Comprehensive Exam Prospectus

Ph.D. in Environmental Sciences and Resources

Submitted by: Christine L. Weilhoefer
February 2002

For Examinations to be taken:
April 2002

Comprehensive Examination Committee
Portland State University

Dr. Yangdong Pan
Dr. Roy Koch
Dr. Joseph Maser
Dr. John Rueter

Approvals

The Comprehensive Examination proposal submitted herein for Christine L. Weilhoefer is hereby approved.

Examination Committee:

Dr. Yangdong Pan ___________________________ Date ____________

Dr. Roy Koch ___________________________ Date ____________

Dr. Joseph Maser ___________________________ Date ____________

Dr. John Rueter ___________________________ Date ____________
Curriculum Vitae
Christine Lynn Weilhoefer

Education:
2000 - present  Portland State University, Portland, OR
    enrolled in Ph.D. program in Environmental Sciences and Resources
    Awards: EPA STAR Graduate Fellowship  (2001 - 2004)
            Oregon Sports Lottery Scholarship (2000 - 2001)

1995 - 1998  University of Texas at Austin, Austin, TX
    MA, Marine Science
    Thesis: The effects of freshwater inflow, salinity and nutrients on salt
            marsh vegetation in south Texas.
    Awards: University Graduate Fellowship (1995 - 1996)

    BA, Environmental Studies and Botany
    Honors Thesis: Assessment of recent and long-term limnological trends
    in a eutrophic lake in western Connecticut.
    Awards: graduated summa cum laude and with Honors

Work Experience:
3/00 - 9/01: Graduate Research Assistant, ESR Dept., Portland State University, Portland, OR
    Assessment and classification of Oregon Coastal Range ecoregion streams based on diatom
    assemblages as part of the Oregon DEQ Salmon Initiative. Duties included: diatom identification,
    data analysis and result publication.

8/00 - 9/01: Adjunct Professor, The Art Institute of Portland, Portland, OR
    Responsible for designing the curriculum and teaching the lectures and laboratory activities for
    introductory Environmental Science course.

1/01 - 6/01: Adjunct Professor, Clark College, Vancouver, WA
    Responsible for teaching lectures and laboratory activities for introductory Biology course.

6/95 - 8/98: Graduate Research Assistant, Department of Marine Science, UT Austin, TX
    Researched impacts of freshwater diversion and increased nutrient loading on salt marsh vegetation.
    Responsible for data analysis, presentation and publication. Teaching Assistant for Marine Botany and
    Estuarine Ecology courses: designed and supervised lab activities.

1/98 - 6/98: Teaching Assistant, Department of Biological Science, UT Austin, TX
    Assisted in supervision of laboratory and fieldwork exercises and graded laboratory reports for
    introductory Ecology course.

    Co-designed and supervised study of Connecticut River shoreline vegetation. Duties included: vegetation
    identification and mapping and creation of management guidelines.
Assessed the impacts of changing land-use patterns on aquatic ecosystems. Duties included: diatom identification, water chemistry analysis and GIS work.

Publications:
Weilhoefer, C. L. and Y. Pan. 2001. Using diatom assemblages to assess freshwater wetland health in the Columbia River Basin, OR (manuscript in prep.).
Weilhoefer, C. L. and Y. Pan. 2001. Using periphyton to assess stream quality in Oregon coastal range streams (manuscript in prep.).
**Research Abstract:**

*Can a Biota-Based Model Be Used to Assess Wetland Mitigation?*

**Research Rationale and Goals:** Loss of wetland acreage continues to be a problem in the United States despite the “no net loss” policy advocated by the National Wetlands Policy Forum. Section 404 of the U.S. Clean Water Act calls for mitigation of wetland acreage lost as a result of development activities. Wetland mitigation has become a common practice, but successful restoration has not been well documented. The imperiled status of wetlands warrants a scientifically based method to assess the success of wetland mitigation projects. One of the key elements in undertaking a study of mitigation wetlands is having a reference standard for comparison of ecological structure and function. Reference wetlands should exhibit typical, pre-disturbance conditions for the study area. However, reference wetlands may differ from one another based on key abiotic factors that can cause changes in wetland structure even in the absence of environmental stress. This can confound their utility to serve as benchmarks for mitigation success. The goal of my dissertation research is to develop a predictive model for assessing the success of mitigated wetlands.

