

Forest Ecosystems and Society – Final Competency Plan, PhD

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1. Disciplinary skills and knowledge.

Knowledge of a student's chosen field of study, and closely related fields, including history and trends in major findings, concepts, theories, approaches, and context.

A. Learning Outcomes

- 1) Develop expert knowledge in the fields of hydrology and geomorphology that will enable me to evaluate the processes and variables related to the transport of large wood from terrestrial environments to riparian and aquatic environments.
- 2) Develop expert knowledge in the field of aquatic ecology that will enable me to evaluate the interaction of large wood with aquatic environments in temperate forests of the Pacific Northwest.
- 3) Develop expert knowledge about the development and ecological function of large wood in terrestrial and aquatic environments of temperate forests of the Pacific Northwest.

B. How will competency be achieved?

1) Coursework Completed

- ❖ *FE 530: Watershed Processes (4)*. Effects of land use practices on the physical hydrology (interception, infiltration, evapotranspiration, subsurface flow and surface runoff, water yields, and peak flows) of forested watersheds.
- ❖ *FE 532: Forest Hydrology (4)*. Physical hydrology, erosion processes, and attributes of stream ecosystems for forested watersheds.
- ❖ *FE 536: Watershed Impacts of Forest Disturbance (4)*. Impacts of forest disturbance (primarily harvest) on watershed hydrology, fluvial erosion, translational landslides, large wood, and stream temperatures.
- ❖ *FS 553: Forest Wildlife Habitat Management (4)*. Management of terrestrial vertebrates in forest ecosystems. Effects of silvicultural practices and landscape pattern on habitats and populations.
- ❖ *FES 536: Carbon Sequestration in Forests (2)*. Understand global carbon cycle at the scale of stands, landscapes and the globe. Understand the effects of forest management systems or carbon sequestration.

2) Coursework to be completed

- ❖ *FW 580: Stream Ecology (3)*. Structure and function of stream ecosystems, with emphasis on biological processes; physical and chemical relations; riparian influences and landscape perspectives.
- ❖ *Geo 548: Field Research in Geomorphology and Landscape Ecology (3)*. Natural history interpretation of disturbance and recovery processes and management implications in forest-stream landscapes of western Oregon. Course consists of field experience and several seminars.

(Disciplinary skill and knowledge, continued)

- ❖ *FES 505: Reading and Conference (3)*. Content to be developed by Committee members Dr. Walter White and Dr. Roy Hinkley on stochastic processes related to episodic disturbance in forested watersheds.
- ❖ *FOR 646, Forest Ecosystem Analysis and Application (4)*. The structure and function of forests and associated streams in natural and managed landscapes; application of ecosystem analysis to policy management decisions; roles of models; scaling from individual processes to ecosystems, landscapes, and beyond.

3) Integration of knowledge gained in course work through research and writing.

4) Knowledge gained through research.

C. How will competency be demonstrated?

1) Successful completion of required coursework.

2) Successful completion of preliminary exams.

3) Through results evidenced in research, dissertation, and publications.

2. Trans-disciplinary/interdisciplinary skills and knowledge

Knowledge of the relationship of the student's field/s of study to social and/or biophysical sciences, and approaches for integration and synthesis during research, outreach, and teaching. For social science students, emphasis is on knowledge of biophysical sciences and how to use them to analyze and interpret information. For biophysical science students, knowledge of social sciences and how to use them to analyze and interpret information.

A. Learning Outcomes

- 1) Effectively integrate knowledge from the fields of stream ecology, hydrology, economics, law, and social sciences into policy alternatives that provide for the maintenance of riparian and aquatic ecosystem values at watershed scales of analysis, *and* over temporal scales that consider the episodic nature of landscape-level disturbance regimes.
- 2) Integrate consideration of the motivations and values of forest and agricultural landowners into policy analysis and the development of policy options.

B. How will competency be achieved?

- 1) Completed and planned coursework includes topics of ecology, hydrology, economics, education, and social values related to natural resources.
- 2) My Master's had a concentration in Natural Resources Education and Extension, and included coursework in education theory, and in social sciences related to natural resources. As a project-in-lieu of thesis, I integrated knowledge from diverse sources (qualitative and quantitative; grey and peer-reviewed literature) about the interests, motivations, beliefs, and prior knowledge of small woodland owners with respect to intergenerational planning, invasive species management, climate change, riparian management, and the development of management plans.

