PROFESSIONAL SCIENCE MASTER’S IN APPLIED SYSTEMATICS IN BOTANY
(Name Change)

Name of Institution: Oregon State University
Name of Proposing College: Agricultural Sciences
Name of Proposing Program: Botany and Plant Pathology
Date of Proposal: 29 June 2011
Proposed Effective Term: Fall 2011

A. Title of the proposed instructional, research, or public service unit. For name changes, give both the current and proposed names. Describe the reason(s) for the proposed change.

Current name: MS in Botany and Plant Pathology (non-thesis option in Applied Systematics in Botany)
Proposed name: Professional Science Master’s in Applied Systematics in Botany

This program has been offered as a non-thesis Professional Science Master’s (PSM) program since 2003. The PSM is a unique program that combines graduate-level education in Science, Technology, Engineering, or Mathematics (STEM) with training in business management, communication, research ethics, and other employer-relevant skills (http://psm.science.oregonstate.edu). Students complete an internship in lieu of thesis research, giving them practical experience in the workplace. There are now over 238 PSM programs offered by 110 institutions across the U.S. (http://sciencemasters.com/). There is a statewide PSM program development project underway involving multiple campuses in the OUS (http://oregonpsm.org). The Oregon University System (OUS) Provosts’ Council and State Board of Higher Education approved the “PSM” as a new degree option in Oregon (http://www.ous.edu/sites/default/files/about/polipro/files/ORPSMGuidelinesNov2010.pdf) on 24 February 2011. Changing the name of the degree will help us brand and promote these unique programs to employer groups, prospective students, and will recognize graduates who’ve completed this education, designed to provide depth of knowledge in STEM disciplines as well as breadth of training in management.

B. Location within the institution’s organizational structure. Include “before” and “after” organizational charts (show reporting lines all the way up to the Provost).

There will be no change in location within OSU’s organizational structure. This degree will offered as an option through the existing Botany and Plant Pathology (BOT) Program residing in the Department of Botany and Plant Pathology, College of Agricultural Sciences.

C. Objectives, functions (e.g., instruction, research, public service), and activities of the proposed unit.

1. Explain how the program’s current objectives, functions, and/or activities will be changed. Where applicable, address issues such as course offerings, program requirements, admission requirements, student learning outcomes and experiences, and advising structure and availability. How will the reorganized program be stronger than the existing program?
The existing degree options in the BOT Program will remain the same; however, a PSM in Applied Systematics in Botany will now be recognized as a separate degree instead of simply a non-thesis MS option within the program.

Systematics is the science devoted to the discovery, description, and classification of the earth's biological diversity. The need for an accurate and comprehensive knowledge of biological diversity is now recognized by a broad array of interests in the public and private sectors. Plants and fungi are the focus of current initiatives in the conservation of endangered species, the restoration of native ecosystems, and the control of invasive weeds. The objective of the PSM in Applied Systematics in Botany is to train students to be able to function effectively in non-governmental organization, consulting, government agency, and non-profit settings where these skills are needed.

The PSM program can usually be completed in two years, based on full-time study and at least 50 credit hours. [http://psm.science.oregonstate.edu/program-curriculum-m-s-applied-systematics](http://psm.science.oregonstate.edu/program-curriculum-m-s-applied-systematics)

Comparison between the BOT non-thesis MS and PSM in Applied Systematics in Botany:

<table>
<thead>
<tr>
<th>MS Botany &amp; Plant Pathology</th>
<th>PSM Applied Systematics in Botany</th>
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</thead>
<tbody>
<tr>
<td>Core courses (20-23 credits)</td>
<td>Core courses (19 credits)</td>
</tr>
<tr>
<td>Electives and seminar (4 credits)</td>
<td>Electives (7 credits)</td>
</tr>
<tr>
<td>Cohort courses (9 credits)</td>
<td>Professional courses (18 credits)</td>
</tr>
<tr>
<td>Research and thesis (9-12 credits)</td>
<td>Internship (BOT 510; 6-12 credits)</td>
</tr>
<tr>
<td>Total: minimum 45 credits</td>
<td>Total: minimum 50 credits</td>
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Core courses form the foundation of both programs and are the same except MA, MS and PhD degree requirements also require either Advanced Plant Systematics (BOT 521; 4 credits) or Selected Topics in Mycology (BOT 590; 1-3 credits). Core courses for the PSM in Applied Systematics in Botany include:

