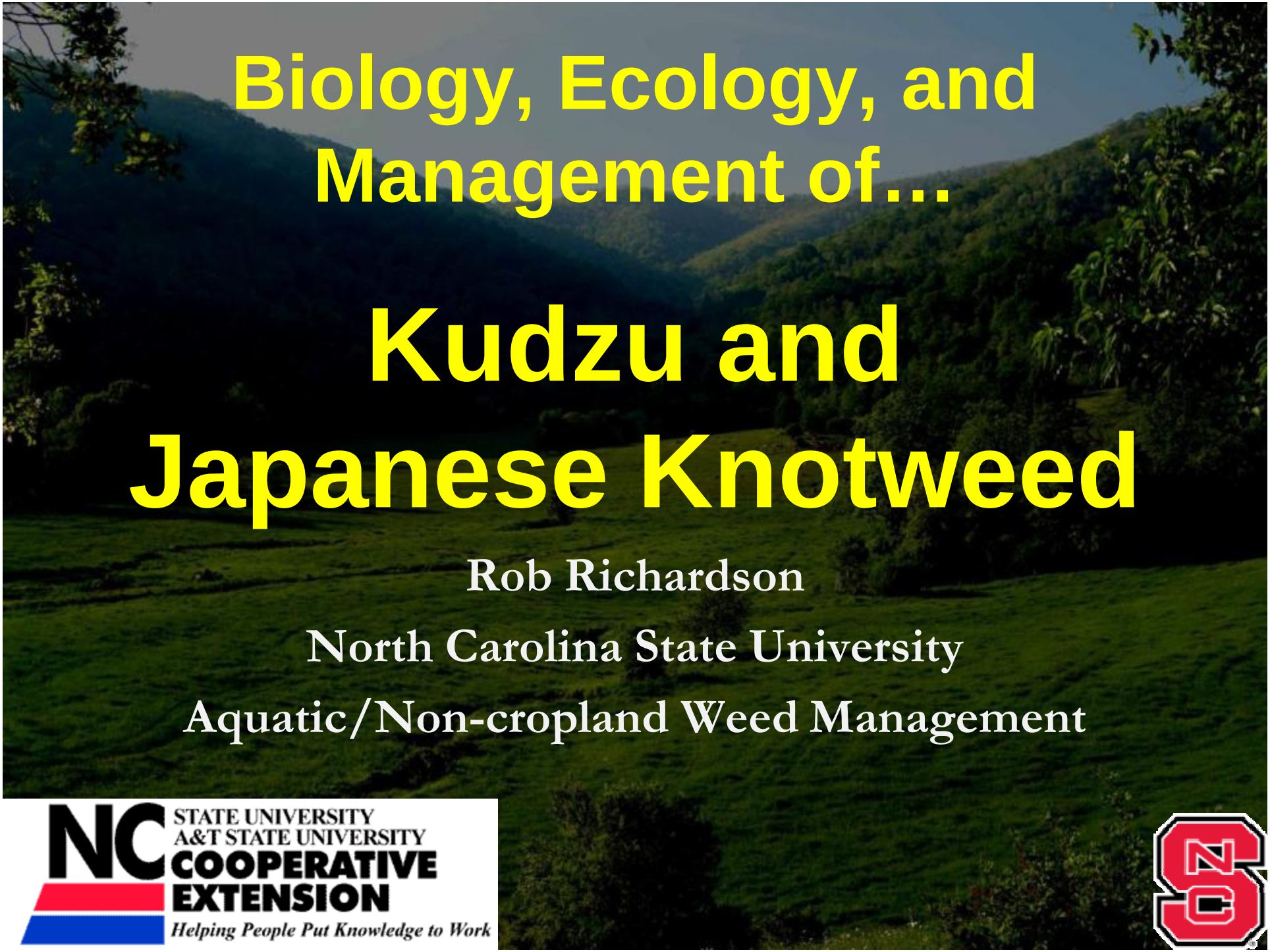

Biology, Ecology, and Management of…

Kudzu and Japanese Knotweed

Rob Richardson

North Carolina State University

Aquatic/Non-cropland Weed Management

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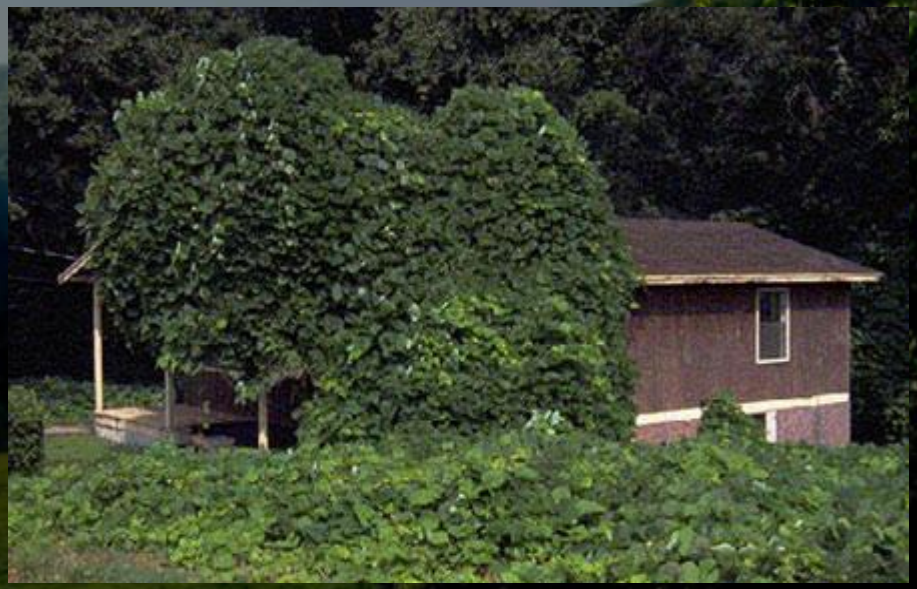
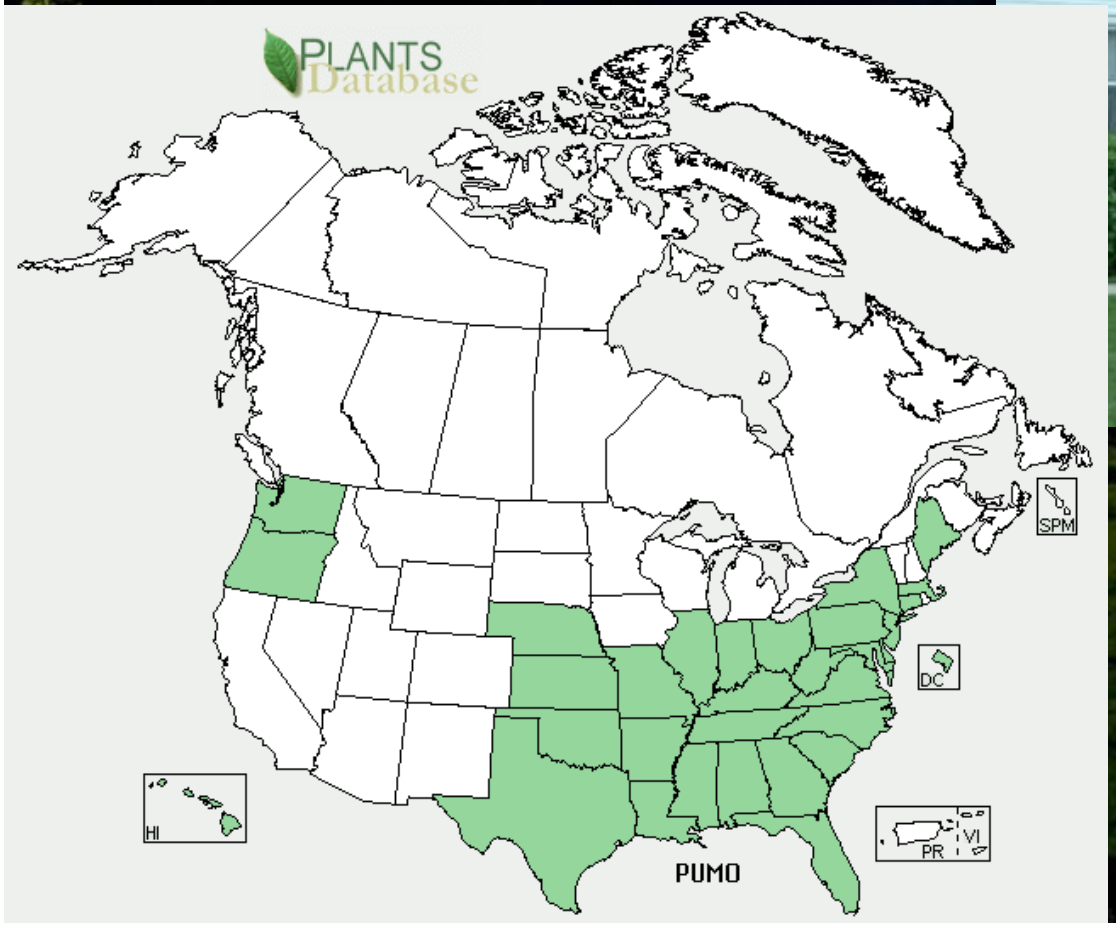
Kudzu



Distribution

- 1876 introduction
- 85 million seedlings planted for erosion control



- Estimated to cover over 3 million hectares in eastern U.S.

Flowers and Fruit

- Typical of legumes
- Red to purple flowers in axillary racemes
- Bloom in late summer
- Fruit is a hairy pod
- Numerous seed/pod
- Low seed viability

Kidd and Orr, NCSU

- 81% of kudzu seeds in NC damaged by insect feeding
- Plants from China were less damaged by insects than U.S plants
- Chinese plants put more resources into vine growth than root growth compared to U.S. plants
- Different biotypes may exist

Kidd, K.A. NCSU Thesis. Interaction of kudzu, *Pueraria montana* and arthropods in North Carolina.