C. How will competency be demonstrated?

- 1) My PhD dissertation will integrate topics hydrology, geomorphology, aquatic ecology, law, policy, economics, and social science.
- 2) My Master's project, *Toward the development and application of novel strategies for the pursuit of Gococcyx californicus*, provides a representation of transdisciplinary skills and knowledge acquired during my Master's program.

3. Communication skills (oral, written, professional)

Ability to write and speak to diverse audiences in an organized and clear fashion about relevant areas of expertise, both disciplinary and inter/transdisciplinary. Ability to modify oral and written communications for specific audiences. Knowledge of contemporary electronic tools for communication, such as for supporting lectures, social media, and blogs.

A. Learning Outcomes

- 1) Ability to write scientific and technical documents for publication that effectively communicate intended content in a professional, objective, and engaging manner.
- 2) Ability to present technical material to diverse audiences that effectively communicates intended content in a professional, objective, and engaging manner.
- 3) Effectively use contemporary electronic tools to compose and present technical material to diverse audiences.

B. How will competency be achieved?

- 1) Communication skills, especially writing skills, are a necessary component of much graduate-level coursework. My written, presentation, and professional communication skills have, and will continue, to improve as a result of my graduate coursework.
- 2) My Master's program of study had a specialty concentration of Natural Resources Education and Extension. Education theory coursework was grounded in socio-cultural learning theory, and included *Communities of Practice* and *Free-Choice Learning* models. These models emphasize the importance of individual and group identities, and the importance of tailoring the presentation of information to characteristics of the individual or audience.
- 3) For three terms I have taught writing in FOR 460 (Forest Policy), an Intensive Writing Class, as the Graduate Teaching Assistant. In that capacity, I have organized the assignments, presented lectures on writing, graded papers, and discussed writing quality with students. I will continue for one more year (three more classes) as the FOR 460 Teaching Assistant. This work has provided me valuable lessons that have allowed me to develop my writing, presentation, and communication skills.
- 4) As I complete stages of my academic program and research, I will gain experience by communicating my findings through publication, posters, and oral presentation.
- 5) I will take workshops offered on campus in the use of contemporary electronic communication tools.

C. How will competency be demonstrated?

- 1) My ability to effectively communicate ideas verbally and in writing to diverse audiences will be demonstrated through publications, presentations, and lectures.
- 2) Competency in the application of contemporary electronic communication tools will be demonstrated through the ability to effectively use tools such as *Blackboard* and *Canvas*, conferencing software, social media, and blogs.

4. Critical thinking skills

Ability to evaluate the quality, context, scale, and biases in information, and to synthesize diverse kinds of information, in written and oral forms. Capacity for real-time discussion of biophysical and social systems and their interactions.

A. Learning Outcomes

- 1) Ability to evaluate the validity and scope of inference of information from diverse sources as they apply across different conceptual frameworks, analytical constructs, and scales of analysis.
- 2) Ability to integrate and synthesize diverse forms of knowledge relating to watershed analysis, policy analysis, and policy formulation.
- 3) Ability to recognize conceptual connections (or disconnects) across knowledge domains.
- 4) Ability to apply logical principles of argument construction and analysis in my own work, and in evaluating the work of others.

B. How will competency be achieved?

- 1) For my Master's project, I developed a comprehensive Critical Appraisal Tool as a means of assessing the validity and generalizability of literature describing characteristics of Oregon small woodland owners. This subject literature came from diverse methodological and conceptual backgrounds, including quantitative landowner surveys and qualitative case studies. The work required clarification and alignment of applied constructs and units of analysis, and consideration of the epistemological and ontological foundations of the respective methodologies.
- 2) For my Master's project I integrated knowledge from diverse sources (qualitative and quantitative; grey and peer-reviewed literature) about the interests, motivations, beliefs, and prior knowledge of small woodland owners with respect to intergenerational planning, invasive species management, climate change, riparian management, and the development of management plans.
- 3) As with communication skills, critical thinking skills are an integral component of much graduate-level coursework. Coursework I have completed that has stressed critical thinking includes:
 - ❖ *FOR 563, Environmental Policy and Law Interaction (3)*. Required critically integrating statutory and regulatory authorities with legal precedent arising from judicial opinions to assess the policy implications of complex and evolving legal frameworks.
 - ❖ *FOR 599, Conservation Ethics (2)*. This course teaches argument analysis and construction as a means of identifying the underlying premises that are at the core of natural resource controversies.
 - ❖ *FOR 534, Economics of the Forest Resource (3)*. Course structure required critical analysis and discussion of key literature in the field of natural resource economics.
 - ❖ *FES 521, Natural Resource Research Planning (3)*. Course content included critical analysis of research proposals of peers, and revision of my own research proposal based on peer review.