**BOT 516. AQUATIC BOTANY (4).** Taxonomy and ecology of aquatic vegetation, emphasizing freshwater and marine algae and the submergent vascular plants. Morphology, physiology, and classification of the algae; morphological and physiological adaptations of aquatic vascular plants; and primary production in aquatic ecosystems. Laboratory practice in the identification of local taxa. Field trips. Lec/lab. PREREQS: BI 213

**BOT 561. MYCOLOGY (4).** A broad taxonomic survey of the fungi. Topics include life histories, systematics, ecology, genetics, and ethnomycology. Participation on field trips and the submission of a specimen collection are required. Lec/lab. PREREQS: BI 213

**BOT 514. AGROSTOLOGY (4).** Classification and identification of grasses, with emphasis on the modern system of grass classification; laboratory practice in keying grass specimens to genus and species. Lec/lab. PREREQS: BOT 321

**BOT 565. LICHENOLOGY (4).** Biology of lichens; includes structure, life histories, classification, and ecology. Field trip fee. Lec/lab. Offered alternate years. PREREQS: BI 213 and two botany courses.

BOT 525. FLORA OF THE PACIFIC NORTHWEST (3). Vascular plant identification, terminology, and diagnostic characteristics of plant families. Lab emphasizes the use of keys for identification to the species level and ability recognize by sight those plant families found in the Pacific Northwest. Field trips. Lec/lab. PREREQS: BOT 321 or equivalent.

Approved electives are chosen in consultation with the student’s major advisor and include a minimum of 7 credit hours chosen from the following options:

BOT 542. PLANT POPULATION ECOLOGY (3). Ecological aspects of plant form and reproduction; demography and population modeling; species interactions, including competition, mutualism, and herbivory. Lec/lab. PREREQS: BOT 341 or equivalent.

BOT 543. PLANT COMMUNITY ECOLOGY (3). The structure, diversity, and successional dynamics of terrestrial plant communities; methods of analysis. Lec/lab. PREREQS: BOT 341 or equivalent.

FOR 545. ECOLOGICAL RESTORATION (4). Fundamentals of restoring and reclaiming disturbed landscapes and ecosystems. Topics to be covered include types and assessment of site conditions; determining restoration goals and feasibility; hydrologic, biotic, and soil functions and their importance in restoration; and measures of successful restoration. CROSSTLISTED as FW 445/FW 545. PREREQS: BI 370 or instructor approval required.

CSS 530. PLANT GENETICS (3). Introduction to the principles of plant genetics with an emphasis on the structure and function of economically important plant genomes. CROSSTLISTED as HORT 430/HORT 530. PREREQS: One year of biology and chemistry.

BI 570. COMMUNITY STRUCTURE AND ANALYSIS (4). Quantitative methods for the analysis of biotic communities, including community concepts, estimation of community composition parameters, theoretical aspects of multivariate methods of analyzing species-importance data, and overview of multivariate tools; hands-on computer analysis of data sets. Lec/lab. PREREQS: BI 370 and (ST 412 or ST 512) and calculus or equivalent.

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. Lec/lab. PREREQS: ST 209 or ST 351 or the equivalent. ST 511, ST 512, and ST 513 must be taken in order.

BOT 507. SEMINAR (1) or BOT 505 READING & CONFERENCE (1). Section 1: Departmental seminar (F, W, S). Section 2: Communities in Ecology (F). Section 3: Community and Habitat Analyses (W). Section 4: Lichens and Bryophytes Research (S). Weekly one-hour meetings for reporting and discussions of proposal research, review and discussion of recent literature, and mini-workshops on particular problems. Graded P/N.

The required professional courses are designed to be taken in sequence during the first academic year and include:
COMM 550. COMMUNICATION AND THE PRACTICE OF SCIENCE (3).
[Pending approval #79896] Course develops a broad range of skills encompassing verbal, written, and visual media styles of communication. Topics include: working in teams and collaborative decision-making; interpersonal and organization communication; writing and making presentations to diverse audiences; negotiation and consensus building; and persuasion and influence in communication.

