WSU Five-Year Program Review
Self-Study

Cover Page

Department/Program:	Botany
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Self-Study Team Chair:	Barbara Wachocki
Self-Study Team Members:	Eugene Bozniak, Stephen Clark, Ron Deckert, Sue Harley, Sonya Welsh (Lab Manager)
Contact Information:	Barbara Wachocki
Phone:	801-626-7223
Email:	bwachocki@weber.edu

Program Review Team:

Dr. Pamela K. Diggle:
Professor, Dept of Ecology & Evolutionary Biology, Univ of Colorado
Address:
EBIO
Ramaley N122
Campus Box 334
University of Colorado
Boulder, CO 80309-0334
303-492-4860
pamela.diggle@colorado.edu

Dr. Marshall Sundberg:
Professor, Dept of Biological Sciences, Emporia State University, Kansas
Address:
Department of Biological Sciences
Emporia State University
Emporia, KS 66801
Phone 620-341-5605
Fax 620-341-5607

Dr. Linda Watson
Head of the Department of Botany, Oklahoma State University
Address:
Oklahoma State University
Dept. of Botany
301 Physical Sciences, Stillwater, OK 74078-3013, USA
Tel.: +1 (405) 744 5559,
Fax.: +1 (405) 744 7074
E-mail: linda.watson10@okstate.edu

Dr. Jeffrey White:
Professor of Botany, Department of Biological Sciences,
Humboldt State University
Address:
Department of Biological Sciences
Humboldt State University
1 Harpst St., Arcata, CA 95521
Phone: (707) 826-5551
Fax: (707) 826-3201
Email: jww12@humboldt.edu

A. Introductory Statement

The last Program Review of Weber State University's Botany Program was extremely positive. The reviewers noted that the department offers great course breadth and depth for a department its size, it was at a critical number and should not fall below the then six full-time faculty, it plays a vital role in Botany education in the state, it is one of the few undergraduate Botany Departments left nation-wide, and it should continue to be supported. They also encouraged further development of our undergraduate research program, and more involvement with the community and schools, if possible, to increase our visibility and help recruitment. We have followed all of these recommendations.

The Botany Department at Weber State University is **the last remaining undergraduate Botany department in Utah**, and one of the few left nation-wide. Trends to downsize, consolidate, or eliminate Botany programs have been occurring for over 20 years. The impact this is having and will have, is well documented in the 2010 report, A*ssessing botanical capacity to address grand challenges in the United States*, issued by the Chicago Botanic Garden and Botanic Gardens Conservation International U.S. (http://www.bgci.org/usa/bcap). The report is based on a survey of over 1,500 respondents and 30 workshop members. It states that since 1988, "undergraduate degrees earned in botany are down 50% and advanced degrees earned in botany are down 41%." In addition, "courses eliminated tend to be from among those required for the 0430 (botanist) federal job code." These jobs require at least 24 credit hours of botany courses. Utah Valley University, which recently started a Botany degree within their Biology Department, does not meet this requirement. Hence, **USFS, Utah Division of Wildlife Resources, BLM, Red Butte Garden (at the University of Utah), and other employers seek out WSU Botany majors and graduates to fill temporary and permanent positions.**

The report points out that "Botanical Capacity encompasses the human, scientific, technological, organizational, institutional and resource capabilities that support botanical education, research and management." "A lack of botanical capacity will severely compromise progress in solving the nation's grand challenges (President Obama's Strategy for American Innovation)." These grand challenges include climate change, sustainability (including food, fiber, biofuel and medicine), preservation of ecosystem services, food scarcity, invasive species control, habitat management and restoration, biodiversity conservation, and carbon-neutral biofuel production. The need for knowledgeable and skilled botanists has never been so great. With retirements of existing botanists in USFS, etc., the need will only increase.

Recognizing our unique position, the department feels that we can help supply botanists to address a variety of the grand challenges. Over the past few years, the department, faculty, staff, and students, have made a concerted effort to put in motion a multiple-pronged approach to increase student research and internships, improve our student portfolio assessment tool, and increase recruitment and retention by delving into new and exciting areas within the discipline. The department a) is developing a Forensic Botany reference collection and a *Forensic Botany* course, b) has started a Pre-

Natural Medicine option within the Track A major, c) added an *Herbal Medicines* course, d) plans to expand its Ethnobotany offerings, and e) has the potential for collaboration with Native American tribes via grants. The department has started a variety of community garden projects. Through a grant, the department has taken the lead in establishing an after school science program in local junior high schools and is committed to help increase recruitment of STEM majors from high schools and community colleges.

Unfortunately, as an aging department, we are feeling the effects of faculty attrition. One faculty member went to half-time in 2009, and a second retired in summer 2012. The latter, especially, has left a void as he managed the greenhouse, taught courses in soils, plant propagation, and three General Education courses. Both faculty taught BTNY 1403 (*Environment Appreciation*), an important support course for several majors in other colleges. Due to the efforts of the lab manager, the willingness of the remaining faculty to take on overload and summer teaching, and the hiring of adjunct faculty, SCH production has been maintained and has slightly increased since 2009-2010, with a slight increase in the proportion of upper division and Botany-specific course SCHs. Although the number of graduates reported is low for 2011-2012, there will be at least five this year and next, a trend that will likely increase with more recruitment efforts. All faculty members are also involved in mentoring student research, committee work, and/or community service. In addition, four Hemingway grants have been awarded to our faculty within the past two years, primarily for outreach efforts to local schools and local tribes. Faculty research is also continuing as evidenced by internal and external grants, publications, and presentations at professional meetings. Faculty regularly attend workshops and meetings for professional development.

The department is clearly is at a crossroads, between expanding into new areas that will attract majors and financial support, and just maintaining the quality program we have. This program review comes at a crucial time for our department and we welcome input as we navigate our future course.

B. Botany Department Mission Statement

In providing a quality undergraduate education to students at Weber State University, the Botany Department seeks to maximize opportunities for the promotion of effective education and communication about the value and intellectual appeal of plants. We attempt to inspire students to pursue the study of plants as an intellectual endeavor in understanding life's major component – the plants, with their physically and functionally dominant place in the world. In addition, botanists offer expertise about plants to policy-makers involved in agriculture, conservation, and protection of the environment. We also believe that a more knowledgeable public will be able to make more informed decisions with regard to plant derived products and environmental issues. This understanding should also lead to a paradigm shift that garners greater support for botany as a vitally important profession.

The Botany Department mission meshes with the university Access Theme:
The Botany Department offers a Bachelor of Science degree in four areas to fit a variety of career goals: laboratory emphasis, pre-natural medicine, field emphasis, and general Botany. Pre-professional preparation is available for individuals interesting in pursuing degrees in forestry, range management, agriculture, and horticulture. The department also offers a minor and a Bachelor of Integrated Studies emphasis area in Botany. Several courses are offered which meet the WSU life science general education criteria.

The Botany Department mission meshes with the university Learning Theme:
Botany majors are required to develop a portfolio, which includes the documentation of a capstone experience and an assessment of expected outcomes for Botany majors. These include a thorough knowledge and comprehension of the core concepts in Plant Biology, mastery of fundamental skills which are needed to function effectively as professionals within the field, and a demonstration of significant value-added progress in the affective domain. The affective domain includes developing an appreciation of the diversity of cultures and intellectual points of view, understanding ethical issues and responsibilities, commitment to the development of cultural perspectives that do not disparage others, and appreciation that Botany follows the Liberal Arts tradition.

Educational experiences for Botany students involve small classes which emphasize opportunities for hands on activities in the field or laboratory. Individualized learning is available through independent research and an undergraduate thesis option. The student-led Botany Club provides extracurricular activities, including field trips and service projects.

The Botany Department mission meshes with the university Community Theme:
The Botany Department contributes to the community through the training of pre-service and post-service K-12 teachers. Students, faculty, and staff participate in a variety of outreach programs, notably those which target a K-12 audience. In addition, Botany faculty, staff, and students participate in community education and service through sponsored workshops, presentations, and community events. Through a Hemingway grant, the Botany Department has established and maintains the WSU Community Garden and has been involved with planning additional community gardens within the city.

B. Curriculum

1. Types of Degree Offered

Botany Major - B.S. degree

Track A, Option 1: Laboratory Emphasis or Graduate School Preparation - enriched with quantitative science and intense laboratory hands- on experiences with embedded Chemistry minor, designed to prepare students for graduate school and careers in laboratory research.

Track A, Option 2: Pre-Natural Medicine- enriched with quantitative science and intense laboratory hands- on experiences with embedded Chemistry minor, designed to prepare students for admission to Natural Medicine schools.

Track B: Field Botany Emphasis- enriched with field-oriented course opportunities, is designed to best prepare students for field-related careers such as ecology, environmental science, and natural resource management.

Track C: General Botany Emphasis- with a slightly reduced number of required courses but with more elective courses, is designed to meet the needs of students who wish to obtain a General Botany degree, with flexibility for transfer students to minimize the time to graduation.

Biology Composite Teaching Major - the Botany and Zoology departments cooperate in offering a Biology Composite Teaching Major

Botany Departmental Honors program

Departmental Honors - students must have a minimum overall GPA of 3.7, and have a completed portfolio with a grade of A in the capstone "Portfolio Summative Assessment" course. The completion of a written thesis and a thesis presentation that has been evaluated by the thesis committee and faculty that not only receives a grade of A in the "Botany Thesis" course but is deemed outstanding. The Honors Director will sign off on a Botany thesis written for departmental honors.

Pre-professional programs - Two year (no degree)

Pre-Agriculture and Pre-Horticulture - these programs are designed for students who wish to complete university general education requirements and general Botany requirements prior to transferring to an institution with degree programs in Agriculture and Horticulture.

Pre-Forestry and Pre-Range Management - these programs are designed for students who wish to complete University general education requirements and general Botany requirements prior to transferring to an institution with degree programs in Forestry and Range Management.

Botany Minor/Emphasis Programs

Minor/BIS Emphasis - students must complete a minimum of 19 credit hours in Botany courses.

Biotechnician Training Program (Associate of Science Degree & Certificate) The Department of Botany participates with the Departments of Microbiology and Zoology in the Associate of Science Degree and 3rd - year Certificate in Biotechnician training for the biotechnology industry.

General Education and Service Courses provided by the Program

The Botany Department offers four General Education courses, Botany LS1203 *Plant Biology*, Botany LS1303 *Plants in Human Affairs*, Botany LS1403 *Environment Appreciation*, and Botany LS1370 *Principles of Life Science*. Additional service courses include Botany SI2104 *Plant Form and Function*, Botany SI2114 *Evolutionary Survey of Plants*, and Botany DV2303 *Ethnobotany*.

