Population and community dynamics of non-native species in an 80-year post-agricultural forest chronosequence

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Forest history

Land-use history shapes forest composition

Most eastern forest is second-growth, carries land-use legacies

Flinn and Marks 2004, Holmes and Matlack 2018,
Land-use history and non-native species

Species introductions follow human movement

- Food crops, horticultural plantings
- Weeds, accidental introductions

Agricultural land use creates habitat

- Soil disturbance
- Canopy openings

Non-native species are a land-use legacy

Agricultural legacies

- Environmental homogenization
- Physical and chemical soil disturbance
- Some heterogeneity retained
- Structural features encourage establishment
Research questions

1. Do non-native populations and communities differ with land use?

2. How do populations and communities change through time?
Experimental Design

- Replicated chronosequence
- Two treatments: pastured and cultivated
- Four age classes
  - 0-21 years
  - 21-40 years
  - 41-60 years
  - 61-80 years
- Control Group
  - >120 years

4 age classes x 6-10 replicates + control = 40 sites total
Non-native community metrics

- Age: $p = <0.0001$
- Land use: $p = <0.0001$

a. Non-native abundance

b. Non-native species richness
Composition and time

Age: $p = 0.0469$

Environment NS
Composition and land-use history

Cultivation:
- Openland species
- Clonal groundcovers

Pasturing:
- Woody species
- Fleshy fruit

Land use: $p = 0.0099$
Species dynamics

Most species decline after 40-80 years

*Celastrus orbiculatus, Glechoma hederacea, Lonicera japonica,*

*Ligustrum vulgare, Lysimachia nummularia*

Mortality from environmental change

Stunted growth and reproduction

Small populations persist

*Rosa multiflora, Duchesnea indica*

Growth and reproduction can be stimulated by disturbance
Conclusions

Non-native species are a land-use legacy

Non-native richness and abundance decline with stand age

Community-level and population-level response to land-use history

Pay attention to land-use history

Many non-native species will disappear with time

Prioritize species likely to invade and persist in high-quality habitat
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