(Critical Thinking, continued)

C. How will competency be demonstrated?

- 1) My Master's project, *Toward the development and application of novel strategies for the pursuit of Gococcyx californicus*, provides a representation of critical thinking skills acquired during my Master's program.
- 2) Competency in critical thinking will be demonstrated through the overall conceptual integrity of my work, including attention paid to epistemological, ontological, and theoretical foundations as they relate to political, social, ethical, and scientific contexts.

SAMPLE

5. Research skills

Knowledge sufficient to understand the use of quantitative and qualitative summaries of data as evidence for conclusions and scientific inference. This can include skills and knowledge with statistical, mathematical, graphical and process models sufficient to plan, implement, analyze, and interpret research.

A. Learning Outcomes

- 1) Evaluate the validity and scope of inference of research findings as they apply across geographic and temporal scales, and conceptual and theoretical frameworks.
- 2) Effectively use ecological and physical (e.g., hydrologic) process models within a geographic information systems as a means of analyzing and interpreting primary scientific research findings.
- 3) Formulate research questions, develop research projects, and write research proposals.

B. How will competency be achieved?

- 1) For my Master's project, I developed a comprehensive Critical Appraisal Tool as a means of assessing the validity and scope of inference of literature describing characteristics of Oregon small woodland owners. This subject literature came from diverse methodological and conceptual backgrounds, including quantitative landowner surveys and qualitative case studies. The work required clarification and alignment of applied constructs and units of analysis, and consideration of the epistemological and ontological foundations of the respective methodologies.
- 2) For my Master's project I integrated knowledge from diverse sources (qualitative and quantitative; grey and peer-reviewed literature) about the interests, motivations, beliefs, and prior knowledge of small woodland owners with respect to intergenerational planning, invasive species management, climate change, riparian management, and the development of management plans.
- 3) Research skills will be developed and sharpened in the process of writing research proposals and peer-reviewed publications.
- 4) Coursework Completed
 - ❖ *GEO 599: GIS Programming with Python (3)*. Using Python programming language to program routines within ArcMap GIS software.
 - ❖ *GEO 580, Advanced GIS Applications in Geosciences (4)*. Explores the concepts and uses of geographic information systems (GIS) for spatial analysis. Structured as an applications-based course where students learn how to acquire, clean, integrate, manipulate, visualize and analyze geospatial data through laboratory work.
 - ❖ *GEO 565, Geographic Information Systems and Science (4)*. Introduction to modern spatial data processing, development, and functions of geographic information systems (GIS); theory, concepts and applications of geographic information science
 - ❖ *FES 521, Natural Resource Research Planning (3)*. Research planning and study plan development, investigative procedures, the principles and ethics of natural resource science, principles and practices in scientific communication.

(Research Skills, continued)

- ❖ *FES 520, Posing Research Questions (3)*. Acquaints beginning graduate students in the natural resources to the scientific method and formation of good researchable questions. The course consists of lectures, readings and discussions. Concepts in the course are reinforced and amplified by discipline-specific companion modules. Students prepare and orally present a researchable question in their area of interest that is critiqued by the class and instructors.
- ❖ *ST 511, Methods of Data Analysis (4)*. Graphical, parametric and nonparametric methods for comparing two samples; one-way and two-way analysis of variance; simple linear regression.

5) Coursework to be completed

- ❖ *GEO 544, Remote Sensing (4)*. Fundamentals of satellite remote sensing and image analysis. Topics include physical principles of remote sensing from the ultraviolet to the microwave, sensors and sensor technology, and environmental applications of remote sensing through image analysis.
- ❖ *CE 505, 3D Laser Scan and Imaging (Lidar) (3)*.

C. How will competency be demonstrated?

- 1) My Master's project, *Toward the development and application of novel strategies for the pursuit of Gococcyx californicus*, provides a representation of my ability to assess the validity and scope of inference of social research.
- 2) Successfully complete required coursework.
- 3) Through results of my graduate work evidenced in research, dissertation, and publications.
- 4) Write, and have accepted for publication, a scientific article in a peer-reviewed journal.

6. Research ethics

Knowledge of processes and guidelines for assuring that research is conducted in socially and professionally acceptable and legal ways, while minimizing and managing conflicts of interest. Topics of relevance may include conduct general ethics, peer review, bias during data analysis and presentation, plagiarism, animal welfare, treatment of human subjects, collaboration, and authorship.