Botany LS1203, Botany 2104, and Botany 2114 serve as a pool from which Microbiology, Zoology, Geosciences, and Biology Composite Teaching majors select one or more as required courses. In addition, Geosciences recommends the Botany 3214 (*Soils*) course for their Applied Environmental Geosciences major and Botany 3214 (*Soils*), Botany 3303 (*Plant Genetics*), or Botany 3473 (*Plant Geography*) for their Earth Science Teaching major. Botany DV2303 is used as a course to meet the University diversity requirement and represents the only such course offered within the College of Science.

Botany LS1403 *(Environment Appreciation*) **is a service course** required of all majors in the John B. Goddard School of Business and Economics, and the Automotive Technology program and Construction Management program in the College of Applied Science and Technology. Botany LS1370 (*Principles of Life Science*) serves the students in the Elementary Teaching program. The Botany Department also provides the primary instruction for the cross-listed course 2600 (Laboratory Safety). This course is cross-listed in five departments within the College of Science and is a required course in the in Forensic Science program (Department of Criminal Justice), College of Social and Behavioral Sciences. A course in Forensic Botany is being developed, which could further support the Forensic Science program.

C. 2. Curriculum Map (A complete list of Botany courses, course descriptions, and schedules, can be found at: http://documents.weber.edu/catalog/1112/catcrs.htm, select BTNY-Botany

Core Courses in Department/ Program	Department/Program Learning Outcomes														
	Knowledge and Comprehension			**Skills**								**Affective Domain**			
BTNY Course #s	plant/ other organism similarity	plants are unique	plant products	field/lab research	critical thinking	problem solving	communi-cation	computer	information seeking	cooperation & social	self-assessment	appreciation of d diversity	ethics	liberal arts	aesthetic appreciation
LS1203(Plant Bio)	M	M	M	L	M	M	M	M	M	L	O	M	M	M	M
LS1303 (Plts in Hum Affairs)	H	H	H	O	M	L	M	M	M	L	L	M	M	M	H
LS1370 (Princ of Life Sci)	M	M	O	M	M	M	H	M	H	H	M	M	M	L	M
LS1403(Env Apprec)	0	M	O	O	H	M	M	L	L	M	O	H	H	M	H
SI2104 (Plt Form & Func)	L	H	L	H	H	H	H	M	H	M	L	L	L	L	L
SI2114 (Env Survey of Plts)	H	H	L	M	M	M	L	L	O	M	O	H	L	M	H
2121 (Career Plan for Bot)	0	O	O	O	L	L	L	L	M	L	M	L	L	L	L
2203 (Home & Garden)	M	H	M	H	M	L	M	M	L	L	L	L	L	M	H
DV2303(Ethnobotany	M	H	H	L	L	L	L	L	L	L	L	H	H	H	H
2413 (Nat Resource Mgt)	O	M	O	O	H	M	M	L	L	M	L	H	H	M	H
2600 (Lab Safety)	O	O	O	M	M	H	L	L	L	O	L	O	L	O	O
2830 (Readings in Bot)	V	V	V	O	H	L	M	L	V	O	O	V	V	V	V
2920 (Workshops, etc.)	V	V	V	V	V	V	V	V	V	V	L	V	V	V	V
2950 (Elem Field Bot)	L	H	L	H	L	L	L	L	O	H	L	O	H	L	H
3105 (Anat & Morph)	M	H	L	H	M	M	M	O	L	M	M	M	O	L	L
3153 (Bio of the Plt Cell)	M	H	O	L	H	H	M	L	H	L	L	L	L	L	L
3204 (Plt Physiol)	L	M	O	H	H	H	H	M	H	M	M	M	L	O	O
3214 (Soils)	0	M	O	H	M	M	M	L	M	L	M	L	M	M	M
3303 (Plt Genetics)	M	M	M	M	H	H	M	M	L	M	M	L	M	L	O
3403 (Env Apprec, Upp Div)	O	O	O	O	L	L	H	M	H	L	M	L	L	L	L
3454 (Plt Ecol)	M	H	O	H	M	H	H	M	M	H	M	L	L	L	M
3473 (Plt Geog)	M	H	O	M	M	L	L	L	M	L	L	H	L	M	H

Core Courses in Department/ Program	**Department/Program Learning Outcomes**														
	Knowledge and Comprehension			**Skills**								**Affective Domain**			
BTNY Course #s	plant/ other organism similarity	plants are unique	plant products	field/lab research	critical thinking	problem solving	communi-cation	computer	information seeking	cooperation & social	self-assessment	appreciation of d diversity	ethics	liberal arts	aesthetic appreciation
3504(Mycology)	M	H	M	H	M	L	M	L	L	M	M	L	O	O	L
3514 (Algology)	H	H	H	M	M	M	H	L	L	M	M	M	L	L	H
3523 (Marine Biology)	H	M	H	L	M	M	H	L	L	L	M	M	M	L	M
3570 (Foundat of Sci Educ)	O	O	O	M	H	M	H	L	M	M	M	M	M	H	O
3583 (Herbal Medicines)	L	H	H	H	M	M	L	L	H	L	M	H	H	H	H
3624 (Taxon of Vasc Plts)	L	L	O	H	M	M	L	L	L	L	M	L	O	M	H
3643 (Intermtn Flora)	L	L	L	M	M	M	L	L	L	L	M	L	L	O	H
4113 (Plt Evol)	M	L	O	L	H	H	L	M	L	L	M	H	O	M	H
4252 (Cell Culture)	M	M	L	H	M	M	M	M	L	M	L	O	L	L	L
4750 (Topics in Bot)	V	V	V	V	V	V	H	V	V	V	M	V	V	H	V
4800 (Indiv Research)	V	V	V	V	H	V	H	V	V	V	M	V	V	V	V
4830 (Readings in Bot)	V	V	V	V	H	V	H	V	V	V	M	V	V	V	V
4840 (Thesis Readings)	V	V	V	V	H	H	H	V	H	V	H	V	V	V	V
4850 (Thesis Research)	V	V	V	H	H	H	H	M	V	V	H	V	V	V	V
4890 (Co-Op Work Exper)	V	V	V	M	M	M	H	M	V	H	H	V	V	V	V
4920 (Workshops, etc.)	V	V	V	V	V	V	V	V	V	V	H	V	V	V	V
4950 (Advanced Field Bot)	L	H	L	H	L	L	L	L	O	H	H	0	H	L	H
4970 (Botany Thesis)	V	V	V	H	H	H	H	H	V	V	H	V	V	V	V
4980 (Portfolio Sum Assess)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
4990 (Seminar in Botany)	V	V	V	V	H	H	H	H	V	V	H	V	V	V	V
5030 (Bot for Teachers)	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V

H = high emphasis, M = moderate emphasis, L = low emphasis, V = variable emphasis, depending on topic and instructor,
0 = outcome not emphasized

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C. **3. Student Learning Outcomes and Assessment**

I. a. <u>Measureable Botany Department/Program Learning Outcomes</u> (NOTE: For a complete description of the Botany Student Portfolio, please see Appendix G).

Upon graduation, <u>Botany majors</u> should:

1. have a thorough **knowledge and comprehension** of the core concepts in the discipline of Plant Biology. These include the fact that :

   a. <u>Plants are *like* other organisms</u> in regard to: basic metabolism, sexual reproduction, clonal reproduction, hormonally regulated development, ability to respond to the environment, diversity and evolution.

   b**.** <u>Plants are *unique* organisms</u> in: their varied life histories - especially a sporic one with alternation of generations; their role as primary producers in food webs, serving as the interface organisms between the organic and inorganic worlds *via* mineral assimilation and photosynthesis; and the oxygenation of the atmosphere.

   c. <u>Plants serve as an important source of products</u>: food, fiber, flavorings, feed, fuel, pharmaceuticals, etc.

2. have mastered a set of fundamental **skills** which would be useful to function effectively as professionals and to their continued development and learning within the field of Plant Biology. These skills include the following:

   a. ***Communication Skills***: Botany graduates will be required to demonstrate competence in communication, both written and oral, and present the results of their research in senior theses, senior capstone courses, and in all upper-division courses where such communication is expected and evaluated by both their peers and the instructor.

      i. <u>Writing Skills</u> - This component shall also demonstrate *critical thinking, reasoning, and effective argument skills*.
      ii. <u>Speaking Skills</u> - any oral presentation(s) given in courses or extracurricular events.

   b. ***Computer Skills***
   c. ***Field and Laboratory Research Skills***
   d. ***Problem-Solving Skills***
   e. ***Self-Assessment Skills***
   f. ***Cooperation/Social Responsibility Skills***
   g. ***Information Seeking Skills***

3. demonstrate significant value-added progress in developing the following **values (affective domain)**:

a. ***Appreciation* of** the ***diversity*** of cultures and intellectual points of view.
b. ***Understanding* of *ethical issues*** and responsibilities c. ***Commitment* to *non-discrimination*** d. ***Appreciation* that Botany follows the *Liberal Arts* tradition**
e. ***Appreciation* of the *aesthetic* attributes of nature**

I. b. General Education Natural Science and Life Science Leaning Outcomes

Foundations of the Natural Sciences Learning Outcomes

1. **Nature of science**. Scientific knowledge is based on evidence that is repeatedly examined, and can change with new information. Scientific explanations differ fundamentally from those that are not scientific.
2. **Integration of science**. All natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.
3. **Science and society**. The study of science provides explanations that have significant impact on society, including technological advancements, improvement of human life, and better understanding of human and other influences on the earth's environment.
4. **Problem solving and data analysis.** Science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.

The Life Sciences Learning Outcomes

1. **Levels of organization:** All life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.
2. **Metabolism and homeostasis**: Living things obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.
3. **Genetics and evolution:** Shared genetic processes and evolution by natural selection are universal features of all life.
4. **Ecological interactions:** All organisms, including humans, interact with their environment and other living organisms.

Summary Information

General Education Life Science (LS) courses:

All four of Botany's Gen Ed courses were re-approved for Gen Ed LS status in 2010-2011. Formal assessment of courses, showing direct evidence of student learning began at that time. The Gen Ed LS Assessment Subcommittee (of the University Gen Ed Committee) is in the process of developing an assessment tool that will be accepted by all departments

that teach Gen Ed Life Science (LS) courses. Once established, the Botany Department will adopt it.