PHL 547. RESEARCH ETHICS (3). An examination of the interrelationship between ethical values and scientific practice. Topics include professionalism in science; scientific integrity, misconduct, and whistleblowing; the ethics of authorship; conflicts of interest between academic science and commercial science, and social responsibilities in science. Guidelines relating to patent, trademark, copyright, and authorship issues are covered as well.

PSM 513. PROFESSIONAL SKILLS (3). Students work in teams with off-campus mentors to address a contemporary problem in a scientific field within the context of an existing business. This collaborative project will provide students with opportunities to integrate and apply their collective knowledge of business management, communication, and science to create innovative solutions. Project management, team skills, and leadership styles are also covered, and a final report and presentation are usually required. PREREQS: COMM 550 and PHL 547 and PSM 565 and PSM 566 and concurrent enrollment in PSM 567

PSM 565. ACCOUNTING AND FINANCE FOR SCIENTISTS (3). Students develop business management skills by learning principles of managerial and financial accounting and understanding profit and loss statements, cost analysis, and investment risks. Individuals utilize basic financial tools needed to develop business proposals and successful manage scientific projects in public and private work sectors.

PSM 566. PROJECT MANAGEMENT AND MARKETING SCIENTIFIC TECHNOLOGIES (3). Students gain an understanding of marketing principles and global markets with a focus on scientific technologies. Project management skills needed to effectively manage diversity, conflict and change in corporate, government and nonprofit environments as well as entrepreneurial ventures will be emphasized. PREREQS: PSM 565

PSM 567. INNOVATION MANAGEMENT (3). Students learn about different types of innovation, development and implementation of new technologies, and intellectual property. Student teams develop and present business plans as term projects. Structuring small business enterprises, project planning and management, and commercialization of new products and services prepare individuals for leadership roles in the innovation process. PREREQS: PSM 565 AND PSM 566

Students are required to complete a 3 to 6 month internship (6-12 credits) in lieu of thesis research. Guidelines for development of an internship proposal, evaluation of performance, and final report requirements are available online and help ensure that the internship is a meaningful educational experience (http://psm.science.oregonstate.edu/internships). Students have been hired by a variety of companies as interns, including the Institute for Applied Ecology, U.S. Fish and Wildlife Service, U.S. Department of Agriculture, Winterbrook Planning, LLC, Department of Environmental Quality, Seed of Success, and the Willamette National Forest. Opportunities are posted online
Admission requirements are similar to those for other BOT graduate programs and include a minimum GPA of 3.0 on the last 90 quarter credit hours, completion of a 4-year undergraduate degree in math, science or engineering (equivalent to one academic year of biology and chemistry, as well as some math, statistics, and botany relevant courses such as plant identification, ecology or water resources), GRE scores of at least 1,100 combined verbal and analytical, TOEFL scores for international applicants (minimum of 550), a statement of interest, and three letters of recommendation.

Graduates from the PSM in Applied Systematics in Botany will be able to work in both private and public sectors to solve problems related to the conservation of endangered plants, the control of invasive plants, and habitat restoration with native plants by applying their advanced technical expertise in plant systematics and taxonomy. They will also have a basic understanding of business principles, as well as project management and oral and written communication skills, to help them apply their science in a business context.

Students in this PSM program belong to two cohorts, which enhances their graduate experience: 1) classmates enrolled in the BOT graduate program, and 2) the PSM collective cohort comprised of students from other STEM disciplines (e.g., biotechnology, physics, and environmental sciences). The PSM cohort engages in a variety of activities to help develop group cohesion and increase retention:

- A 5-day workshop the week prior to the start of fall term is held at an off-campus facility, and important topics not included elsewhere in the curriculum are covered. Some of these topics include project collaboration in the virtual environment, networking and dining etiquette, and interview and time management skills.
- All students complete the 18 credits of professional coursework together during the first academic year (two courses per term).
- Social events are regularly scheduled and include a fall gathering event at the beginning of fall term, a student mentorship program, an industry luncheon in early December, monthly seminars featuring off-campus speakers, 1st Friday happy hour gatherings, and an end-of-the-year barbecue picnic with industry representatives.

