Weeds: the Great Biodiaspora

Weed: A plant species (or any organism) not in its normal geographic distribution, spread by human activities, and usually with some negative impact to humans and/or "native" flora/vegetation/fauna

What then is a *weed*?

- introduction
- non-native
- naturalized
- alien
- invasive

Kahili ginger

Weeds: the Great Biodiaspora

What is *not* a weed!

Eupatorium maculatum
Joe-pye weed

Although the Wisconsin Cranberry Association has labeled *Eupatorium maculatum* a weed as it decreases their profits!

Weeds: the Great Biodiaspora

What is *not* a weed!

Cirsium pitcheri
Dune thistle

Weeds: the Great Biodiaspora

Weeds: negative aspects

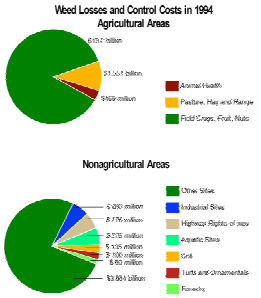
Some "weeds" are simply disgusting and universally detested

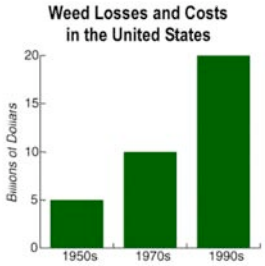
Blatella germanica - German cockroach

Weeds: the Great Biodiaspora

Weeds: negative aspects

The economics of weeds (human impact) drives a huge business and academic industry

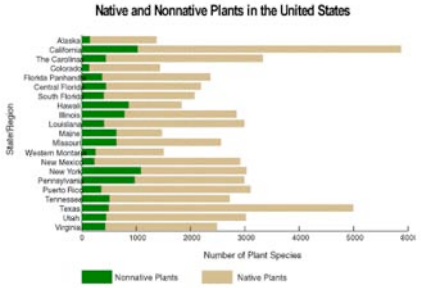




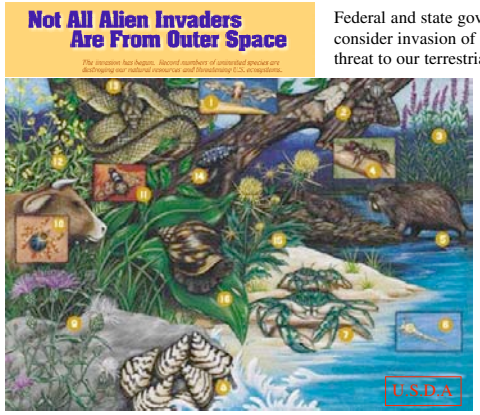
Weeds: the Great Biodiaspora

Weeds: negative aspects

Native flora/fauna of many areas (e.g., islands, "portals") are at risk with invasive weeds



Weeds: the Great Biodiaspora



Federal and state government agencies now consider invasion of the **aliens** as the newest threat to our terrestrial and aquatic biota.

This month's issue of TREE

Weeds: the Great Biodiaspora

How do you tell a weed?

1. Fossil evidence or its lack
2. Historical evidence of introductions
3. Probable means of introduction
4. Typical reproductive patterns
5. Disturbed habitats
6. Geographical distribution patterns
7. Genetic diversity

Weeds: the Great Biodiaspora

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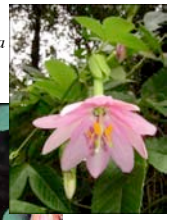
Passiflora mollissima
Banana poca
Hawaiian invasive



Introduced from South America to Hawaii in early 1900s as a vine to hide an outhouse in Hawaii

Weeds: the Great Biodiaspora

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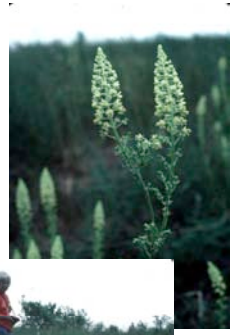

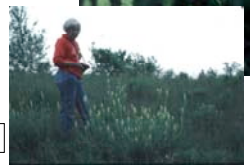

Reseda lutea (mignonette) from Mediterranean found "natively" in pristine Thompson Prairie west of Madison

Rock garden ornamental - via shoes?