Courses within the major:

For many years, the Botany Department has been requiring that majors complete a Student Portfolio. The portfolio is introduced in Botany 2121 (*Career Planning for Botanists*) and is added to throughout the student's studies at WSU. Students complete and polish their portfolios in BTNY 4980 (*Portfolio Summative Assessment*), taken in their final semester. The portfolios are also graded in this course. Each Botany course emphasizes some or all of the Botany Learning Outcomes to varying degrees and helps students develop skills, knowledge, and experience that they can document in their portfolio (see Curriculum Map. C.2).

The Portfolio consists of a substantial essay, worth 30% of the portfolio grade. The essay is a culmination of the knowledge that the student gained throughout their studies at WSU. Additional evidence of skills development, self-assessment skills, career preparation, as well as creativity, ethics, and an appreciation for diversity are also required. In addition, all students must have a capstone experience (thesis or directed research, paid or volunteer Botany work experience, or a library research project) that they present orally. The portfolio also requires a written statement as to how the capstone experience impacted them (see Appendix G).

Summaries of courses assessed during the 2010-2012 academic years follow. All Gen Ed courses and courses required for the major will be assessed within a five year period. **(see Appendix H for details):**

II. a. DIRECT EVIDENCE of Learning: General Education Courses
(NOTE: Threshold for Evidence of Student Learning is 65%)
(See Appendix H. a. for details).

BTNY 1203, Plant Biology, Gen Ed LS course: Threshold of Student Learning met in all but two areas (a few questions requiring math to analyze data and a few on metabolism)

- Natural Science and Life Science Learning outcomes are assessed by exams, reading and writing assignments. Except for a few questions requiring math to analyze data and a few on metabolism, at least 65% of the students answered the questions correctly. Reading and writing assignments produced better problem solving and data analysis results (average score = 91.5%)

BTNY 1403, Environment Appreciation, Gen Ed LS course: Threshold of Student Learning met in all areas

- Numerous questions from four exams, as well as writing assignments addressed the Gen Ed learning outcomes. The threshold was met for all outcomes, and with few exceptions, 70% of the students answered the questions correctly.

III. a. <u>DIRECT EVIDENCE of Learning: Course within the Major</u>
(NOTE: Threshold for Evidence of Student Learning is 75%)
(See Appendix H. b. for details).
The number of students in upper division courses is typically small, especially in the Portfolio Summative Assessment and Senior Seminar courses. Hence statistical results are difficult to assess.

BTNY 2104, Plant Form and Function: Threshold of Student Learning for all Botany Student Learning Outcomes assessed in this course were met (78%)

- Botany Learning Outcomes are assessed by exams, quizzes and assignments.
- The mean score on all assessment tools was a minimum of 74%

BTNY 3303, Plant Genetics: Threshold of Student Learning for all Botany Student Learning Outcomes assessed in this course were met (80%)

- Botany Learning Outcomes are assessed by exams, quizzes and assignments.
- The mean score on all assessment tools was a minimum of 80%

BTNY 3454, Plant Ecology: Threshold of Student Learning for all Botany Student Learning Outcomes assessed in this course were met (82%) with the exception of one quiz (69%)

- Botany Learning Outcomes are assessed by exams, quizzes and assignments.
- The mean score on all assessment tools was a minimum of 82 % with the exception of one quiz (69%)

BTNY 4980, Portfolio Summative Assessment: Threshold of Student Learning for all Botany Student Learning Outcomes was met (4 students)

- Botany Learning Outcomes are assessed by on a comprehensive essay and the quality of the portfolio.
- The mean score on the portfolio was a minimum of 75%, the essay averaged 64%

BTNY 4990, Botany Senior Seminar: Threshold of Student Learning for all Botany Student Learning Outcomes was met (2 students)

- Botany Learning Outcomes are assessed by a seminar presentation and preparation for it
- The mean score on all assessment tools was a minimum of 64%

b. <u>INDIRECT EVIDENCE of Botany Department/Program Learning:</u>

i. WSU Botany graduates are recognized nationally by the Botanical Society of America, Chicago Botanic Garden and agencies who hire CLM interns as being knowledgeable, capable, competent in the field, and highly competitive among other recent BS graduates in similar fields.

- **Two WSU Botany graduates from last year (2011-2012) were among only 29 undergraduate Botany students nation-wide to receive the Young**

Botanist Award from the Botanical Society of America. Weber State was one of 19 institutions represented. A complete list of recipients can be found on the BSA at the website http://www.botany.org/awards_grants/detail/bsayby.php. This was the first time in many years that we nominated our students. The intent is to nominate our best undergraduate researcher(s) each year, as most of our students are now working on thesis projects or do research through grants. Award winners from many years are listed on the BSA website, so we hope that this will help build awareness of our exceptional program and will serve as a recruitment tool in the future.

- **One graduate from last year, (double major, Zoology and Botany), received a prestigious Conservation and Land Management (CLM) internship from Chicago Botanic Garden in Spring 2012.** She was among the 91 hired of the 665 students who applied last year (**only 14% were hired**). She has just completed paid internship working for the BLM in Cedar City and is pursuing graduate school.

- **In Spring 2009, two Botany graduates were also awarded CLM Internships through Chicago Botanic Garden.** They were the first two ever to apply from WSU (**now we are at a 100% hire success rate**). One student worked with the USFS Shrub Lab in Provo Utah, and the other worked for the Red Butte Botanic Garden in Salt Lake City, Utah, with the *Seeds for Success Program*. The former is now employed full-time with a state agency and the latter is in graduate school at the University of Utah.

ii. **Exit interviews with each graduating senior and the entire Botany faculty are conducted each semester in which we have graduating student(s).** Since the addition of the *Portfolio Summative Assessment* course, refinement of the grading rubrics, and better coordination between this course and *Career Planning for Botanists*, students increasingly see the value of the portfolio requirement.

iii. **WSU Botany majors have the knowledge and skills to secure competitive student research grants and/or be hired as interns on faculty-obtained grants.**

Currently FUNDED Botany Thesis/Research Projects in Progress (2011-2012):

Project Title	Funding Source	Advisor
Student OUR grant		
Plant species occurrence in Utah's diverse habitats	OUR, Spring2011	B. Wachocki
Cataloguing the Macrofungi of the Uinta Mountains	OUR grant, Spring 2011	R. Deckert
Vegetative survey and soil analysis of pygmy rabbit habitat in northeastern Utah	Utah Division of Wildlife Resources, Summer 2011	B. Wachocki
Chimeral Induction of Astrophytum myriostigma: Protoplast Versus Suspension Culture	OUR grant, Spring 2012	R. Deckert
Presence of sesquiterpene lactones in local plant species	OUR grant, Spring 2012	S. Harley
Improving the Success and Diversity of Native Re-Plantings for River Restorations	OUR grant, Spring 2012	B. Wachocki
Faculty obtained grant/Student assistant/intern		
GPS: Great Plant Search with Ogden City Schools	Hemingway Excellence grant, student assistant, Spring 2011	B. Wachocki, PI
Establishing the WSU Community Garden	Hemingway Excellence grant, student assistant, Spring 2011	D. Gatherum, PI
Creating the Forensic Botany reference collection	50/50 Internship Program through Provost's Office, 2011-present	R. Deckert
Ethnobotanical Studies of the Northwest Band of the Shoshone Nation and Northern Ute Tribes of Northern Utah and southern Idaho	Hemingway Excellence grant, student assistant, (awarded Spring 2012)	S. Clark, PI
Studies in Scirpus maritimus	RS & PG grant, student assistant, (awarded Spring 2012)	S. Clark, PI
Encouraging future scientists through Junior High after school science and math program	Hemingway Excellence grant, student internships, (awarded Spring 2012)	B. Wachocki, PI

iv. Less Recent Graduates:

Some graduates of the Botany Department from years ago have gotten jobs and now actively recruit our majors and graduates for internships or permanent jobs upon graduation. Some of these graduates include:

Michael Duncan, a USFS Regional Botanist
Sonya Welsh, the current Botany Department Lab Manager, Adjunct in Botany Department
Rachael Bush, former Botany Department Lab Manager
Brian Hadley, the current WSU Landscape Manager
David Bracken Davis, Environmental Scientist with Utah Division of Agriculture and Food, Adjunct in Botany Department

Other successful graduates include:

3 received PhDs
1 went to a Natural Medicine School (ND)
1 went to Medical School (MD)
3 received Master's degrees
6 employees at Red Butte Garden
3 employees at Albion Laboratories
6 employees at Nutraceuticals (natural products company)
3 employees at local nurseries
1 works for Ogden School District
5 went into teaching

IV. a. DIRECT EVIDENCE of Learning: High Impact or Service Learning

Evidence of Learning: High Impact Service Learning					
Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
BTNY 4890: Cooperative Work Experience (N=2, 1 paid & 1 volunteer)					
Goal 1: gain real-world experience and skills working in a Botany related field on a paid or volunteer basis.	Learning Outcome 1. acquire Research Skills	Measure 1: Evaluation sheet filled out by Co-Op supervisors. They are scored on a scale of 1-5 on 8 skill-related criteria.	Measure 1: The Co-Op students evaluated in 2010-2011 averaged 96.25% on 8 skill-related criteria.	Measure 1: Co-Op demonstrated that they gained Botany-related skills.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2:	Measure 2:	Measure 2:	Measure 2:
Goal 2: gain real world experience in social/people-related areas.	Learning Outcome 2. Acquire social/people skills (Affective Domain)	Measure 1: Evaluation sheet filled out by Co-Op supervisors. They are scored on a scale of 1-5 on 8 social/people-related criteria.	Measure 1: The Coop students evaluated in 2010-2011 averaged 95% on 8 social/people-related criteria.	Measure 1: Co-Op demonstrated that they gained social/people-related skills.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2:	Measure 2:	Measure 2:	Measure 2:
BTNY 4970: Student Thesis Research (N=1)	Learning Outcome 1. acquire Research Skills	Measure 1: Evaluation based on grade in class and presentation of thesis.	Measure 1: The student received an A in the course.	Measure 1: The student learned research/analytical skills & gained in writing and oral presentation skills.	Measure 1: No curricular or pedagogical changes needed at this time.

b. <u>INDIRECT EVIDENCE of High Impact or Service Learning:</u>

i. Botany Graduates who were involved in undergraduate research in Botany have successfully transitioned into graduate schools, professional schools, and jobs within their fields upon graduation and beyond.