Kidd and Orr, NCSU

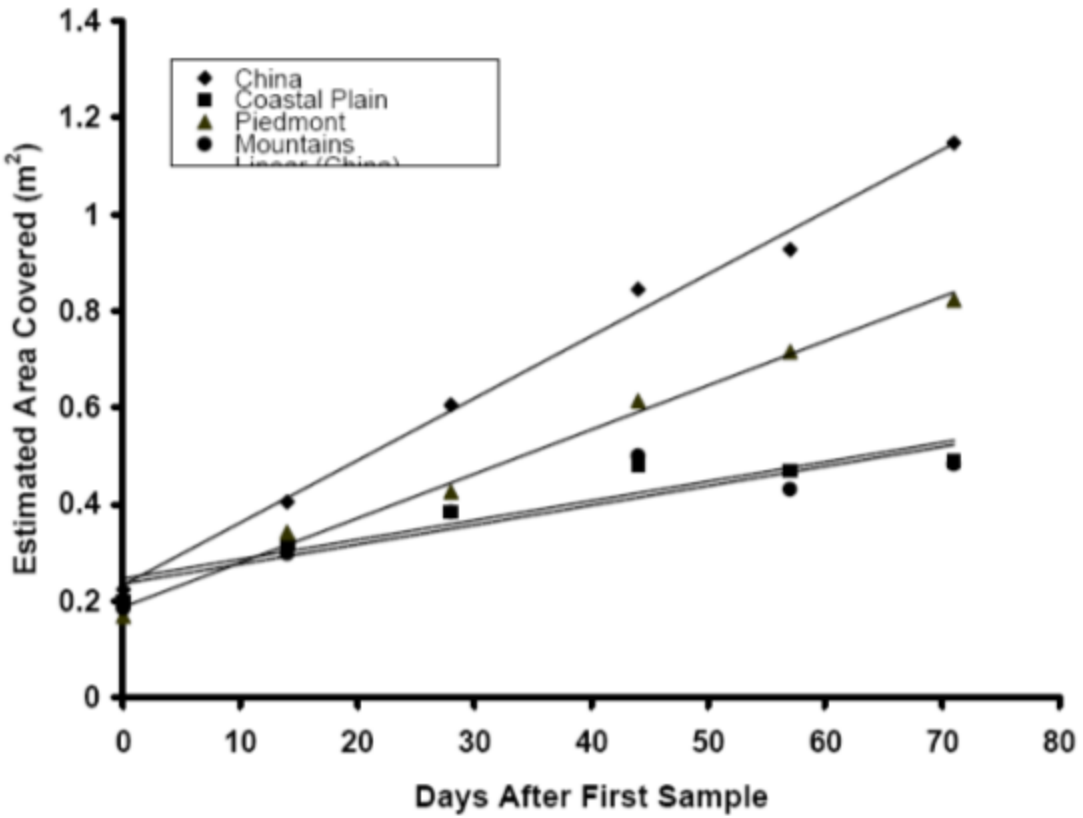


Figure 2. Estimated area (m^2) covered by kudzu. Rates of increase for each accession are represented by the equations: China = 23.3 + 1.3x, R^2 = 0.99; Piedmont = 18.7 + 0.9x, R^2 = 0.99; Mountains = 23.5 + 0.4x, R^2 = 0.80; Coastal Plain = 24.5 + 0.4x, R^2 = 0.87.

Grazing

- May be very effective
- Don’t forget water and fence
- Goats for rent?

Kudzu Management

Herbicidal Control:

- Year 1. Spray 1.33 pt/A Transline plus adjuvant
- Year 2. Spray 1.33 pt/A Transline plus adjuvant
- Year 3. Spray 1.33 pt/A Transline plus adjuvant

- Treat from July 1 until 30 days before leaf drop.
- More southern locations may require 2 applications per year.
- In general, only legumes and asters sensitive to Transline. May substitute Milestone.

Alternative Herbicides

Riparian or aquatic areas:

- Renovate, 1.25 gal/A or 2% solution
- Glyphosate products, ~1 gal/A or 2% solution
- Apply both in 100 gal water/A. 2 app/year may be necessary.

Non-sensitive areas:

- Tordon, 1 to 2 gal/A
  - Tomatoes, tobacco, grapes, etc. are very sensitive

Sensitive visibility areas:

- Apply above ~21 days before leaf color change
- Krenite, 1.5 to 3 gal/A applied Aug. - Sept.

Early Season Alternative

Early season suppression: apply Vanquish (dicamba) at 1/2 gal per acre in 100 or more gal water during late winter when the kudzu is still dormant; Apply to wet. This will suppress kudzu through mid-summer.

- Avoid treatments in root zone of shrubs and trees or damage may occur.
- Adding a non-ionic surfactant (0.25% v/v minimum) of finished solution will improve wetting
- Spray regrowth with Transline or other as indicated