Weeds: the Great Biodiaspora

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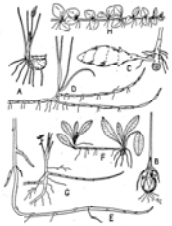
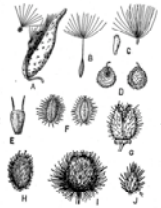
Weeds often possess modified vegetative and sexual reproductive features as part of the "weed syndrome"

Modified vegetative features



Modified dispersal features



Weeds: the Great Biodiaspora

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Veronica beccabunga (water speedwell) native to Europe

Weeds: the Great Biodiaspora

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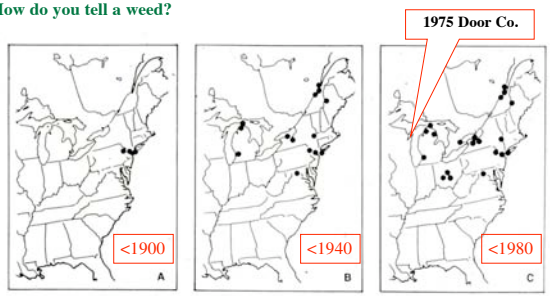

Historical herbarium specimens of *Veronica beccabunga* in North America

Weeds: the Great Biodiaspora

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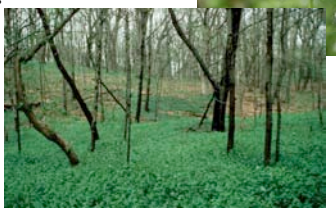
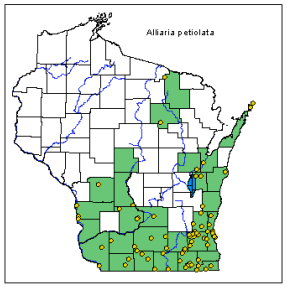


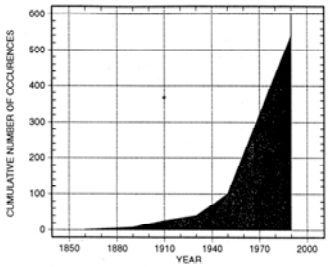
Alliaria petiolata (garlic mustard) native to Europe

Weeds: the Great Biodiaspora

How do you tell a weed?



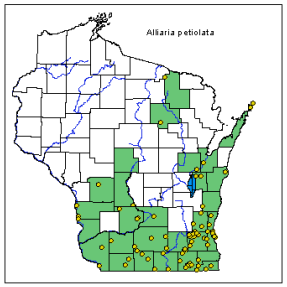
Garlic mustard distribution - 2004



Garlic mustard collections in U.S. herbaria

Weeds: the Great Biodiaspora

How do you tell a weed?



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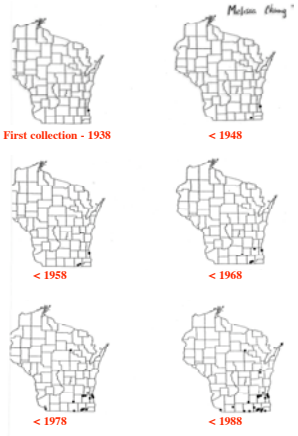

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Phragmites australis (common reed) native or invasive?

Weeds: the Great Biodiaspora

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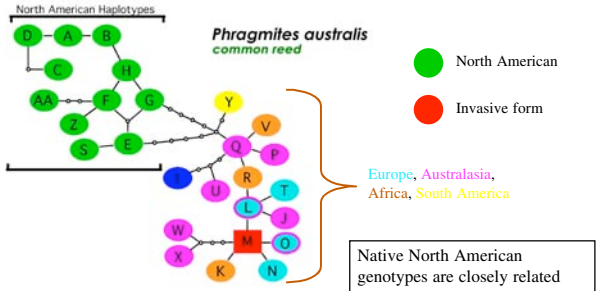

Genotype tree based on chloroplast DNA

Native North American genotypes are closely related and they are unrelated to the invasive form from the Old World

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

1. Direct introduction
2. Agriculture
3. Ballast
4. Roads & pickles (salt)

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

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Pueraria lobata - Kudzu

Kudzu introduced from Japan into SE U.S. for soil erosion control

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Miconia introduced into Hawaii as ornamental

Miconia calvescens
"green cancer"

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Gypsophila introduced into Great Lakes (now invasive on dunes) as "baby-breath" ornamental

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Heracleum mantegazzianum (hogweed) introduced from Asia by gardeners

Hogweed: over 6 ft and looks like cow's parnsip but bigger and with purple stem splotches; phototoxic!