Botany Track	Project title	Capstone	Advisor	Funded	Post-graduation
2011-2012					
Track B/Zool Minor	Post-wildfire seeding and re-vegetation: Does it work?	Senior Seminar	B. Wachocki	Paid summer internship with USFS	Hired 2 summers as intern with USFS
Track B & Zoology double major	Habitat ecology of pygmy rabbits (*Brachylagus idahoensis*) in northeastern Utah	Botany Thesis	B. Wachocki	Hired through grant from UDWR	CLM Internship; pursuing grad school
2010-2011					
Track A/Chem Minor	Interaction of a virus encoded protein and fibrillarin	Directed Research & Senior Seminar	S. Harley		Pursuing job at Monsanto
Track C/Chem Minor	Subcellular pathogen fractionation as a method for chitinase induction	Directed Research & Senior Seminar	R. Deckert	OUR* grant	Worked 1 yr for a biotech company; now in grad school funded by NIH grant
Track B/Geospatial Analysis Minor	Protecting pygmy rabbit (*Brachylagus idahoensis*) and sage brush (*Artemisia tridentata* var. wyomingensis) communities of Woodruff, Utah, from ecological devastation	Co-Op (paid) & Senior Seminar	B. Wachocki	Hired through grant from UT Div of Wildlife Resources	Has worked for Red Butte Garden in SLC since graduation; currently applying to grad school in Ethnobotany
Track B/Geospatial Analysis Minor	Biochar applied as a soil amendment for fertility improvement and possible carbon sink in Welsh soils	Co-Op (vol) & Thesis	D. Gatherum		
2009-2010					
Track B/Geospatial Analysis Minor	GIS mapping potential of a *Halogeton* invasion in a native winterfat community	Thesis	B. Wachocki	OUR grant	Is working for Red Butte Garden in SLC
Track B/Geospatial Analysis Minor	Classification of vegetation communities in high alpine wetlands using aerial imagery	Thesis	B. Wachocki		In grad school at Univ of Utah

Botany Track	Project title	Capstone	Advisor	Funded	Post-graduation
Track B/Geospatial Analysis Minor	Effective methods for rare plant surveys for the Uinta-Wasatch-Cache National Forest in northern Utah using GIS techniques	Thesis	S. Clark		Planned to pursue grad school in Ethnobotany
Track B/Spanish Minor	Procedures for tissue culture obtained from cotyledons of rare *Astragalus* species	Thesis	S. Harley		CLM internship; hired full-time by UDWR
Track B/Communications Minor	Micropropagation of *Drosophyllum lusitanicum* (Droseraceae) using seed and embryo explants	Thesis	G. Bozniak		CLM internship; in grad school at Univ of Utah
2008-2009					
Track B/Chem Minor	Creating a water-wise and native plant landscape demonstration garden at the Ogden Botanic Garden	Thesis	D. Gatherum	Donations from local businesses	Received M.S. at USU; working for a local greenhouse company
Track B/Anthro Minor	The Migration of Plants and Culture: The Presence of Traditional Mexican and Central American Medicinal Plants in the Latin Markets of Ogden, Utah	Thesis	S. Young (adjunct)		Worked several years as Naturalist at Ogden Nature Ctr; now environmental specialist at local elementary school
Track A & Botany Teaching/Chem Minor	Germination success of *Cypripedium calceolus* using crude soil inoculums	Directed Research & Senior Seminar	R. Deckert		Just received M.S. from Univ of NC

OUR = Office of Undergraduate Research
UDWR = Utah Division of Wildlife Resources

ii. Over the past five years, WSU Botany majors have presented their research at:

Botanical Society/Mycological Society of America joint meeting
International Society of Salt Lake Research meeting
Wildlands Shrub Symposium
National Conference for Undergraduate Research (NCUR)

WSU Undergraduate Research Symposium
WSU Sigma Xi

iii. In 2010, a Botany major was published in *SegoLily*, Newsletter of the Utah Native Plant Society

D. Academic Advising

1. Advising Strategy and Process

Initial advising of potential Botany majors and minors begins with a meeting with the department chair. Career interests, graduate school, and future plans are explored to see which of the tracks/options within the major best meets the needs of the student. Possible complementary minors(Geospatial Analysis, Anthropology, Chemistry, etc.) are also discussed. At this meeting, the student is shown the Botany web site, the CatTracks degree evaluation/planning tool, general graduation requirements (40 CH of upper division CH, etc), General Education requirements, the portfolio and capstone experience options, and the student is encouraged to explore independent research, thesis projects, paid and volunteer internships, and co-op work experiences. The student is then taken on a tour of the department facilities, including the greenhouse and majors' room, and is introduced to faculty, staff, and Botany Club members available at that time.

Once students become majors, they take BTNY 2121 (*Career Planning for Botanists*). Here, they are introduced to the student portfolio and begin drafts of certain components of the portfolio (essay, self-assessment, resumé, etc.) Guest lecturers include the Science Counselor from Career Services, the Regional Botanist from the USFS (graduate of the WSU Botany Department), alumni in various fields/grad schools, Botany faculty, and current majors with internship experience. This gives students many perspectives within Botany.

Throughout their time at WSU, all Botany majors are e-mailed reminders to meet with the chair at least once/year to review their course selections, employment/graduate school opportunities, capstone projects, and progress towards graduation and careers.

Most Botany majors join the student organization, the Botany Club. This support network is invaluable as students navigate coursework, apply for jobs, form study groups, and establish social ties with like-minded people. A room is set aside for majors, minors, BIS students, and pre-professional students. The room is available for students to study, eat, converse, and hold weekly meetings.

In order to help students start to build their resumes while in their sophomore to senior years, the faculty and lab manager forward job announcements, especially summer

internships, to the Botany Club president who sends them to all members via e-mail. Students are encouraged to apply for undergraduate research grants and have been hired as student assistants on a variety of grants as well as the 50/50 program through the Provost's office. Majors in their graduating year are encouraged to apply for the CLM Internship through the Chicago Botanic Gardens to help transition them into permanent jobs at federal or state agencies.

In their last semester, all majors, minors, and BIS Botany emphasis students must be cleared for graduation by the department chair.

2. Effectiveness of Advising

The effectiveness of advising has increased over the past several years as evidenced by:

- Most majors meet annually with the chair to assess progress toward graduation
- The majority of junior and senior majors involved in directed/thesis research
- The placement rate of junior and senior majors in paid summer internship positions. Many start in freshman/sophomore years as volunteers for USFS, Ogden Nature Center, or Red Butte Garden, which helps land paid internships as juniors/seniors.
- Students ensuring that they have the prerequisites for graduate/professional programs at specific schools. They are encouraged to start looking for schools early, make contact with potential advisors, and present their research at the undergraduate research symposium and national conferences when possible.
- Students pursuing minors that compliment their career goals
- The increasing quality of student portfolios

Data on advising are primarily collected during graduating senior Exit Interviews. Students who have received departmental advising or advising from the College of Science advisor, have been pleased with the advising they received. Complaints are few with the vast majority of students pleased with the availability of advising from the department. Consensus seems to be that Botany is regarded as a small and caring department with faculty and staff having the student's best interests in mind at all times. Their doors are always open and students who need advice get it when they need it.

3. Past Changes and Future Recommendations

The implementation of BTNY 2121 (*Career Planning for Botanists*) several years ago has helped prepare students for success in the program, research, and career goals. The implementation of the 3 CH, upper division, *Portfolio Summative Assessment* class has completely changed the attitude of students regarding the validity and importance of the portfolio.

Based on exit interviews, we have:

- encouraged students to become involved in research earlier and more often,
- encouraged more students interested in ecology to minor in Geospatial Analysis,
- incorporated research projects into more lab courses

Going forward, more emphasis will be put on the CatTracks degree evaluation and planning tool to help students effectively plan long-term and make progress toward graduation. This will become increasingly critical as the university is moving toward automatic graduation clearance based on data in CatTracks. This will hopefully encourage students to meet regularly with the chair and faculty mentors.

E. Faculty

1. Faculty Demographic Information

Until Summer 2009, the Botany Department faculty was comprised of six full-time members. Two are Canadian immigrants, two are native Utahans, one is from California and one is from Michigan. In Summer 2009, Gene Bozniak stepped down as department chair and went to a half-time (half-retired) status. He no longer teaches in the fall, only in spring. In Summer 2012, Dawn Gatherum retired. This leaves the department with only 4 ½ faculty in the fall and 5 in the spring. The last program review team stressed that the department should be at least maintained at six full-time faculty in order to be able to provide the depth and breadth of our course offerings. This becomes more critical as more students seek research opportunities and prepare to pursue graduate school or careers.

2. Programmatic/Departmental Teaching Standards

The departmental teaching standards are essentially those of the university, as set down in PPM 8-11 (Evaluation of Faculty Members) and PPM 9-5 (Faculty Responsibilities to Students). Opportunities to foster awareness of and adherence to these standards are created in various ways. There is constant dialogue, both between individual faculty and in the department as a whole, on how to improve teaching and learning in our courses. All classes taught by Botany faculty, both contract and adjunct, are required by the department to have syllabi that list the course outline, assignments, grading policies, and other pertinent information. We review all departmental syllabi to check for completeness, offer suggestions to one another, and make sure that various sections of the same course cover similar material. While professors are free to choose content for their courses, the department has broad control over what is taught to ensure that course titles and catalog descriptions match content. We were pleased to discover a high amount of similarity among course sections, and good quality syllabi present for all courses.

All faculty are expected to do the best job possible in their teaching. In hiring decisions, candidates are required to teach a regular class in addition to giving a research seminar. This gives the department a feel for the candidates' teaching style and ability to connect with undergraduate students. Previously demonstrated teaching ability and interactions with WSU students during the interview process are also weighted heavily. In the exit interview with our graduating seniors, many of the questions we ask deal with curriculum issues such as possible improvements or problems in the curriculum, student satisfaction, breadth of training they feel they have received in their major, etc. We feel that this is an excellent way to get feedback on our program and ensure that we are meeting our students' needs.

New hires are told when they interview that the department is teaching-centered, and the

bulk of their time will be spent interacting with students in and out of class. We also try to hire like-minded individuals whose primary interest lies in teaching.

All faculty are informed of the PPM and its importance to guiding the operation of all aspects of the university. In addition, faculty are informed of the College of Science Tenure document as well as their expectations relative to the teaching standards embedded in the *Annual Review of Faculty* process.

In summary, the model teacher in the Department of Botany is: knowledgeable and current about the subject matter; enthusiastic about botany, teaching, and students; organized during class; constantly challenging students to apply knowledge in problem solving; one who requires students to go beyond bare facts to consider implications; approachable in and outside of class; innovative; and supportive of students and their activities.

3. Faculty Qualifications

As Appendix B indicates, the Department of Botany is made up of tenured faculty members that are well-trained in diverse areas of expertise. They all hold PhDs from a variety of institutions both in the US and Canada. Two of the remaining tenured faculty have extensive post-doctoral experience. Faculty conduct research and remain current in their areas of expertise.

