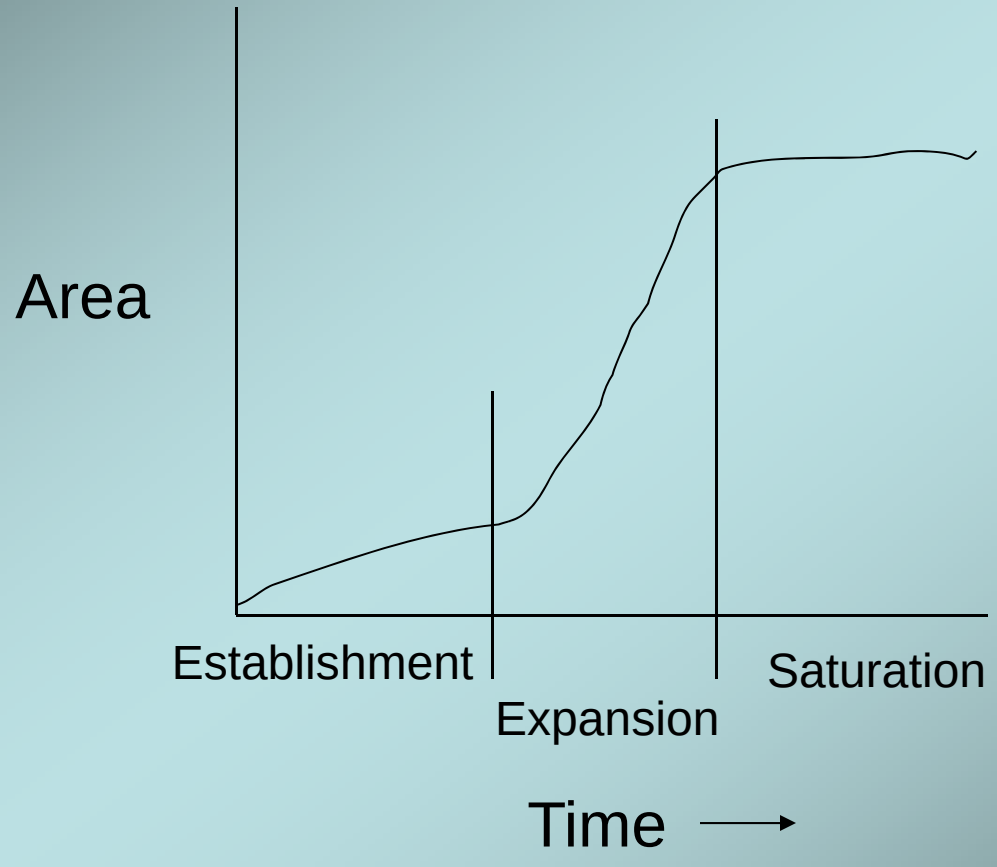
Fixes Nitrogen
North America and Hawaii



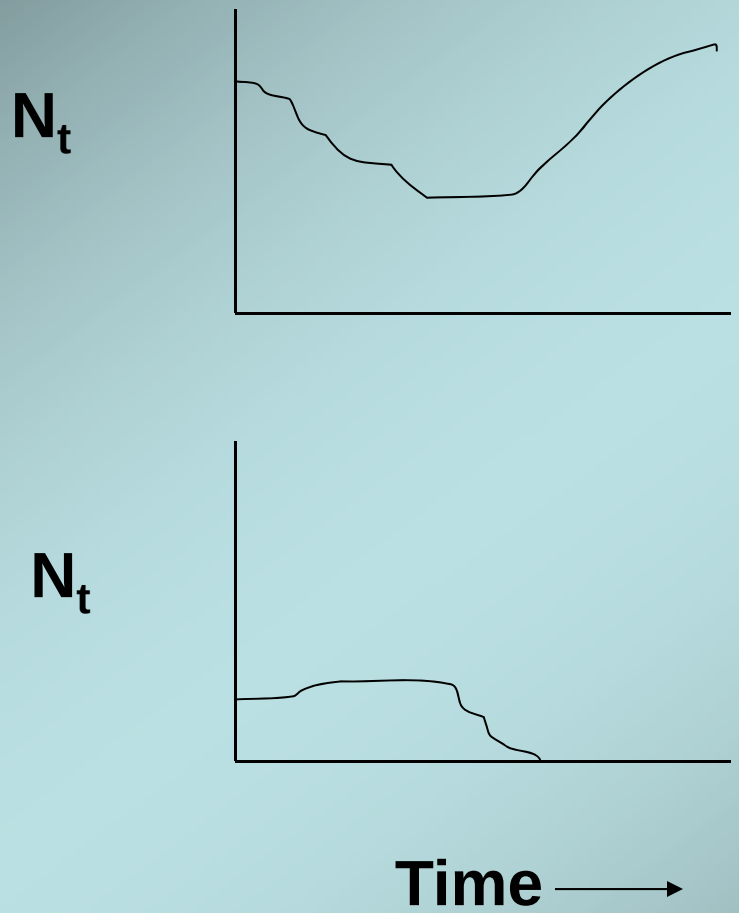
Invades Elsewhere
North America and Hawaii



Phases of Invasion



Effect of Propagule Pressure



Evidence for Propagule Pressure

- Florida nursery, probability of invasion increases the longer species were sold, 70% of species sold >30 years naturalized (Pemberton and Liu 2009)
- British catalogs, frequency of sale in 19th C and today predict naturalization (Dehnen-Schmutz et al. 2007)
- Substantiated by theoretical modeling (Drake and Lodge 2006)