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

1. Direct introduction
2. **Agriculture**
3. Ballast
4. Roads & pickles (salt)

Agriculture basically came from Eurasia to North America

Many of our weeds are agriculture based

Few North American weeds in Eurasia

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Three of the five Wisconsin state listed "obnoxious" weeds arrived with agriculture

Convolvulus arvensis
field bindweed

Euphorbia esula
leafy spurge

Cirsium arvense
Canada thistle

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

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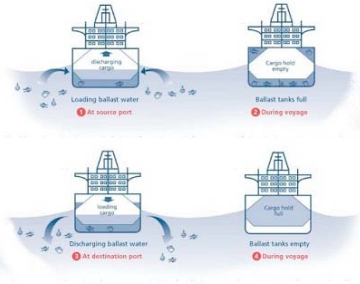


Ballast (water now; soil/gravel before) used to stabilize ships is a major source of aquatic organisms and seeds

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Dreissena polymorpha
Zebra mussel

The most infamous ballast species

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Dreissena polymorpha
Zebra mussel

12 year invasion history

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

Lythrum salicaria
Purple loosestrife

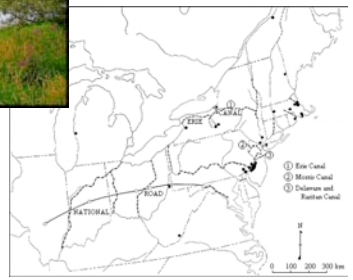
Ballast plants

Myriophyllum

Centaurea maculosa
Spotted knapweed

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"



Canals allowed early spread of *Lythrum salicaria* by 1880.

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

1. Direct introduction
2. Agriculture
3. Ballast
4. **Roads & pickles (salt)**

Spartina patens (east coast salt marshes) first collected in Michigan pickle sites in 1910

Salt used on roads or as brine (pickle factories) has brought in halophytic (salt loving) weeds from the Great Plains and East Coast

Weeds: the Great Biodiaspora

Sources of weeds — "rogues gallery of exotica"

1. Direct introduction
2. Agriculture
3. Ballast
4. **Roads & pickles (salt)**

Muhlenbergia asperifolia (alkali muhly) from Great Plains first seen on de-iced roads in late 1930s

Salt used on roads or as brine (pickle factories) has brought in halophytic (salt loving) weeds from the Great Plains and East Coast

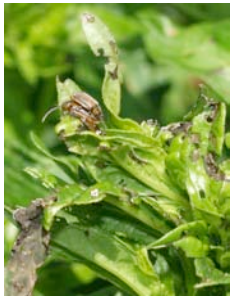
Weeds: the Great Biodiaspora

Issues with weeds after arrival:

1. Control with source area organisms

2. Invasive complex formation

3. Hybridization with native species



Galerucella feeds on purple loosestrife leaves and then flowers

Dipteran leaf miner feeds on European honeysuckle

Weeds: the Great Biodiaspora

Issues with weeds after arrival:

1. Control with source area organisms

2. Invasive complex formation

3. Hybridization with native species

Cyrtobagous salviniae on Common Salvinia, Salvinia minima

Sepik River Lagoon in New Guinea Covered with Giant Salvinia

Same Lagoon Less Than Two Year after Release of C. salviniae

Weeds: the Great Biodiaspora

Hybridization with native species

Common phenomenon

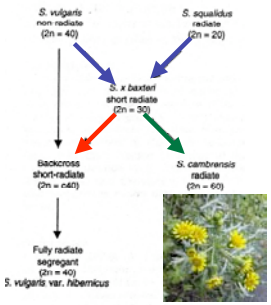
Senecio squalidus
Oxford ragwort

- introduced into Oxford Botanical Garden from Sicily in late 1600s
- escaped from Garden in 1794
- first collected outside Oxford in 1832
- now abundant

Weeds: the Great Biodiaspora

Hybridization with native species

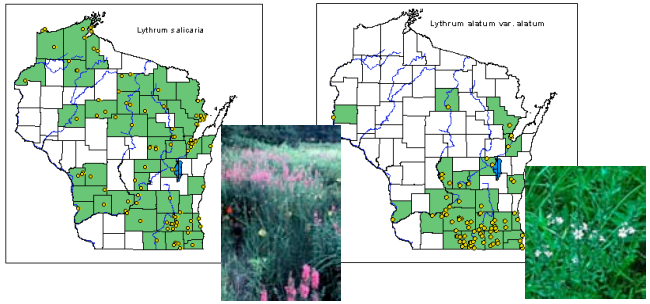
- introduced *Senecio squalidus* hybridized with native *S. vulgaris* (common groundsel)
- the hybrid has backcrossed into the native species (introgression of weed into a native)
- the hybrid also underwent ploidy doubling to form a new polyploid species *S. cambrensis* (Welsh ragwort)



Weeds: the Great Biodiaspora

Hybridization with native species

- Has purple loosestrife hybridized with closely related but native winged loosestrife (*Lythrum alatum*)?
- Is this part of the recent (delayed) invasive nature of the weed?



Weeds: the Great Biodiaspora

A final thought:

Unlike some other threats such as logging or pollution, which in theory can be stopped and allowing native vegetation/flora to recover, **alien invasions** are **self-sustaining** once started and extremely **difficult to reverse**