One of the five adjunct faculty members hired over the past five years has a PhD and all the rest have Master's degrees. Adjunct faculty mostly teach general education courses best suited for their areas of expertise. A plant physiologist teaches BTNY LS1203 (*Plant Biology*), a paleoethnobotanist/anthropologist teaches BTNY LS1303 (*Plants in Human Affairs*), and BTNY LS1403 (*Environment Appreciation*) has been/is taught by adjuncts who have professional experience in land management and re-vegetation. Until recently, we have only had adjuncts teach classes at other campuses and/or at night. However, recent retirements have forced us to use adjuncts during the day for two other courses, BTNY 2413 (*Introduction to Natural Resource Management*) and BTNY 3214 (*Soils*). Both adjuncts are qualified, the latter course being taught by our Lab Manager. However the fact that these two required courses for the Track B major cannot be covered by existing faculty is a great concern.

Until now, the number of faculty was sufficient to offer a wide range of courses which serve the needs of students in all of our degree programs. Our program offers diversity in its courses, enabling students to choose tracks of specialization within the scope of Botany which prepare them for careers in the field, laboratory, teaching or graduate school.

Our department has sufficient breadth to provide a quality education in basic botany, environmental awareness and responsibility as well as specialty areas including plant anatomy, ecology, evolution, geography, plant tissue culture, physiology, morphology, taxonomy, algology, marine biology, genetics, ethnobotany, and mycology. Faculty are also proficient in field and laboratory skills and techniques, plant specimen collection, preservation and preparation which are taught to students through laboratory courses,

field trips and directed research. **The areas of expertise now lacking are soils and plant propagation.** This problem is compounded because we have been preparing to expand into a new area, *Forensic Botany*, with the expertise of our plant anatomist. Further enhancement of our ethnobotany curriculum has also been discussed, particularly to meet the growing interest in Ethnobotany and Natural Medicine among our majors.

We seek to provide mentors and role models for all of our students and have succeeded in achieving a faculty composition that meshes with the needs of our student body. There has been considerable stability in the departmental faculty. In the past 40 years only two members have left for reasons other than retirement. In the past, when faculty have retired, they have been replaced by well qualified faculty who can teach the same courses, and often have additional strengths which add to our departmental offerings. We are confident that this will be the case again if we are allowed to hire replacements.

Our program's mission is to provide our students with a strong foundation in botany, a sense of responsibility to the environment, and sufficient breadth and depth of knowledge to succeed in their chosen field.

4. Evidence of Effective Instruction

The course evaluation form used by the Botany Department includes 13 questions which students answer on a scale of 1 to 7(7 being best). Students are also encouraged to write comments which are typed up by the secretary. Copies of the evaluations are given to the appropriate faculty members.

Copies of each faculty member's evaluations as well as departmental averages are on file in the Botany office. Overall departmental averages for recent semesters range from:

Spring 2011: 4.62 to 5.99
- and 3.70 for "Has this course influenced you to take another Botany course?"
    - this number is low because most students take BTNY 1403 to fulfill a requirement in their already chosen major and therefore would rarely take another Botany course

Fall 2011: 4.97 to 6.08
- and 3.94 for "Has this course influenced you to take another Botany course?"

Spring 2012: 4.64 to 6.00
- and 3.72 for "Has this course influenced you to take another Botany course?"

Over the decades, the Botany faculty have received College and University-wide Teaching Awards. This is evidence of instruction quality as recognized by peers at WSU.

i. Regular Faculty

The main tool we use to determine the quality of teaching is the student course evaluations as well as peer evaluations of faculty during their tenure/promotion reviews. While tenured faculty are required by the university to be evaluated in 2

courses per year, most have students evaluate them in every course they teach, which is the requirement for non-tenured, tenure-track faculty. The department chair and the individual faculty member review the evaluations, and discuss them in the annual review of the faculty. We get some information about the quality of our teaching from our graduating seniors during their exit interviews. Each faculty member is evaluated during the tenure and promotion process, and a teaching portfolio documenting the quality of instruction is part of the peer review process. The University Policies and Procedures Manual specifies that teaching is the primary responsibility of WSU faculty and gives guidelines on how evaluations of teaching quality are to be made by the department chair, dean of the college, etc.

ii. Adjunct Faculty

Student evaluations from every course taught are reviewed by the department Chair who discusses the results with the faculty member.

5. Mentoring Activities

New faculty members are given a one course reduction in load during their first year. This enables them to adjust to their teaching load and affords them time for personal research. It is imperative to encourage new faculty to begin preparing for tenure review and promotion as soon as possible. For this reason, we encourage new faculty to focus on personal research at least the first year, before starting to mentor students.

Mentoring is provided on an informal but very workable basis by experienced faculty, both by providing advice and guidance and also by modeling appropriate behavior. New faculty learn what is expected of them, in part, by observing the established faculty. Our department is proud of its teaching quality and the rapport we have with our students, and we strive to help students any way that we can. The chair and other faculty freely share syllabi for courses, observations and advice for best teaching strategies for specific courses and types of students. Our faculty are extremely open in sharing new ideas, strategies, problems, and suggestions. Training is also readily available for Canvas, Chi-Tester, etc. and faculty participate on a regular basis.

New faculty are discouraged from becoming too involved in service the first year, but are gradually assigned departmental or college committee assignments in their second year. Involvement in university service is strongly encouraged prior to tenure review.

The chair meets annually with each faculty member to review teaching, scholarship and service for that year. Goals are reviewed and new goals are set to encourage faculty members to strive for success in all areas. The chair has successfully encouraged and supported different faculty in applying for internal grants/funding to start the WSU Community Garden, the Forensic Botany reference collection and course, and the herbarium of plants important to Northern Utah tribes.

6. Diversity of Faculty

Two of the 4 ½ current contract faculty positions in the Botany Department are held by

females. Of the male faculty, two are Canadian immigrants and the other is part Native American. Every effort is made to hire new faculty from diverse backgrounds and ensure that the pool of applicants itself is as diverse as possible. In addition, of the five adjunct faculty that have been hired over the past three years, four are female.

7. Ongoing Review and Professional Development

a. Ongoing Review:

Contract Faculty:

1. Contract faculty are evaluated annually by the Botany Department Chairman with regards to teaching, scholarship and service. The evaluation is then reviewed by the Dean in order to assist the faculty in the improvement of teaching, scholarly activities, service, and in the determination of merit pay (when available). A post-tenure review process is currently being formulated within the College of Science.

2. Tenured faculty are required to have at least two written student evaluations conducted per academic year. The faculty member chooses student evaluations from two classes per year to be included in his/her professional file. Non-tenured, tenure-track faculty must provide written student evaluations for each course taught each semester. Summaries are made by the faculty of these evaluations and included in their professional file to be used for tenure and promotion decisions.

3. Graduating seniors are interviewed by the entire faculty during Exit Interviews and asked to point out the strengths and weaknesses they perceive in the department. These are discussed by the departmental faculty and evaluated in terms of improving the department.

Adjunct Faculty

1. Student evaluations from every course taught are reviewed by the department Chair who discusses the results with the faculty.

2. Adjunct faculty are encouraged to self-assess their pedagogical methods and discuss these with other faculty.

3. Adjunct faculty are encouraged to attend special workshops for adjuncts offered throughout the academic year designed to improve instruction and communication with various campus entities.

b. Professional Development:

The Botany faculty are actively involved in professional development activities including research, field work (in the U.S. and abroad), grant writing, teaching improvements, conferences/workshops, professional presentations, consulting, etc., which are supported through departmental, institutional, and external funding sources.

Contract Faculty:

1. Faculty are encouraged to attend seminars/workshops that are available on teaching strategies, presentation technologies, assessment, etc. offered through a variety of sources on campus (e.g. Teaching and Learning Forum, etc.).

2. Faculty are encouraged to attend and participate in professional meetings/conferences related to professional development in teaching or their area of expertise in order to remain current.

3. Funding (at least partial) for travel and registration fees for professional meetings/conferences is available through the department or other university sources.

Adjunct Faculty

1. Adjunct Faculty are encouraged to attend seminars/workshops that are available on teaching strategies, presentation technologies, assessment, etc. offered through a variety of sources on campus (e.g. Teaching and Learning Forum, etc.).

F. Support Staff, Administration, Facilities, Equipment, and Library

1. Adequacy of Staff

Currently, the department has one full-time Professional Staff (Laboratory Manager) and one half-time Classified Staff (Secretary). At one point during the past five years, the Lab Manager position was reduced to ¾ time, however this was restored to a full-time position. Both, because of their competence, training, and experience, have been indispensable to the operation of our program. Unfortunately, **the secretary is moving out-of-state and the department is in the process of hiring a new secretary** (as of mid-November, 2012). It is hopeful that the department will be able to hire a competent, genial, and collegial secretary very soon, although it will be difficult to replace our outgoing one.

The Secretary's role has become more complex over time and includes mastering changing centralized computing systems, more complex budget tracking, room scheduling during times of competing needs, providing faculty support, administrative report preparation, communications with various publics, student registration problem-solving, inputting major/minor declarations, and inputting clearance for graduation. In addition, the growing need to maintain assessment records, track majors/minors, and recruitment efforts has intensified. The term Secretary should be replaced by Office Specialist or Administrative Assistant and pay made commensurate with the changed responsibilities. It would be considerably better to have a full-time Classified Staff person in the department.

Our Laboratory Manager has changed over the course of this review period. Our current Lab Manager was hired in Summer 2011. She graduated in 2008 from our department with a B.S in Botany and minors in Chemistry and Geosciences. She then received her M.S. at Utah State University in the Department of Watershed Sciences with a focus on ecogeomorhphology and ecology and is also experienced in GIS. She is extremely

proficient in all aspects of the job, and has a pesticide applicator's license. She is an invaluable resource to both faculty and students. In addition to her many duties as Laboratory Manager she is very familiar with our program and provides students with current information on job openings, graduate schools, and a sympathetic ear when needed. She also trains and oversees the department's service award, fellowship recipients, and work-study students who assist in the laboratory and greenhouses. She assists our Botany Club in its activities and fund-raisers (plant propagation, sales, programming, etc.,) and has taken an active role in recruitment activities (Career Day, Major's Fair, etc.). Her position and personality provide an important liaison between the students and faculty.

Due to the vacancy left by the retirement of Dawn Gatherum, our Laboratory Manager is currently teaching the Soils class, as it is required of Track B majors and is an elective chosen by Geosciences majors, among others. At present, no one else on the faculty in Botany is qualified to teach the course and the Geosciences Department cannot absorb it either. In addition,

i. Ongoing Staff Development

<u>Professional Staff (Laboratory Manager):</u>

Initial orientation and training includes:

- tours of the campus, Science Laboratory Building and the Botany laboratories
- a tour of the greenhouses by the faculty greenhouse director
- instruction on laboratory safety, chemical and waste storage, etc.

