Comprehensive Exam Prospectus

Ph.D. in Environmental Sciences and Management

Submitted by: Christa von Behren

For Examinations to be taken:
March 20112

Comprehensive Examination Committee
Portland State University

Dr. Alan Yeakley
Dr. Sarah Eppley
Dr. Joe Maser

Approvals

The Comprehensive Examination proposal submitted herein for Christa von Behren is hereby approved.

Examination Committee:

Dr. Alan Yeakley ___________________________ Date ________________
Dr. Sarah Eppley ___________________________ Date ________________
Dr. Joe Maser ______________________________ Date ________________
Seed dispersal in riparian areas of small urban streams and its effects on community development

Riparian vegetation provides many valuable services in urban areas, including recreation, bank stabilization, stream shading, and nutrient buffering (Cordes et al. 1997). However, urban structures and processes can drastically change riparian areas, altering their ability to provide these services. Studies of riparian vegetation have shown large differences in species composition between urban and non-urban riparian communities (Burton and Samuelson 2008; Burton et al. 2009; Moffatt et al. 2004; Pennington et al. 2010; White and Greer 2006). Several studies have suggested that this urban shift in riparian vegetation is due to altered soil moisture and disturbance regimes (Burton et al. 2009; Groffman et al. 2003; White and Greer 2006). However, less is known about how dispersal properties may constrain species composition in urban riparian areas, particularly those of small streams The purpose of this study is to determine how different seed dispersal vectors affect the formation and maintenance of riparian vegetation communities adjacent to small, urban streams.

Urbanization can drastically alter the hydrology of streams and their riparian areas. Impervious surface areas channel water quickly to streams, leading to flashy hydrographs and incised channels. Channel incision combined with reduced water infiltration can reduce groundwater levels in riparian areas (Groffman et al. 2003). There can be particularly drastic effects of urbanization on small streams and their riparian areas, because these systems rarely receive any protection. Reduced baseflow can affect the permanence of small streams (Roy et al. 2009).

Studies have shown large effects of urbanization on riparian vegetation. Non-native species and early successional species are more common in urban riparian communities than their non-urban counterparts. Understory vegetation in particular seems to be affected by urban development (Pennington et al. 2010). Mature riparian trees can appear to be unaffected by urban development, however Burton et al. (2009) found that the species composition in the woody regeneration layer is often altered. In surveyed urban riparian areas, the regeneration layer was characterized by more flood and shade intolerance, fast growth rate, and shorter life span than the mature layer (Burton et al. 2009). There is some evidence that these changes are at least partially due to altered hydrology in these areas (Groffman et al. 2003).
It is unclear how dispersal processes in urban areas may contribute to the altered vegetation communities characteristic of urban riparian areas. Several studies of riparian vegetation have found hydrochory (dispersal by water) to be an important dispersal vector and a major factor in shaping vegetation communities (Honnay et al. 2001, Nilsson et al. 2010, Merritt et al. 2010, Moggridge and Gurnell 2010). Hydrochory appears to be the most important dispersal vector in the winter time when flows are high (Gurnell et al. 2008, Moggridge and Gurnell 2010), while anemochory (dispersal by wind) may be more important during the summer (Moggridge and Gurnell 2010).

Along small streams (first- to fourth-order) much less is known about seed dispersal and deposition processes than along larger streams (Richardson et al. 2005), however the results of two studies suggest that hydrochory may play an important role (Honnay et al. 2001, Vogt et al. 2004). There is a particular lack of knowledge about seed dispersal and deposition in urban riparian areas of small streams.

The overall goal study is to determine how seeds are deposited in riparian areas of small urban streams, and what the consequences of different dispersal vectors are for the resulting vegetation community. Four research questions have been established: 1) Are substantial numbers of seeds brought into the riparian areas by hydrochory? 2) Are different vectors important for native and non-native species or for wetland and upland species? 3) Are there seasonal differences in seed deposition by different vectors? 4) Are “new” species (species not present in the standing vegetation) being deposited? By which vectors are they deposited and at what time of year?

