

US EPA ARCHIVE DOCUMENT

Quantifying and Modeling the Risk of Disturbance to Ecosystems Caused by Invasive Species

Introduction to the Problem

Invasive species are biological pollutants that threaten ecosystem health. Identifying the mechanisms of invasion and developing predictive models of invasion will be critical to developing risk management strategies for limiting the economic and environmental damage caused by invaders.

Background

Eastern redcedar (*Juniperus virginiana*), a prolific evergreen tree and its associated vertebrate seed dispersers, will be used as a model invader-disperser system. Limiting factors of invasion (growth and seed dispersal; see Figure 1) will be studied through manipulative field experiments conducted at Oklahoma State University's (OSU's) Cross Timbers Experimental Range Research Site. Researchers from OSU will collaborate to complete research tasks.

Objectives

- Investigate the mechanisms of invasion by *Juniperus virginiana*
- Quantify the susceptibility of ecosystems to invasion
- Develop predictive models of invasion probability based on empirical data

Approach

The effects of local plant diversity and soil characteristics on *J. virginiana* survival and growth (which are measures of invasion ability) will be examined in a field experiment. *J. virginiana* seedlings will be planted in three distinct ecosystem types: old field, deciduous forest, juniper forest (see Figure 2). Seedling growth and survival will be analyzed in relation to adjacent plant species and soil type and chemistry. *J. virginiana* dispersal limits will be studied by monitoring seed consumers (see Figure 3) and their rates of consumption at *J. virginiana* trees, fenced to exclude small mammals and deer. A greenhouse experiment will be conducted to determine the effects of both nitrate nitrogen and ammonium nitrogen on seedling growth. Models of ecosystem susceptibility to *J. virginiana* invasion will be developed using empirical data collected in this study and projecting onto existing geographical data bases on vegetation type, soil type, animal distributions, and nitrogen deposition in the United States.

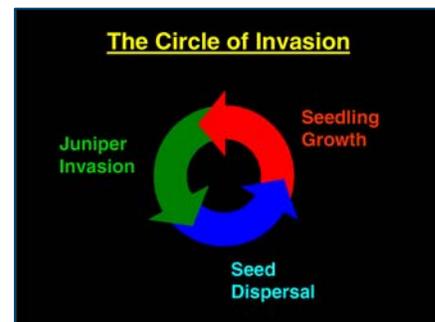


Figure 1: The Circle of Invasion

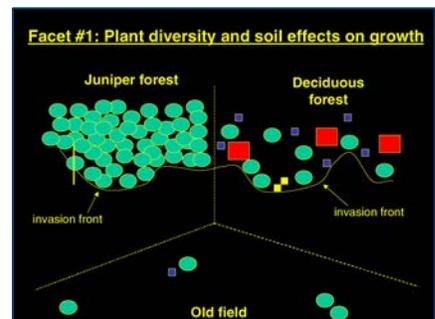


Figure 2: Plant diversity and soil effects on growth

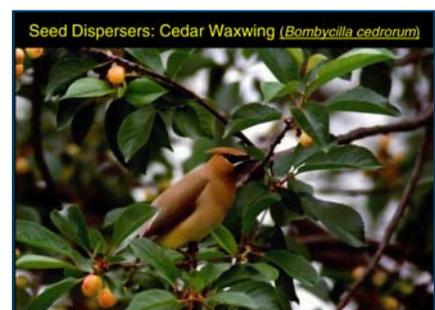


Figure 3: Seed Dispersers: Cedar Waxwing

Accomplishments to Date (February 2003)

- Completed all field work on plant diversity, soil characteristics, and seed consumption
- Completed lab analysis of soils
- Presented papers and posters at three national meetings
- Greenhouse study is under way

Near-Future Tasks

- Continue greenhouse experiment on nitrogen effects on growth
- Complete reports for field and lab work portions of study
- Develop predictive models of invasion

Goals

- Arrive at a better understanding of the mechanisms of ecosystem invisibility
- Develop unique field techniques
- Identify vulnerable stages of invader life history
- Develop predictive models of invisibility applicable to other species and useful to land managers responsible for addressing invasive species problems

Investigators

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Collaborators

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