Ongoing staff development includes:

- discussions of greenhouse matters with the faculty greenhouse director on a regular basis. (**Dawn Gatherum, as the horticulturist, was also the faculty greenhouse director. His recent retirement has left that position empty**). Currently, other faculty provide as much help as possible.
- asking questions of the faculty and staff and receiving feedback on general or specific job-related issues
- updated pesticide applicator training and licensure is provided through the local ATC
- a comprehensive *"job description"* which outlines the duties of the laboratory manager and she is encouraged to ask questions as they arise. She is instructed to keep a list of duties not included in the *"job description"* that develop to be included in the next iteration of the job description.
- development opportunities and plans drawn up as part of the annual Performance Review and Enrichment Program (PREP). These involve goal setting and strategies for achieving those goals that include resources.

Classified staff (Secretary):

Initial orientation and training includes:

- tours of the campus, Science Laboratory Building and the Botany laboratories
- introduction to other staff in the college
- secretaries are required to attend training sessions on scheduling, and using the university computer systems (e.g. registration, student records, etc.).

Ongoing staff development includes:

- training sessions on updates of computer systems, etc.
- workshops on online courses, etc.
- development opportunities and plans drawn up as part of the annual Performance Review and Enrichment Program (PREP). These involve goal setting and strategies for achieving those goals that include resources.

2. Adequacy of Administrative Support

Budget

Except for times when budget cuts are incurred due to enrollment shortfalls, the budget for the department had been marginally adequate. The principal source of support is legislative appropriations and its E & G budget allocation. Tuition and state appropriations, grants (both internal and external), donations, and laboratory fees are currently sufficient to cover the cost of operation. These are generally deemed marginally adequate since occasional special funding through either grants, special legislative appropriations for technology enhancement, or private donations have been made available for equipment purchases outside the capability of the current expense budget.

As often happens, the downturn in the economy caused enrollments to increase and funding to decrease. Normally, the department would be able to adjust loads, etc. However recent retirements with no increase in our instructional wage budget, made it impossible to offer all of the service courses as well as the regular offerings without hiring adjuncts and increasing the load of the chair to full load in the falls and over half-load in the springs. The College of Science has been extremely helpful in paying for some adjuncts, and Continuing Education has given Botany as many evening and on-line classes as possible. However, this situation clearly cannot be sustained. The department is in dire need of hiring a new faculty member.

3. Adequacy of Facilities and Equipment

Facilities

WSU is in the process of trying to secure state funding to build a new science building. The Science Lab building is very old and has age-related issues, such as old pipes, cracks due to settling, and too little space. That said, the College of Science and Facilities have done a good job of holding it together until a new building is available.

Fourth Floor Classrooms

Room SL424 was completely remodeled following semester conversion in 1998 as a multimedia room with laboratory benches to provide work space for microscopy work. Most 2000-level and upper division courses meet in this room. Courses with primarily "wet" laboratories or a mixture of microscopy and wet laboratories are scheduled in the other rooms.

The entry courses for majors and minors are two 2000-level laboratory intensive courses (which do not carry general education credit) meet in SL421, with the equipment and supplies to support those courses housed in that room. Like LS424, this room has a ceiling-mounted digital projector, DVD/video tape player, and dedicated desktop computer for lectures and student presentations. SL421 is also used for the lecture portions of Plant Physiology and Plant Genetics as well as the Life Science class for elementary education majors.

SL422 is used for the Plant Physiology and Plant Genetics labs and for independent student research projects. All chemical storage, most glassware, and equipment for preparing chemicals for classes are kept in this room. This is also the only fourth floor room with a fumehood, resulting in occasional use of the room by other botany classes.

SL425 is used by Soils and for independent student research projects.

The conference room area in SL423 a popular majors' lounge with two computers with printer, a work table, and access to a refrigerator and microwave.

All rooms in the Science Lab Building have wireless internet access.

Classroom Space in Lind Lecture Hall

The space for lectures is adequate given our current enrollment needs. The lecture rooms for which we have primary authority, LL126 and LL 129, are equipped with ceiling-mounted digital projectors, computers, and DVD/video tape players. All lecture halls in Lind were remodeled three years ago. The old anchored seats with pull up desks were replaced with long tables and desk chairs with castors.

Herbarium

To date, our herbarium has served us well. It houses nearly 23,000 specimens,

representing mostly the flora of North Central Utah and collections dealing with the ethnobotany of the Great Basin. Space, however, has become a problem. Our cabinets are full, yet thousands of new specimens are needed in order to represent the ecological and morphological diversity of the plants in our area. If we develop a Forensic Botany course to be used in the Criminal Justice program, more space for a reference collection of plant materials will be needed. A small wet room would be desirable for ethnobotanical studies as well.

Greenhouse

A few years ago, support of expansion of our greenhouses was generated, however, an engineering assessment showed that the building structure could not support such an expansion. The basic structure of the greenhouse facility is sound and the design is good. The floors were coated and sealed in 1999, and one of the two greenhouse floors was redone in 2012. The misters, drains, and watering system work well. The east wall has finally been repaired. A new growth chamber is being installed. However, the glasshouses are showing the problems you would expect after over 40 years. The main problems are with the temperature control system. There are four different thermostats (primary bench heaters, auxiliary heater, louver controls, and an evaporative cooler) with various electrical problems as well as periodic forays onto the roof by the lab manager to coat the glass in lieu of a mechanical shade cloth system. Two of the swamp coolers were replaced in 2012. Another problem is that of glass breakage. In Dec 2011, a large wind storm knocked out several panes as well as the power. Hence, some of the plants were lost due to cold. A back-up generator would be ideal, but is unlikely.

Plant Culture Facility

A small room with light banks and its own heating/cooling system has been set aside for growing plants in culture. This room is used by the Botany and Microbiology Departments. The adjacent room contains laminar flow hoods and belongs to the College of Science as a whole. It is also primarily used by the Botany and Microbiology Departments and is adequate at present.

Faculty Research Space

One of the lab rooms in the Engineering Technology Building has been allocated to the department. It is primarily used by Dr. Deckert and his students.

Equipment

The safety equipment in the laboratories is good. There is a full shower, several eye wash units, dedicated storage units for flammables and acids, and an explosion proof refrigerator. Unfortunately, refrigerators are old and will need to be replaced at some time.

The microscopes available for student use are in good to excellent condition. Sixteen microscopes were purchased for the introductory botany courses 14 years ago, six of which have been replaced. The Laboratory Manager is invaluable in keeping these microscopes in good working order. There are also eight new dissecting

microscopes for these courses. Last year, six phase contrast microscopes were purchased for upper division courses. The 12 compound light, and six dissecting microscopes used in upper division courses are all in excellent condition. A digital photography system that can be easily transferred among the different types of microscopes in use was purchased this year.

The College bought a SEM a few years ago and it is providing unique opportunities for faculty and student research.

Some basic laboratory equipment has been replaced since the last program review. We have a new UV-Vis spectrophotometer and new pH meter. Several items need to be replaced, including various hot plates and stirrers and a clinical centrifuge. We also need an additional top loader balance and pH meter. Storage space (cabinets, refrigerators and freezers) is adequate, but most of the refrigerators will need to be replaced when we move to the new building if not they are not replaced before then. There are also two student-grade visible light spectrophotometers, a microplate reader, a high speed refrigerated centrifuge, and a good collection of electrophoresis and low pressure liquid chromatography equipment. The microplate reader and a refrigerated centrifuge were the main items purchased with an NSF-ILI grant in 1997.

The laboratory rooms also house three benchtop growth chambers, two refrigerated growth chambers, and an incubator. One growth chamber is new and located in SL421 for use by the 2000-level classes that meet there. The remainder of these items are rather aged and will need to be replaced with the move to the new building if not before.

Computer needs are met. The Dean of the College of Science has made a commitment to replacing faculty computers on a four-year cycle. Faculty are now offered a choice between a desktop and a laptop computer. Other computers in the department are replaced on an as needed basis. The quality of computer support is variable.

Adequacy of Library Resources

Library resources are sufficient for our purposes. The COS has a library representative who is exceptionally helpful and efficient. She notifies us when there is money available and facilitates the purchases of books, videos, etc. Electronic journals and databases, and improved interlibrary loan have been enormously useful for faculty and students alike.

H. Relationship with External Communities

1. Description of Role in External Communities

The Botany Department **faculty** play many roles in the community, including:

a. Identifying plants and fungi for various federal, state, and community groups, including assisting with criminal investigations

b. Dawn Gatherum was the Director of the Ritchey Science and Engineering Fair of Utah for many years.
c. Serving on various community and professional boards, including the:
    - Weber River Weed Management Cooperative
    - Ogden City Urban Forestry Advisory Committee (Co-Chair), and
    - Shrub Research Consortium Executive Committee
d. Helping conduct the Utah Science Olympiad (Event Supervisor)
e. Providing expert advice in establishing an algae exhibit at the Leonardo Museum, Salt Lake City (2011)
f. Providing expert consulting for various agencies, groups including:
    - Boy Scouts of America (training workshops for adult leaders)
    - Utah Division of Wildlife Resources (changes in their Big Game Hunting Proclamation)
    - Antelope Island State Park (plant inventory of the island)
    - The Army Corps of Engineers (re-evaluate threatened wetland sites in Northern Utah)
g. Giving presentations to various community groups, including:
    - Wasatch Audubon Society
    - Weber County Master Gardeners
    - Davis County Master Gardeners
    - Ogden Nature Center
    - Rotary Club
h. Teaching Community Gardening Workshop through CE
i. Securing funding for, starting and maintaining WSU's Community Garden
j. Securing funding for and starting After School Science Program in local junior high schools (involves ten WSU departments in three colleges)
k. securing funding for and developing an herbarium of plants of historical importance to northern Utah Ute and Shoshone tribes
l. working with the Naturalist at the Ogden Nature Center to establish a volunteer Botany intern position to help with gardens and activities at the center
m. Meeting with representatives from the National College of Natural Medicine (NCNM) in Portland, OR to develop a Pre-Natural Medicine curriculum in the Botany program
n. Working with representatives of the USFS and the Ogden School District to increase elementary and junior high students' awareness of, appreciation for, and interaction with nature, especially forests
o. Helping local elementary schools prepare for Science Fair and serve as judges at the Ritchey Science Fair

The Botany Department **students** play many roles in the community, including:

a. Planning and conducting activities for *Science Saturdays* (COS hands-on monthly activities open to the public)
b. Helping establish and managing the WSU Community Garden
c. Leading hikes for local schools

d. Helping re-vegetate local ecosystems, such as the Ogden River Parkway
e. Growing plants to sell twice/year to raise money to fund a Botany scholarship
    - Students provide advice to community members buying plants
f. Volunteering for various agencies/groups (USFS, Red Butte Garden, etc.) to help find and monitor plant populations, collect seeds for re-vegetation efforts, etc.
g. Volunteering for the Raptor Inventory Nest Survey (RINS)
h. Volunteering as judges at local school Science Fairs and the Ritchey Science Fair

2. Summary of External Advisory Committee Minutes

To date, The Botany Department does not have an external advisory committee in place. However, the department is in the process of recruiting members to serve on an Alumni Advisory Committee, which will meet in Spring 2013.