Lag Phase

The time between the introduction of a species and the beginning of rapid population growth

Three categories of population lag:

1) Inherent lag times due to normal population growth

2) Prolonged lag times caused by environmental factors

- soil disturbance
- nutrient enrichment
- climate change
- dispersal vectors
- intra-specific interactions

3) Genetic factors that may improve fitness

From: Crooks and Soule, 1999

Lag Phase

- Length of the life cycle

  ex. Woody plants – may take several years to fruit

  Brandenburg, Germany Study - Published and unpublished records were used to determine time of local introduction and “spontaneous emergence” of woody plants
- Sources date back to 1594
- Average lag time of 147 years (170 trees, 131 shrubs)

Kowarik 1995

Three categories of population lag:

1) Inherent lag times due to normal population growth

2) Prolonged lag times caused by environmental factors

- soil disturbance
- nutrient enrichment
- climate change
- dispersal vectors
- intra-specific interactions

3) Genetic factors that may improve fitness

From: Crooks and Soule, 1999

Lag Phase

- Episodic events

example - Hurricane Andrew in Florida - 1992

Figure 60. Hammock forest in Everglades National Park, Fla., after Hurricane Andrew, September 1992. *(Photographs by Benjamin F. McPherson, U.S. Geological Survey.)*

Paederia cruddasiana

Lag Phase

- New Pathway established for spread

  example - Railroads and Highways – oxford senecio in Great Britain (*Senecio squalidus*)

Three categories of population lag:

1) Inherent lag times due to normal population growth

2) Prolonged lag times caused by environmental factors

- soil disturbance
- nutrient enrichment
- climate change
- dispersal vectors
- intra-specific interactions

3) Genetic factors that may improve fitness

From: Crooks and Soule, 1999

Lag Phase
Genetic Factors

- Phalaris arundinacea (reed canary grass)
- Multiple introductions from several sources in Europe plus cross-breeding in NA
- High genetic variation

Lavergne and Molofsky 2007

Lag Phase

- Lack of human notice/sampling intensity change

  ex. Serrated tussock grass in Australia

Proposed New Noxious Weeds for 2015

- All 4 are horticultural introductions
- All have been in the trade for many years

Arum italicum

Cortaderia selloana

Cortaderia jubata

Saccharum ravennae

Arum italicum
Italian arum

- Proposed Class C
- Known as “escape” for many years
- Riparian areas and shady areas
- Difficult to control
- Will not be quarantined

Cortaderia selloana, C. jubata
Pampus grass

- Proposed Class C
- Isolated plants known for years
- Only *C. selloana* is here
- Both in CA
- Seem to colonize soils with little organic layer
- Will not be quarantined

Saccharum ravennae
Ravenna Grass

- Class A
- Perennial grass
- Near Columbia and Yakima Rivers and N. Oregon
- Red flowering stem, hairs on leaf base
- Likely quarantined

Disposing of Invasive Weeds

- Try to control before flowering and fruiting
- If it is too late, try to cut off flowers/fruits and dispose of in the garbage, rest in compost*
- If rhizomatous, do not put them in home compost

If herbicides have not been used on it

Disposing of Invasive Weeds

- Some can be left on site to dry
- Large amounts can be wrapped in a tarp to dry
- If toxic, seal in a plastic bag, leave to rot, put in trash
- If taking to the dump, make sure it is secured

Toxic Weeds

- Those treated with herbicides
- Poison Hemlock (*Conium maculatum*)

Toxic Weeds

- Those treated with herbicides
- Tansy ragwort (Senecio jacobaea)

Toxic Weeds

- Those treated with herbicides
- Giant hogweed (*Heracleum mantegazzianum*)

Toxic Weeds

- Those treated with herbicides
- Houndstongue (*Cynoglossum officinale*)

Toxic Weeds

- Those treated with herbicides
- Spurge laurel (*Daphne laureola*)

Since 1922, Seattle Pacific U has ended each school year with an ivy ceremony. Seniors circle a rope of ivy while president Philip Eaton and other university leaders snip a sprig for each student to take home and plant as a reminder of the school.

Codes of Conduct
The St. Louis Declaration

- Nursery professionals
- Botanical gardens and arboreta
- Gardening public
- Landscape architects
- Government

http://www.centerforplantconservation.org/invasives/

Codes of Conduct
Gardeners

- Ask nurseries for non-invasive species
- Do not trade invasive species with other gardeners
- Remove invasive species from your land
- Request that botanical gardens display only non-invasive species
- Help with education about invasives

Codes of Conduct
Gardeners

- Request that garden writers promote non-invasive species
- Volunteer with groups to help remove invasive species
- Learn which agencies regulate invasive species in your area and report problem species for them

Hyde Herbarium
hydeherb@uw.edu

Hyde Herbarium
Plant Identification

- Bring in a fresh or dried specimen
- Mail in a dried specimen with downloaded form
- We will identify it and provide suggestions for alternatives if you request it

Conclusions

- Invasive species are a serious threat to wildlands
- Many are introduced through horticulture
- Using species biology and other clues, we could prevent invasions through predictive methods
- Propagule pressure can accelerate invasion

Conclusions

- Lag phases mean that we can’t use simple observation to predict invasion – species can move out of this phase at any time, any where
- The 2015 additions demonstrate lag phase
- Be careful how you dispose of weeds!
- Gardeners can take positive action using the Codes of Conduct