**Approach:** My dissertation research will consist of three main steps:
1. Develop a biota-based classification system to account for heterogeneity of natural wetlands. This will be accomplished by classifying natural wetlands into several biologically similar groups based on diatom assemblages.

![Diagram showing classification system](image)

2. Identify a suite of environmental variables that can best be used to distinguish among groups using multiple discriminant function analysis. This discriminant function will also serve as a predictive tool.

3. By predicting what group a mitigated wetland falls into, the discriminant function model will be able to predict the species membership for that site based on its environmental conditions. A comparison of the expected species with the observed species (O/E ratio) will provide a measure of success of mitigation because it tells how closely the biotic component compares with reference wetlands of similar environmental characteristics.

![Diagram showing discriminant functions](image)

\[
DF1 = a_1X + b_1Y \\
DF2 = a_2X + b_2Y
\]

X, Y: environmental variables  
a, b: discriminant function coefficients
Topic for Exam Questions:

**Area 1: Algal Ecology and Bioassessment: (Dr. Pan)**
Key Topics: hierarchical concept of ecosystems, ecological heterogeneity, periphyton pattern in freshwater wetlands, interactions between benthic algae and their substrata, ecological integrity, reference condition, paleolimnology

**Area 2: Wetland Ecology and Management: (Dr. Maser)**
Key Topics: wetland ecosystem development, wetland classification (HGM), wetland legislation (federal and Oregon State), freshwater wetland mitigation (restoration, creation, enhancement)

**Area 3: Hydrology: (Dr. Koch)**
Key Topics: flow patterns (overland flow, subsurface flow, base flow), aquifer properties (i.e. porosity, hydraulic conductivity, specific yield), Darcy’s Law, hydrograph,

**Area 4: Physiology/Biogeochemistry: (Dr. Rueter)**
Key Topics: algal growth and nutrient uptake, optimization, biogeochemical cycles (C, N, P), soil chemical reactions, soil structure/development, species interactions (i.e. competition),

**Area 5: (Statistics)**
Key Topics: normal distribution, binomial/Poisson distribution, data types (i.e. categorical, continuous, nominal), hypothesis testing (single group, two group, multiple group comparisons), correlation, regression (simple linear, multiple), concepts of multivariate statistics

**Reference List:**


APPENDIX: Course Syllabi and Reading Lists

(only syllabi for courses not taught by committee members provided)

Area 2: Wetland Ecology and Management
ESR 524 Wetland Ecology: Dr. Maser

Area 3: Hydrology
1. ESR 525 Watershed Hydrology: Dr. Koch
Text: Physical Hydrology, 1st edition, S. L. Dingman
2. G 543 Groundwater Geology: Dr. A. Fountain
1. Hydrologic Cycle (pp 1-11, 27-70)
2. Definitions and Properties of Aquifers (pp 77-102)
3. Flow Equations (pp 103-126; 131-153)
4. Aquifer Tests (pp154-171; 197-264)
5. Regional Groundwater (pp275-308)
6. Groundwater Geology (pp319-377)
7. Unconfined Flow (pp163-170)
8. Unsaturated Flow (pp175-191)

Area 4: Physiology/Biochemistry
1. ESR 510 Algal Physiology: Dr. J. Rueter
Readings:
2. ESR 527 Terrestrial Biogeochemistry: Dr. A. Yeakley
Topics:
1. Earth as a biogeochemical system, atmospheric processes
2. Lithosphere and soil processes
3. Carbon cycling
4. Biogeochemical processes in terrestrial ecosystems
5. Hydrology and chemistry of forested ecosystems
6. Nutrient cycling of forested ecosystems
7. Biogeochemical processes in riparian zones
8. Management Considerations
Texts:
A. Biogeochemistry- W. H. Schlesinger (ch 1, 3, 4, 5, 6)

Papers:

3. Bi 523 Microbial Ecology: Dr. A. Reysenbach
Course Topics: Basic ecology definitions, overview of microbial diversity, species concept, methods in microbial ecology, population ecology and biogeography, community ecology, productivity and diversity, biogeochemical cycles (C, N, O, S, Fe, P, Mn)

Readings from:
Ch 3: Interactions among microbial populations
Ch 4: Interactions between microorganisms and plants
Ch 7: Quantitative ecology: numbers, biomass and activities

Papers:

Area 5: Statistics
ESR 510 Biostatistics: Dr. R. Koch
Text: Biostatistical Analysis, J. H. Zar