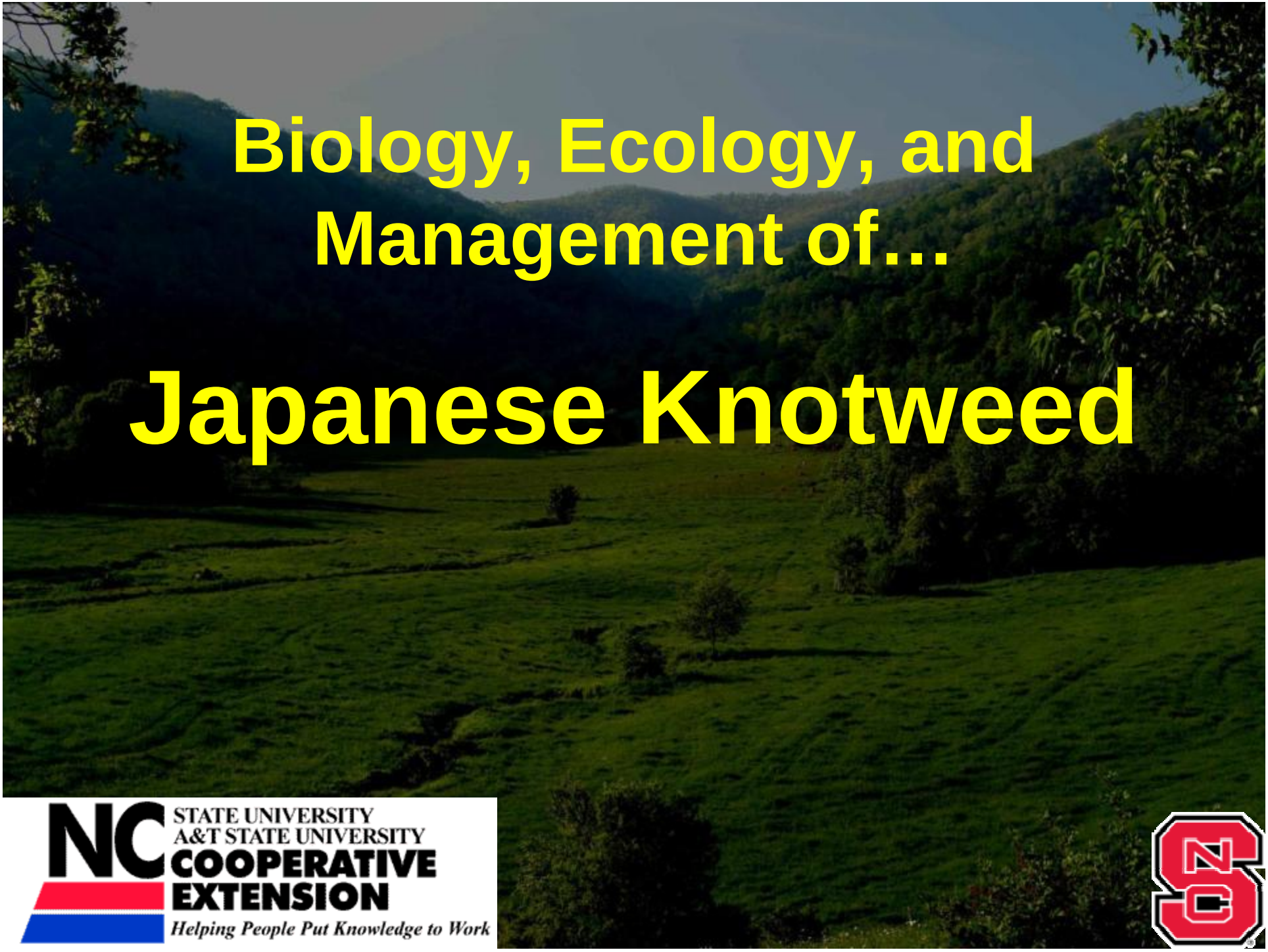
Kudzu Management

Biological Control:

- David Orr at NCSU conducted extensive research with various insects
- Foliar feeders don't have significant impact
- Seed predators don't have significant impact
- Need agents that target roots and rhizomes
- Host specificity problems. Soybean is closely related to kudzu

Mowing:

- May suppress, but will not control


Biology, Ecology, and Management of…
Japanese Knotweed
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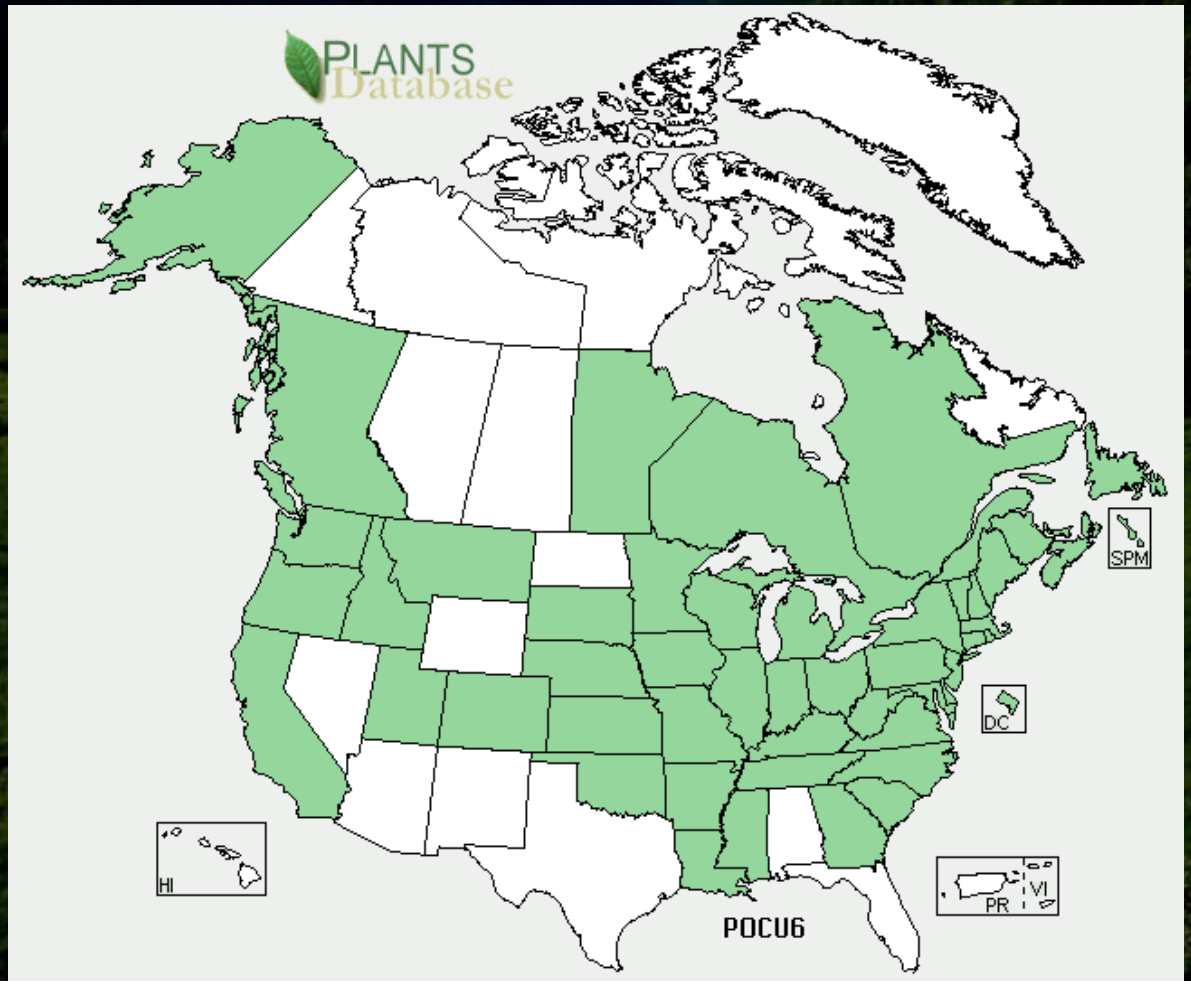
Japanese knotweed

Japanese Knotweed

- Dense, monospecific stands

Distribution

- May grow anywhere in U.S.