A. Learning Outcomes

- 1) Apply all ethical guidelines and practices in the conduct and publication of scientific research.
- 2) Recognize and avoid professional conflicts of interest.

B. How will competency be achieved?

- 1) Two courses that I have completed, FES 520 and FES 521, included segments in research ethics in natural resources research.
- 2) I completed the social science ethics training module as a condition for IRB approval of my Master's research project.

C. How will competency be demonstrated?

- 1) Successful completion of coursework.
- 2) As demonstrated in personal and professional conduct, and in work plans and proposals, work in progress, and completed work.

7. Policy analysis/interpretation

Knowledge of the laws, regulations, social institutions, and governance processes relevant to application of a student's disciplinary and/or inter/transdisciplinary areas of study.

A. Learning Outcomes

- 1) Apply knowledge of relevant laws and regulations (e.g., Clean Water Act, Endangered Species Act, O&C Act, Oregon Forest Practices Act, and National Environmental Policy Act) to frame and analyze natural resource issues.
- 2) Apply knowledge of existing laws, regulations, social institutions, and governance processes to develop alternative policies that conserve aquatic ecosystems.

B. How will competency be achieved?

1) Completed Coursework

- ❖ *FOR 561, Forest Policy Analysis (3)*. Application of federal environmental laws and requirements of the Northwest Forest Plan to sustaining aquatic ecosystems. Emphasis on policy analysis and its uses in decision making.
- ❖ *FOR 563, Environmental Policy and Law Interaction (3)*. Examines environmental torts, regulation of point and non-point source pollution under the federal Clean Water Act, wetlands protection, and laws governing agricultural and forest practices as examples of regulatory frameworks for achieving resource protection.
- ❖ *MRM 520, Coastal Law (3)*. Examines federal and state judicial and legislative protection of public beach access rights; ownership and use of tide and submerged lands, including the public trust doctrine and the federal and state navigation servitudes; federal and state protection of wetlands; and the Federal Coastal Zone Management Act.
- ❖ *FOR 534, Economics of the Forest Resource (3)*. Economic aspects of forest production, regulation, and silvicultural applications. Microeconomic interactions of forest production and regulation and environmental constraints.

2) Coursework to be completed

- ❖ *FOR 562, Natural Resource Policy and Law (3)*. Focus is on mechanisms governing resource allocation within the constraints of private property rights. Emphasis is placed on the federal Endangered Species Act and its relation to water allocation and public trust doctrines. Students will also gain a broad understanding of regulatory "takings" law and the evolving dynamic of government imposed constraints on private property rights in the context of natural resource and species protection.

C. How will competency be demonstrated?

- 1) Competency will be demonstrated by successful completion of coursework.
- 2) Competency will be demonstrated in my research and dissertation by my ability to effectively develop and evaluate alternative policy scenarios for conserving aquatic ecosystems in the context of federal and state laws and regulations.

8. Teaching

Knowledge of contemporary pedagogy, relevant STEM teaching methods, and experience in their application in classrooms, online, and technical/professional environments. Experience in development of a classroom and/or online course, including development of a course syllabus that includes learning outcomes, lectures, laboratories, student assignments, and evaluation methods.

A. Learning Outcomes

- 1) Knowledge, skill, and ability to develop effective curriculums for teaching complex, technical, and/or potentially controversial natural resource topics to diverse audiences.
- 2) Knowledge, skill, and ability to effectively teach complex, technical, and/or potentially controversial natural resource topics to diverse audiences.

B. How will competency be achieved?

- 1) The focus of my Master's program was in Natural Resources Education and Extension. Education theory coursework I completed as part of my program of study was grounded in socio-cultural learning theory, and included *Communities of Practice* and *Free-Choice Learning* models.
- 2) I have worked as a teaching assistant for five terms, and will continue to do so in the 2015/2016 academic year. I have assisted with the development of the course syllabus for FOR 460, Forest Policy, and developed the Writing Intensive Curriculum (WIC) component of the syllabus for the class. I have been responsible for providing course content related to writing, and for coordinating and grading all writing assignments for the course.
- 3) I will assist with the development of content for the new course in the *Natural Resources* curriculum, *When Science Escapes the Lab*.

A. How will competency be demonstrated?

- 1) Competency will be demonstrated the effectiveness of the course(s) I help develop.
- 2) Competency will be demonstrated by feedback from students, formal course evaluations, and independent observations of classroom teaching effectiveness. In the coming academic year, we will add questions to the student evaluation questionnaire about the quality and effectiveness of my teaching.