Plans are also underway to establish an Employer Advisory Committee.

Both committees will help evaluate the effectiveness and efficiency of the program, suggest improvements, and help formulate improved recruitment and retention plans.

I. Results of Previous Program Reviews (2007-2008 Review)

Strengths:

1) The Botany Department is composed of excellent teachers, who have a genuine desire for the students to learn botany and love plants.
2) The Botany Department is unique in Utah and one of the few strong Botany Departments in the nation.
3) The Department is highly efficient with very limited resources.
    - The herbarium at Weber State University is superbly curated and represents well the flora of northern Utah.
4) This is a student-friendly department.

Challenges for Botany Department:

1) Department visibility and marketing to high school students and general education students at the university continues to be a challenge.
2) The Botany Department has done an effective job of cobbling together equipment from various sources to develop effective teaching labs.
3) The current semester schedule is a challenge for integrating field aspects of the taxonomy, ecology, and field botany courses.
4) The Department receives inadequate support from Facilities Management and Technology Support.

5) The Department currently has one-half of a full-time secretary.
6) Although some faculty have maintained strong research programs, in general faculty research has waned over the last decade.

Recommendations for Change

Date of Program Review: 2007-2008	Action Taken	Progress Description
Recommendation 1: The Department should consider methods to make its general education courses more competitive in the SCH market. **(see Summary Information below for further explanation)**	BTNY LS1303 has been offered on-line for several years BTNY LS1203 is now offered online (as of Summer2011) BTNY Gen Ed courses are now offered at the West campus (LS1403 Fall 2010-Spring 2012 & LS1303 Fall 2012, henceforth) The Dept is *considering* offering a hybrid version of BTNY LS1403	BTNY LS1303 (many years) & LS1203 (since Summer 2011) are offered Fall, Spring and Summer on-line and they fill **Problem:** Seats and classes are limited by CE's budget Botany Dept has tried to provide access to more students (West campus) **Problem:** Enrollments at West are typically low; BTNY LS 1303 seems to draw more students, so we will teach that at West This could be an option, perhaps with a 1CH lab component **Problem:** With 1 ½ retirements, we cannot offer all of the sections of LS 1203, LS 1303, or LS 1403; it is difficult to consider expansion at his point
Recommendation 2: The Department does an excellent job teaching basic botany but needs to update its curriculum with current cellular and molecular techniques.	**Problem:** The two main courses in which these techniques are taught (Plant Genetics & Plant Physiology) typically have low enrollments; students do not choose to take the courses	

Date of Program Review: 2007-2008	Action Taken	Progress Description
Recommendation 3: The Department should take advantage of Lisa Largent, the superb development person assigned to the College of Science.	The Dept regularly participates in College of Science events with donors, etc. The Dept has implemented a new Option within our Track A, Pre-Natural Medicine that has potential for new donors/affiliations The Dept is developing a Forensic Botany course and reference collection These may offer new opportunities for donations as well as collaborative research, etc.	Several Botany students have received donor-sponsored scholarships in recent years The Botany Department & the College of Science are exploring connections with the numerous natural products companies in the state for possible donations, etc. Dr. Paul Cox, ethnobotanist, is a supporter of our department. This is in development (reference collection was started last year, includes a student research position), course to be developed in Spring 2013 as a sabbatical project.
Recommendation 4: The Department should find methods to channel the energy of Botany Club to increase department visibility and as a student recruiting tool.	The Botany Club runs the Botany portion of Science Saturdays The Botany Club participates in community efforts such as revegetation of the Ogden River Parkway, etc. Botany Club members are doing thesis and volunteer projects throughout the community, such as establishing community gardens at WSU and a local community center.	We have implemented some of the specific suggestions made by the previous Review Team, such as establishing & maintaining a WSU Community Garden (Botany student thesis project)

Date of Program Review: 2007-2008	Action Taken	Progress Description
Recommendation 4: (cont.)	Currently (Fall 2012), through a Hemingway grant, the Botany chair is coordinating an after school science program in five junior high schools rotating WSU students from different science disciplines to teach sessions twice/week for two semesters	Two Botany Club members (majors) are teaching the Botany portion of the after school program The goal is to increase visibility of Botany and other STEM fields among local junior high school teachers and students
Recommendation 5: Students seem anxious for more field experiences and the department may have to continue to experiment with summer field courses that will more closely fit student needs.	In Summer 2013, BTNY 3624 (*Plant Taxonomy*) will be offered in the first block of the semester	Summer is definitely the best time to offer taxonomy. Hopefully, enough students will be able to take it then. **Problem:** Funding for this class needs to be found. At present, it is not possible to shift a spring load to summer because all faculty are teaching at full capacity to accommodate the retirements.
Additional Recommendation 1: The Department needs college or university support for marketing its program to potential majors and the community.	In Spring 2012, the Botany Dept offered the first Gardening Workshop through CE in response to community requests	In Spring 2013, the second Gardening Workshop will be taught. **Problem:** Since Dawn Gatherum's retirement, the instructor will be provided by the WSU landscape department (Botany graduate).
Additional Recommendation 2: The Department needs better support from the academic support services on campus.	The department has little control over this CE has been extremely supportive of Botany in giving as many sections as possible, even new on-line offerings	A computer support technician dedicated to the College of Science has somewhat helped some computer issues **Problem:** CE's budget is becoming more limited

Date of Program Review: 2007-2008	Action Taken	Progress Description
Additional Recommendation 3: Faculty with external grant-funded research projects should receive support for purchasing, bookkeeping, and other administrative grant activities.		Although Botany faculty have been able to secure small external grants, no additional money has been available under these grants
Additional Recommendation 4: The department secretary position should be changed from half-time to full-time which would free considerable time for the chair.	The department is in the process of hiring its second secretary in four years, and it is still a half-time position	It seems that with such a small department, additional secretarial help will not be supported

Summary Information

Recommendation 1: **The Department should consider methods to make its general education courses more competitive in the SCH market.**

- Although Continuing Education (CE) has been very supportive in giving Botany as many night, on-line, summer, and off campus courses as possible, CE's budget is becoming tighter and enrollments are starting to be limited.
- With recent retirements, the Botany Department faculty is down 1 ½ faculty in fall semester and 1 faculty in the spring semester. Both retirees taught the service course, BTNY LS1403, and one taught BTNY LS 1203 and BTNY LS1303. As a result, in Fall 2012, NO face-to-face BTNY LS1303 and one fewer BTNY LS1403 were offered.
- Another faculty is on sabbatical leave this fall, after being denied two years ago due to the financial crisis. All of his classes were deferred to another semester, and the Gen Ed courses are not part of his load in fall. Hence, the chair had to assume a full load (12 SCH) and is teaching the only two BTNY LS 1403 classes taught during the day. Each section has on average 130 students, much larger than is optimal for this course. Two night sections are also being taught, paid for by CE.
- At present, Botany does not have a sufficient instructional wage budget to even cover one daytime class, so it is difficult to hire adjuncts to cover the load.
- Although the Dean's office has been helpful in covering the costs of some other courses this year and last, this is not a long-term solution. A new faculty hire would enable the department to at least stabilize its course loads again.

J. Action Plan for Ongoing Assessment Based on Current Self Study Findings

1. Action Plan for Evidence of Learning Related Findings

Problem Identified	Action to Be Taken
An accepted assessment tool for Gen Ed LS courses must be developed and approved.	Once the assessment tool for the General Education LS Learning Outcomes is developed, Botany will adopt it and begin to collect assessment data.
Now that rubrics have been developed, more direct assessment data is needed for the student portfolio.	By increasing the number of graduates, more students will complete their portfolios and more data will be collected.
Too few faculty remain to adequately cover all of the course offerings as currently scheduled.	Hire at least one new faculty member this year and adjust schedules as needed. As the number of graduates increase, the case can be made for a second faculty, coinciding with the full retirement of Dr. Bozniak.

Summary Information (as needed)

2. Action Plan for Staff, Administration, or Budgetary Findings

Problem Identified	Action to Be Taken
Currently, there is no secretary.	Hire a new secretary before spring semester starts.
Insufficient full-time, tenure-track faculty in department to cover all course offerings as needed.	Hire a new tenure-track faculty member.
Supplemental instructional wage budget is insufficient to pay for even one daytime course.	Petition to increase the instructional wage budget.
Continuing Education-funded courses, especially on-line, fill quickly, and their budget cannot allow more sections to be offered.	Try to get unused CE seats from other departments re-allocated to Botany.