Leaves and Stem

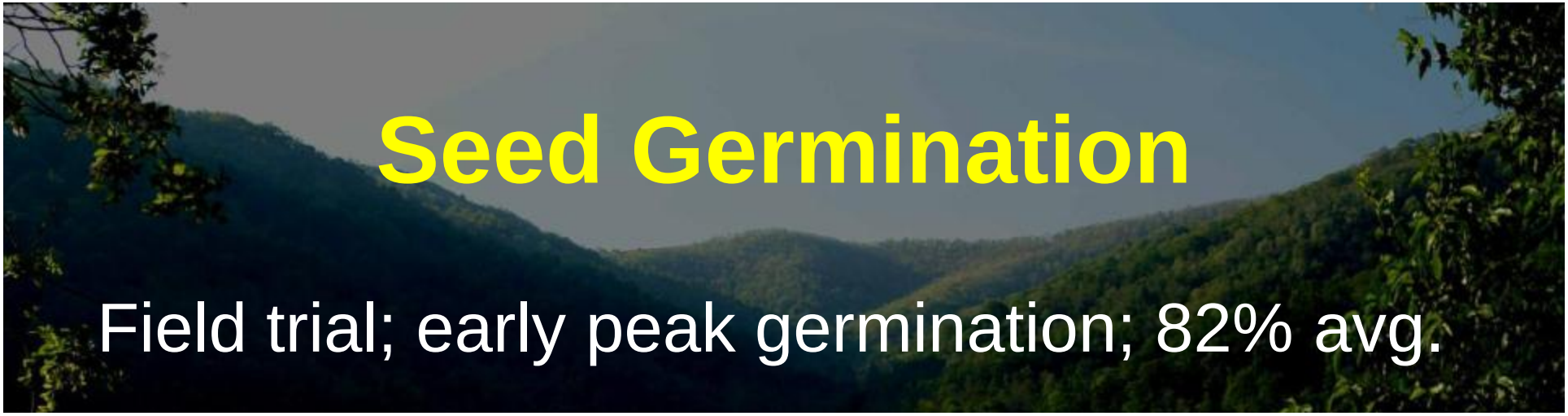
- Alternate leaves on zig-zagging stem
- Herbaceous and hollow stem
- Leaves generally smooth to few hairs
- Ocrea present on stem at each node

Flowers and Fruit

- White to pink flowers in erect clusters
- Bloom in late summer
- Fruit is a 3-winged calyx with 1 seed/fruit
- Fruit may be wind or water disseminated

Reproduction

- Primarily by aggressive rhizomes
- Also from seed



Seed Germination

Field trial; early peak germination; 82% avg.

TABLE 1. Seed germination of Japanese knotweed at the Rising Sun site, Philadelphia, PA. Seeds were buried at 10 locations on December 23, 1999 and germination was monitored on March 10, 16, 24, and 31 in 2000. Data are presented for eight of the 10 locations because germination could not be estimated at Locations 4 and 7 (see text).

		Incremental germination					
Location	N[a]	March 10	March 16	March 24	March 31	Cumulative	Germination
		seedling number					%
1	150	57	18	7	0	82	55
2	150	59	45	21	0	125	83
3	150	36	68	30	2	136	91
5	150	49	66	13	1	129	86
6	150	12	21	77	20	130	87
8	150	30	53	34	4	121	81
9	150	81	35	8	2	126	84
10	150	78	50	8	2	138	92
Total	1,200	402	356	198	31	987	—
Mean	—	50	45	25	4	123	82

[a] Abbreviation: N, initial number of buried seeds at each location.

Bram, M.R. and J.N McNair. 2004. Seed germinability and its seasonal onset of Japanese knotweed. Weed Sci. 52:759-767.

Seedlings by Site

- Differences by site
- Greater germ. in riparian areas
- Lower germ in upland areas