Riparian areas of first- to fourth-order streams will be selected in the metropolitan area of Portland, Oregon. The vegetation along each selected stream reach will be surveyed in the summer. Seeds in the soil bank and seeds deposited by multiple vectors will be sampled and compared to species in the standing vegetation. Soil seed bank samples will be taken in the spring using a soil core sampler. Artificial turf mats will be placed at different elevations on the bank to trap seeds deposited by the stream, following the methods of Wolters, et al. (2004). Mats will be checked and replaced every week and after any large storms. Funnel traps will also be placed at different elevations along the bank to trap seeds deposited by wind. Traps will be left in the sites for a full year to capture seasonal variation in deposition patterns. After cold stratification, seeds from traps and seed bank samples will be grown in a greenhouse and
seedlings will be identified to species. Environmental parameters, including stream flow, wind speeds, and riparian buffer width will be measured at each site and related to dispersal vectors. Species caught in the different traps will be compared to those in the soil seed bank and the standing vegetation using Sorensens similarity index.

References


Topic Areas for Exam Questions

Subject Area 1: Urban ecology and hydrology (Dr. Yeakley)
- Urban soils, hydrology, and vegetation
- Watershed hydrology

Relevant Coursework:
ESR 528 Urban Ecology (Dr. Yeakley)
ESR 525 Watershed Hydrology (Dr. Hagimoto from Oregon State University)

Literature:

Subject Area 2: Plant ecology (Dr. Eppley)
- Dispersal and seed ecology
- Plant life history ecology
- Community ecology

Relevant Coursework:
BI 571 Plant Ecology (Dr. Eppley)
BI 541 Plant Physiology (Dr. Rosenstiel)

Literature:


**Subject Area 3: Wetland and riparian ecology (Dr. Maser)**

- Wetland/riparian biogeochemistry
- Plant adaptations to wetland and riparian environments

Relevant Coursework:

ESR 524 Wetland Ecology (Dr. Maser)

Literature:


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Education

Graduate Student, seeking PhD
Portland State University, School of the Environment, Environmental Science and Management
Dr. Alan Yeakly, PhD advisor
Fall 2009- current

B.A., Cum Laude, 2007
Macalester College, St. Paul, MN
GPA 3.60, Major GPA 3.63
Biology major, Geology and Hispanic Studies minors

School for International Training, Experiment in International Living
Semester abroad, Quito, Ecuador
Comparative Ecology and Conservation
Spring 2006

Research and Teaching Experience

Urban riparian plant research - characterizing urban riparian communities in the Portland Metro Area. Part of a project funded by the US Forest Service, Dr. Alan Yeakley, project advisor
Summer 2010 – Summer 2011

NSF GK-12 Teaching Assistant
Portland State University, Department of Environmental Science and Management
Fall 2010-current

Graduate Teaching Assistant
Portland State University, Department of Environmental Science and Management
Fall 2009 – Spring 2010

Research Assistant and Seeds of Success project coordinator
Berry Botanic Garden, Portland, OR
Fall 2007 – Fall 2010

Conservation Biology Intern
Berry Botanic Garden, Portland, OR
Summer 2007
Herbarium Manager
Macalester College Biology Department, St. Paul, MN
Spring 2007

Ecology Research Assistant
"Fluctuating resources and mechanisms of invasibility along the prairie-forest border", Mark Davis, PI, NSF Grant Number DEB-0208125, 2002-2006
Cedar Creek Natural History Area LTER, East Bethel, MN
Summer 2006

Biology Honors Research Project
“Wetland birds: Effects of local and landscape features on community structure.”
Professor Mark Davis, Advisor, Macalester College Biology Department, St. Paul, MN
2006-2007

Independent Research Project
“Behavior and distribution of the Toucan-Barbet (Semnornis ramphastinus) in the Rio Guajalito Ecological Reserve, Pichincha, Ecuador.”
Vlastimil Zak and Xavier Silva, Ph.D., Advisors
Spring 2006

Posters and Presentations

Student Member, Phi Kappa Phi Honor Society
Inducted Spring 2011

January 24, 2011

Christa von Behren. Impact of agriculture and urban development on the community structure of wetland birds in East Central Minnesota. Presentation at the Winchell Undergraduate Science Symposium, Minneapolis, Minnesota
April 2007

Grants and Awards

William R. Angell Foundation Prize
Macalester College Department of Biology
May 2007

Winchell Undergraduate Science Symposium Best Presentation, Population and Organismal Biology category
April 2007