Students are initially advised by Dr. Ursula Bechert, Director of Off-Campus Programs, Dr. Aaron Liston, Director of the Botany and Plant Pathology Program, and Dr. Kirstin Carroll, PSM Coordinator, and these individuals continue to provide general administrative support to each student enrolled in the program. Like other graduate students, a graduate committee consisting of a major professor and minimum of three members is required for each PSM student. These individuals provide advice regarding coursework and approve a Program of Study form, mentor students within their profession, facilitate research experiences, provide feedback on and final approval of an internship proposal, check on progress made during the internship, and grade the internship based on review of the student’s internship journal, the employer’s formal review, and the final report in lieu of student’s thesis. The internship supervisor provides on-the-job training based on learning outcomes described in the internship proposal.

2. Explain how outcomes in the newly organized program will be assessed.
Student learning is assessed by traditional measures (e.g., performance on written tests and in oral presentations), the internship evaluation, and students are required to undergo a final oral examination to receive their degree. An exit interview is conducted once a student has passed the oral examination to assess the PSM program and student’s perception of learning outcomes. All alumni from the program are tracked to assess post-graduation employment history (http://psm.science.oregonstate.edu/alumni-profiles). There are five alumni of the PSM in Applied Systematics in Botany, one student is currently enrolled, and another four will be joining the program this fall.

The National Governors Association Center for Best Practices report entitled Degrees for What Jobs? Raising Expectations for Universities and College in a Global Economy (March 2011; http://www.nga.org/Files/pdf/1103DEGREESJOBS.PDF) states, “A growing number of governors and state policymakers have come to recognize that higher education, including community colleges, four-year colleges, and research universities, cannot help drive economic growth in their states unless students’ academic success is linked to the needs of the marketplace.” The report emphasized the importance of encouraging employers’ input in higher education, and the PSM in Applied Biotechnology at OSU has attempted to do this starting with a joint industry-faculty workshop in June 2001. Approximately 80% of this program’s PSM graduates find employment in Oregon after graduation, demonstrating how the program contributes to regional economic development.

D. Resources needed, if any: personnel, FTE academic, FTE classified, facilities and equipment.

No additional resources are needed.

E. Funding sources: state sources (institutional funds – state general fund, tuition and fees, indirect cost recoveries), federal funds, other funds as specified.

Funding sources will remain the same.

F. Relationship of the proposed unit to the institutional mission.

The PSM in Applied Systematics in Botany builds on existing faculty expertise in the Department of Botany and Plant Pathology, which includes approximately 120 tenured faculty, tenure-track faculty, research faculty, courtesy faculty, affiliated faculty, active emeriti, research associates, and faculty research assistants. Faculty from other units and departments on campus (e.g., Zoology, Molecular and Cellular Biology) also contribute to the program. This program fits in OSU’s Signature Area of Distinction: Advancing the Science of Sustainable Earth Ecosystems.

Oregon and the Pacific Northwest possess a wealth of habitats and climates. These environments contribute to the plant and fungal diversity of the region, and provide an exceptional natural laboratory for learning about these organisms. In addition, several federal research laboratories are located in the Corvallis region, including the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Forest Service, and the Bureau of Land Management (BLM). Current OSU PSM Advisory Board members affiliated with this program include: Chris Beatty, President of Trillium FiberFuels, Inc., Steve Anderson, Owner of Anderson Risk Analysis, Inc., John Dummer, Principal Engineer for Clean Water Services, John Ledger, Vice President of External Affairs for Associated Oregon Industries, Shelly Miller, Project Leader for the Oregon
G. Long-range goals and plans for the unit (including a statement as to anticipated funding sources for any projected growth in funding needs).

n/a

H. Relationship of the proposed unit to programs at other institutions in the state.

n/a

I. If the program is professionally accredited, identify the accrediting body and discuss how the proposed change may affect accreditation.

n/a

Appendices:
- Transmittal sheet
- Budget table n/a
- Library evaluation n/a
- Liaison