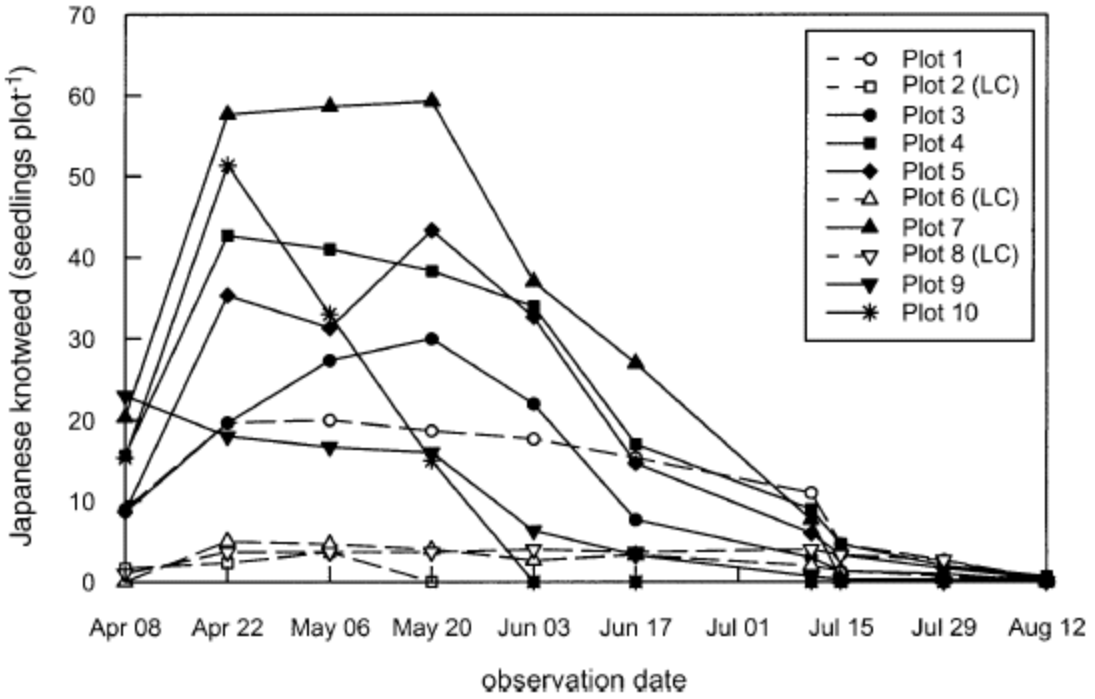


FIGURE 1. Mean Japanese knotweed seedlings on successive observation dates in 2002 in the 10 microhabitat plots at the Carroll Park site, Philadelphia, PA. Plots 1, 2, 6, and 8 (open symbols and dashed lines) were located in wooded upland areas, well removed from existing Japanese knotweed stands. The remaining plots (solid symbols and solid lines) were located in riparian areas, in or near existing knotweed stands. LC denotes plots that became covered with lesser celandine (see text).

Bram, M.R. and J.N McNair. 2004. Seed germinability and its seasonal onset of Japanese knotweed. Weed Sci. 52:759-767.

Days to Germination

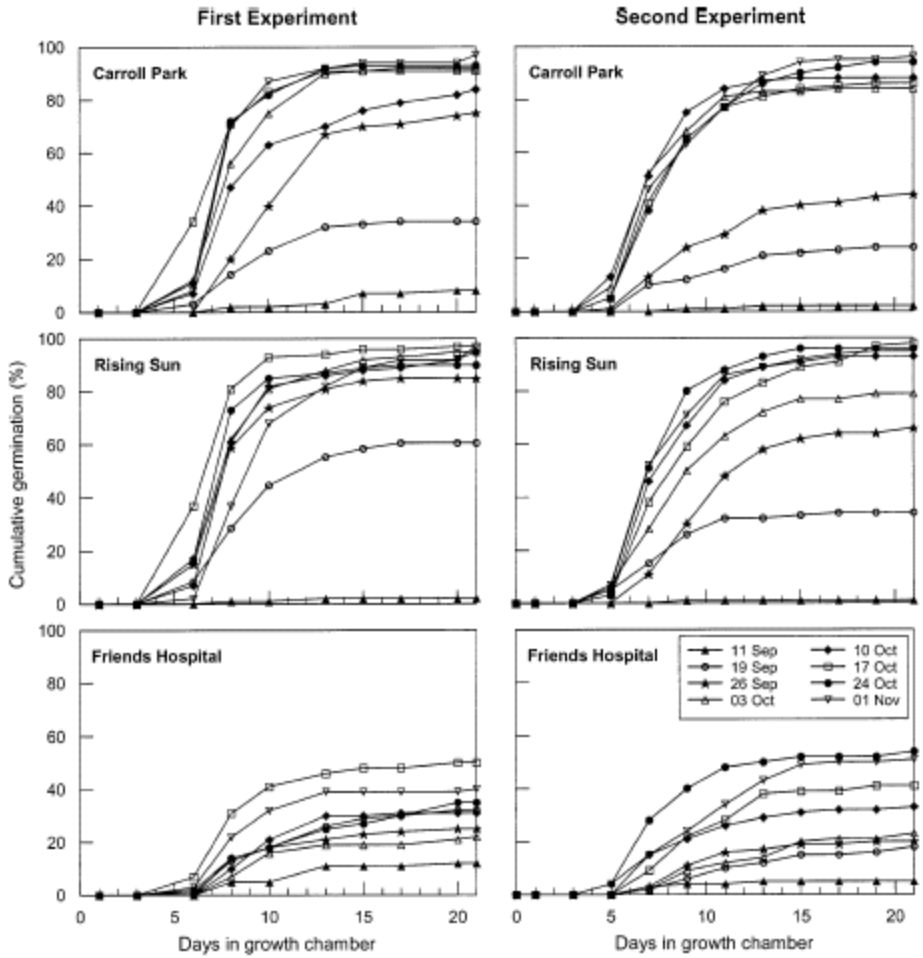
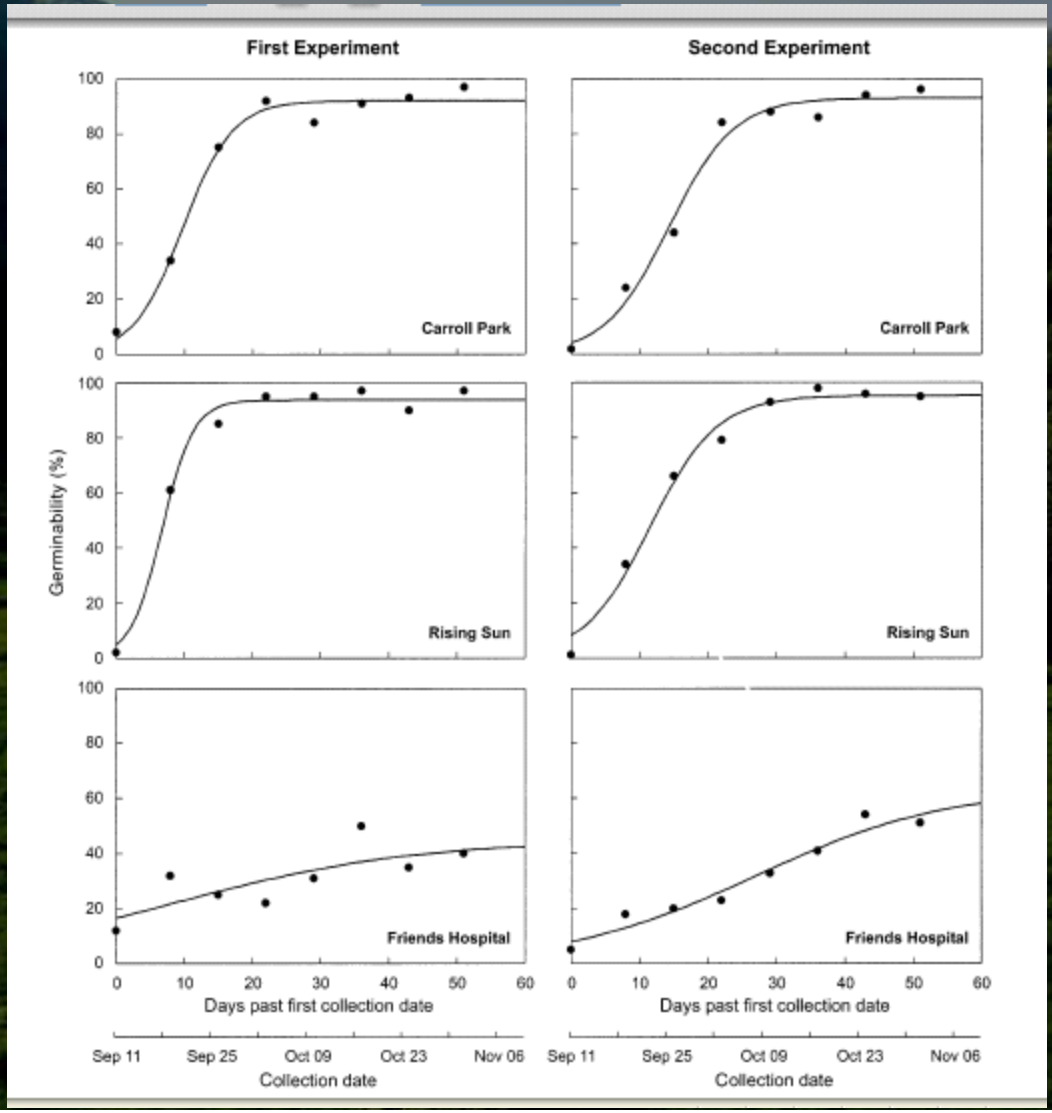


FIGURE 2. Cumulative Japanese knotweed germination percentage in the two germinability vs. collection date experiments as a function of days in the growth chamber. Seeds were collected at the Carroll Park, Rising Sun, and Friends Hospital study sites on eight dates in 2000. Each curve in each panel corresponds to one collection date.

Bram, M.R. and J.N McNair. 2004. Seed germinability and its seasonal onset of Japanese knotweed. Weed Sci. 52:759-767.

Germinability by Collection Date



Bram, M.R. and J.N McNair. 2004. Seed germinability and its seasonal onset of Japanese knotweed. Weed Sci. 52:759-767.

Green Frog Foraging Success

- *Rana clamitans*
- Frog mass declined along transects
- Frogs gained mass in mixed vegetation, not knotweed

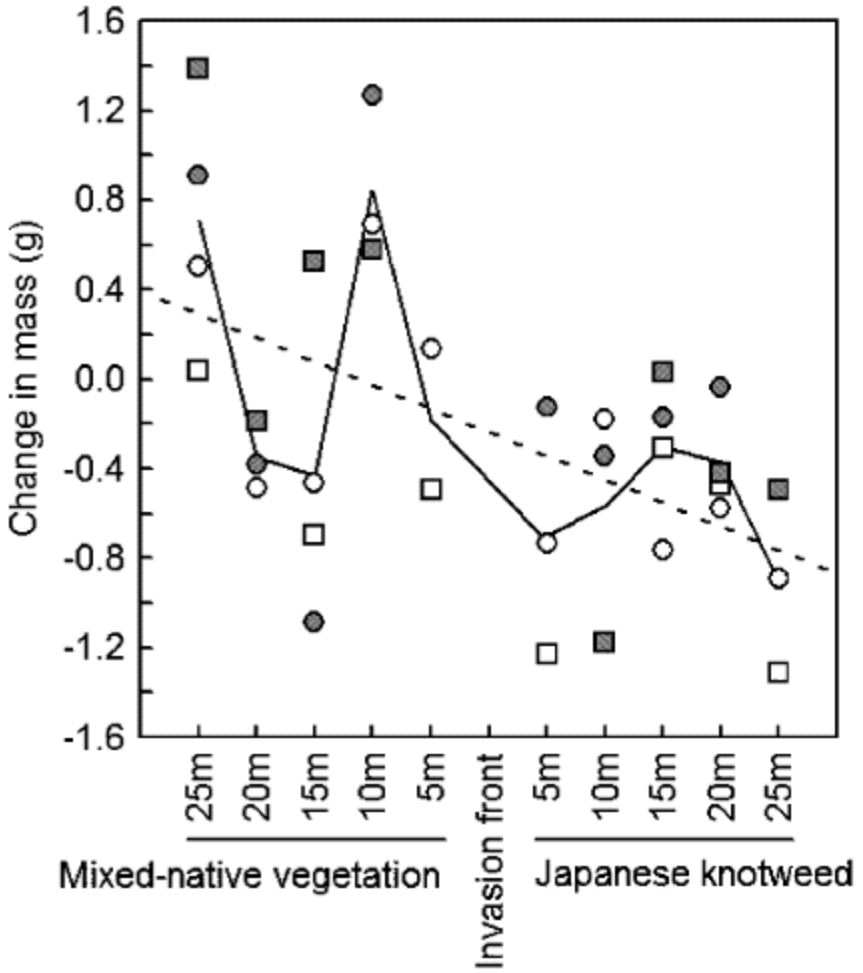


Figure 3. Change in frog mass over 38 h as a function of position on transects running from old field habitat dominated by a mixture of native plants into habitats dominated by Japanese knotweed. Different symbols correspond to the four different transects, and white symbols are transects at site 1 and shaded symbols are transects at site 2. The solid line tracks mean change in mass at each 5 m interval and the dashed line shows the linear relationship between change in mass and transect position.

Maerz, J.C., B. Blossey, and V. Nuzzo. 2005. Green frogs show reduced foraging success in habitats invaded by Japanese knotweed. Biodiversity and Conservation. 14:2901-2911.

Photosynthate Location

- Greenhouse trial
- UK location
- Sept. peak for rhizomes

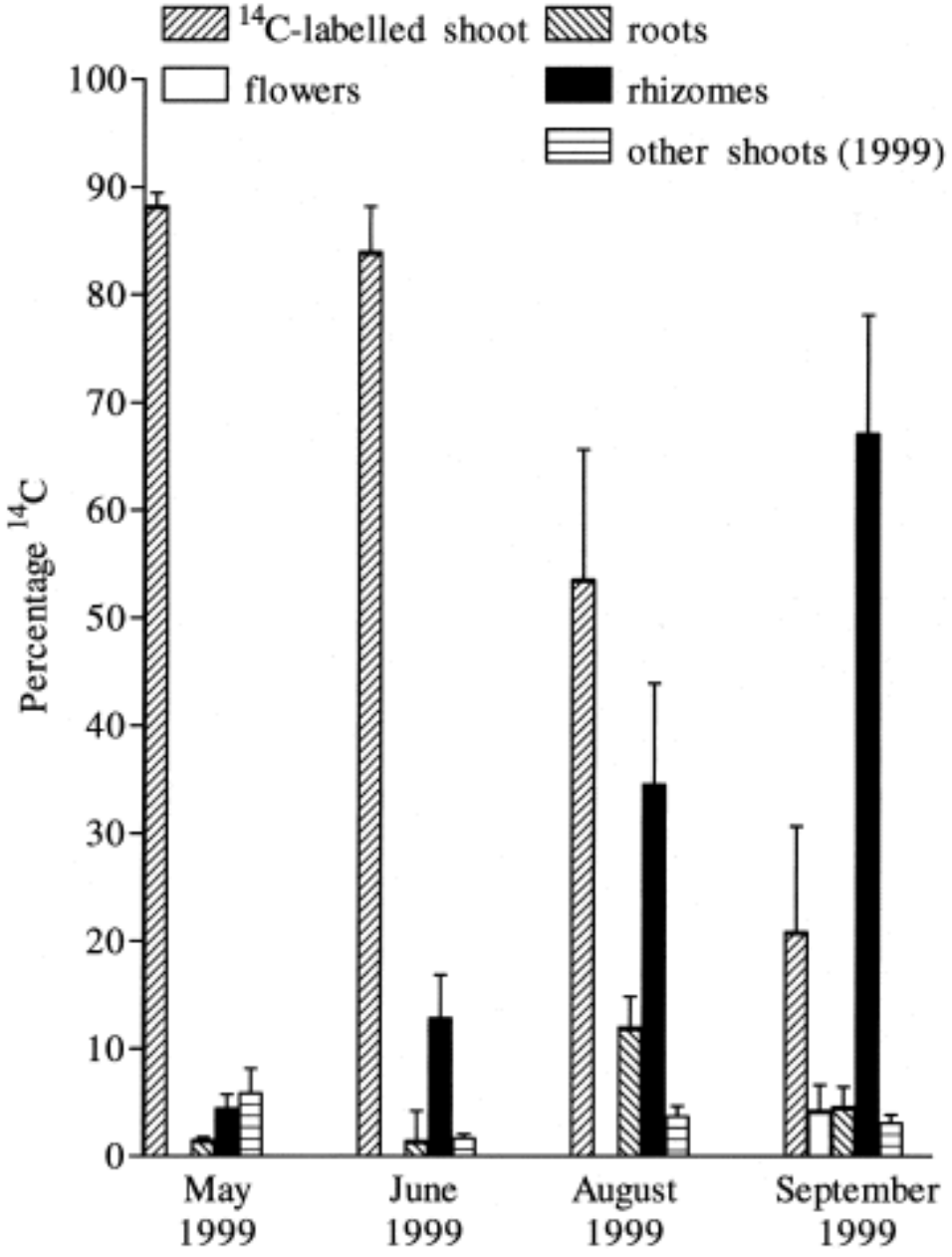


Figure 2. Mean (±SE) percentage ^{14}C in component parts of Japanese knotweed plants supplied with $^{14}CO_2$ at intervals during the growing season (May, June, August or September 1999) and harvested 24 h later to show seasonal changes in photoassimilate allocation patterns.

Price et al. 2002. Evolutionary Ecology. 15:347-362.

Japanese Knotweed Management

Effectiveness of cutting:

- Cut plants accumulated less belowground biomass.
- However, 4 cuts per year would be needed to reduce belowground biomass from initial level.
- Timing not critical, but should be at least 7 wk prior to leaf drop.
- Authors conclusion: Cutting unlikely to eradicate knotweed.

Seiger and Merchant. 1997. Mechanical control of Japanese knotweed: Effects of cutting regime on rhizomatous reserves. Natural Areas Journal. Vol. 17, no. 4, pp. 341-345. Oct 1997.

Japanese Knotweed Management

Glyphosate (Touchdown Pro, Accord, Rodeo, etc.) :

- **Foliar application of 2% glyphosate solution in mid summer, with a follow-up treatment in four to six weeks. Include adjuvant. The initial treatment will cause leaf yellowing, and the follow-up up may complete plant kill.**
- **Stem injections w/ 100% glyphosate 5 mL/stem?**
  - **Assume 50 stems per m^2 …**

    then 202,000 stems per acre …

    then 267 gal per A of product
  - **Most likely an illegal application and enormous waste of product and labor**

Japanese Knotweed Management

Biological Control:

- Search for natural enemies in Japan started in 2000.
- Several potential agents collected
- Testing initiated in UK
- Recently or soon to be initiated in US

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