K. Summary of Artifact Collection Procedure

Artifact	Learning Outcome Measured	When/How Collected?	Where Stored?
BTNY LS1203 Scores for exams	Gen Ed Learning Outcomes; Botany Knowledge & comprehension; skills	3 times per semester	Excel files
Summary + response papers	Gen Ed Learning Outcomes; Problem Solving & Data Analysis	Throughout the semester	PDF files
BTNY LS1403 Scores for exams	Gen Ed Learning Outcomes; Botany Knowledge & comprehension; skills	Exams are every given 3-4 times per semester	Excel files
Group papers	Gen Ed Learning Outcomes; Botany Knowledge & comprehension; skills	Throughout the semester	Excel file & hard copies in file cabinet
BTNY 2104 Essay rubric	Botany Knowledge & comprehension; skills	Students turn in drafts about 2/3 into the semester and the final essay at the end	Copies of some final essays as PDF files
Scores for exams, lab exercises, assignments	Botany Knowledge & comprehension; skills	Throughout the semester	Excel file
BTNY 3303 Scores for exams, quizzes, lab exercises, assignments	Botany Knowledge & comprehension; skills	Throughout the semester	Excel file
Book review rubric	Botany Skills	Students turn in review about halfway through the semester	PDF of rubric
BTNY 3454 Scores for quizzes and exams	Botany Knowledge & comprehension	Throughout the semester	Excel file
Oral presentation rubric with comments	Botany Skills	About halfway through course	Word document
Formal lab reports	Botany Skills	Twice during course	Excel file with scores; some hard copies in file cabinet
Group poster presentation	Botany Skills	At end of semester	Excel file with scores; some posters on display in classroom, some PowerPoint files
BTNY 4980 Essay rubric	Botany Knowledge & comprehension	End of the semester	PDF of completed rubrics
Portfolio rubric	Botany Knowledge & comprehension , skills, affective domain	End of the semester	PDF of completed rubrics
BTNY 4990 Essay rubric	Botany Knowledge & comprehension	End of the semester	PDF of completed rubrics
Portfolio rubric	Botany Knowledge & comprehension , skills, affective domain	End of the semester	PDF of completed rubrics

APPENDICES

Appendix A: Student and Faculty Statistical Summary

	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Student Credit Hours Total[1]	4,351	4,060	4,196	4,528	4,654
Student FTE Total[2]	145.03	135.33	139.87	150.93	155.13
Student Majors[3]	37	35	45	64	62
Program Graduates[4]	8	5	10	4	1*
Student Demographic Profile[5]	**37**	**35**	**45**	**64**	**62**
Female	21	18	20	31	31
Male	16	17	25	33	31
Faculty FTE Total[6]	**7.45**	**7.05**	**6.77**	**7.07**	**8.22**
Adjunct FTE	1.67	1.49	1.16	1.64	3.16
Contract FTE	5.78	5.56	5.61	5.43	5.06
Student/Faculty Ratio[7]	**19.47**	**19.20**	**20.66**	**21.35**	**18.87**

Note: Data provided by Institutional Research

1 **Student Credit Hours Total** represents the total department-related credit hours for all students per academic year. Includes only students reported in Banner system as registered for credit at the time of data downloads.

2 **Student FTE Total** is the Student Credit Hours Total divided by 30.

3 **Student Majors and Minors** is a snapshot taken from self-report data by students in their Banner profile as of the third week of the Fall term for the academic year.

4 **Program Graduates** includes only those students who completed all graduation requirements by end of Spring semester for the academic year of interest. Students who do not meet this requirement are included in the academic year in which all requirements are met. Summer is the first term in each academic year.

5 **Student Demographic Profile** is data retrieved from the Banner system.

6 **Faculty FTE** is the aggregate of contract and adjunct instructors during the fiscal year. **Contract FTE** includes instructional-related services done by "salaried" employees as part of their contractual commitments. **Adjunct FTE** includes instructional-related wages that are considered temporary or part-time basis. Adjunct wages often include services provided at the Davis campus, along with on-line and Continuing Education courses.

7 **Student/Faculty Ratio** is the Student FTE Total divided by the Faculty FTE Total.

Summary Information

***Number of Graduates:**

There is a discrepancy between the number of Botany graduates reported by Institutional Research (IR) and the number of students that complete the program. As an example, in 2011-2012, IR shows one graduate. However, a second student was a double major and Botany was the second major declared. Hence, Botany does not get credit for this graduate. In addition, a third student completed her major, but then found out she needed to take summer classes to complete her minor. Hence, she did not graduate that year.

Trend since last review:

Historically, the number of Botany graduates has been cyclical, with "boom" (2005-2006, 2009-2010) and "bust" (2002-2004) years interspersed between average years. The 2011-2012 number does not really reflect the number of students who successfully completed the program. Since 2005-2006, the number of graduates has been fairly steady, with the exception of 2011-2012. **However, this year (2012-2013), the department should graduate 5-6 majors. The same should hold true for the following year as well.** Unfortunately, the current year's numbers are not included in this review cycle. The increased efforts aimed toward recruitment, more transfers from community colleges (especially Salt Lake Community College and schools in California), seem to be establishing a pool of students who can complete their degrees in a timely manner, providing a continuous (and hopefully increasing) supply of graduates.

Number of majors:

The data from IR shown above and the data that departments can access through Banner often differ. For example, when the department prints the "List of Current Majors", the number shows as about 90 Botany majors, 50% more than what is provided through IR. In addition, the counts that we can access do not include some majors that are very active in the program. One reason for the discrepancy includes the fact that IR only counts majors that are currently enrolled at WSU at the time the count is run.

Problem: Many students take time off to work or go on a mission. Why some active majors (who are enrolled) do not show up on the report that we run, yet do show up on the IR report, is unknown and unexplained.

Trend since last review:

The number of Botany majors has increased about 60% from 2007-2009 to 2010-2012.

Appendix B: Contract/Adjunct Faculty Profile

Name	Gender	Ethnicity	Rank	Tenure Status	Highest Degree	Years of Teaching	Areas of Expertise
Contract Faculty							
Eugene Bozniak (half-time; half-retired since Summer 2009)	M	Canadian immigrant	Full Professor	Tenured	PhD	43	Algology, Marine Biology, Environmental Issues
Stephen Clark	M	Part Native-American	Full Professor	Tenured	PhD	47	Plant Taxonomy, Ethnobotany
Ron Deckert	M	Canadian Immigrant	Associate Professor	Tenured	PhD	10	Plant Anatomy & Morphology, Mycology, Endophytes
Sue Harley	F	American	Full Professor	Tenured	PhD	25	Plant Physiology, Plant Genetics
Barbara Wachocki (Chair)	F	American	Full Professor	Tenured	PhD	22	Plant Ecology, Environmental Issues
Retired as of Summer 2012: Dawn Gatherum	M	American	Full Professor	Tenured	PhD	41	Horticulture, Soils, Weed Science
Adjunct Faculty							
David Bracken Davis (2011-present)	M	American	Adjunct		MS	1	Natural Resource Mgt, GIS/Remote Sensing
Annita Peterson (2011-present)	F	American	Adjunct		PhD	4 yrs as instructor	Plant Physiology, Crop Science
Lynda Sperry (2010-2011)	F	American	Adjunct		MS	1	Habitat reclamation/ Revegetation
Sonya Welsh (Fall 2012)	F	American	Adjunct		MS	½ year	Watershed Science, Ecogeomorphology, GIS, Riparian Ecology
Susan Young (Fall 2012; 1994-2005)	F	American	Adjunct		MA	23	Anthropology, Paleoethnobotany

Summary Information

In Summer 2009, Gene Bozniak went to half-retired status and was no longer available to teach in the Falls. Loads were adjusted, and Botany's participation in the Cell Culture class (team-taught with Microbiology) was suspended until new faculty could be added.

In Fall 2011, Dawn Gatherum took a sabbatical leave to work on a USFS grant monitoring lichens along the Wasatch front. It became necessary to hire adjuncts to teach his BTNY 1203, BTNY 2413, and two BTNY 1403 sections (one at night). At that point, it was assumed that this was a one-time dilemma, and the Dean's office contributed money for the BTNY 1203 class. CE paid for the night class. Barb Wachocki traded with CE: her West campus BTNY 1403 was taught in-load in exchange for CE paying for the BTNY 2413 class.

In Spring 2011, WSU offered a retirement incentive, and Dawn Gatherum retired as of Summer 2012. That has resulted in a dire situation, wherein

Appendix C: Staff Profile

Name	Gender	Ethnicity	Job Title	Years of Employment	Areas of Expertise
Sonya Welsh	F	American	Laboratory Manager; Professional Staff	1 ½ years	Chemical & media preps Greenhouse management Lab preparations Inventory mgt. Purchasing/Equipment acquisition Writing lab protocols Chemical & waste storage & mgt.
To be hired			Secretary II; Classified Staff		Departmental budget oversight Proficient in all computer applications necessary Scheduling (classes, rooms, etc.) Faculty support (exam prep, etc.)

Summary Information

Juliette Draney was the Botany Department Secretary from Aug 2009-Nov 2012. She is moving out of state for her husband's job and the department is in the process of hiring a new secretary.

Appendix D: Financial Analysis Summary

Department	2007-2008	2008-2009	2009-2010	2010-2011	2011-2012
Undergraduate					
Instructional Costs	655,003	678,712	581,602	631,197	610,487
Support Costs	660	801	605	587	3,965
Other Costs					
Total Expense	655,663	679,513	582,207	631,784	614,452
Cost Per Student FTE	$4,521	$5,021	$4,162	$4,186	$3,961
FTE	145.03	135.33	139.87	150.93	155.13
Cost per SCH	$150.54	$167.37	$138.75	$139.53	$132.03
SCH	4,351	4,060	4,196	4,528	4,654

Note: Data provided by Provost's Office

Summary Information

There has been a 7% increase in SCH & FTE production from 2007-2008 and 2011-2012. This is coupled with a decrease of 12.3% in the cost per SCH/student FTE.

The decrease in cost per CSH/student FTE seen in 2009-2010 can be accounted for by the half-retirement of Gene Bozniak. AS part of the retirement incentive offered to Dawn Gatherum in 2012, he will still be paid during the 2012-2013 academic year. It is anticipated that the cost per SCH/student FTE will drop again, once he is no longer paid.

A new faculty member could be hired with a portion of Dawn Gatherum's salary. A second faculty replacement could likely be hired on the remainder of Gene Bozniak's salary, once he retires completely.

Appendix E: External Community Involvement Names and Organizations

Name	Organization
Gene Bozniak	The Leonardo Museum in Salt Lake City (2011)
Gene Bozniak	Wasatch Audubon Society
Gene Bozniak	Weber County Master Gardeners
Gene Bozniak	Davis County Master Gardeners
Gene Bozniak	Ogden City Urban Forestry Advisory Committee (Co-Chair)
Stephen Clark	various state, federal and community groups/ individuals (plant identification)
Stephen Clark	Representatives from Northern Ute and Shoshone Tribes
Stephen Clark	The Army Corps of Engineers
Stephen Clark	Rotary Club
Stephen Clark & Dawn Gatherum	Boy Scouts of America
S. Clark, D. Gatherum & B. Wachocki	USFS
Dawn Gatherum	Ritchey Science and Engineering Fair of Utah (director for many years)
Dawn Gatherum	Weber River Weed Management Cooperative
Sue Harley	Utah Science Olympiad (Event Supervisor)
Barbara Wachocki	National College of Natural Medicine (NCNM)
Barbara Wachocki	Ogden School District (various elementary & junior high schools)
Gene Bozniak, Stephen Clark, Barbara Wachocki	Ogden Nature Center
Barbara Wachocki	Shrub Research Consortium Executive Committee

Appendix F: External Community Involvement Financial Contributions (July 2007-Oct 2012)

Account	Organization/Donor	Amount	Type
McKell Scholarship Endowment in Botany	Various donors	$7,445	Donation
Herbarium Gift Account	Stephen L. Clark	$3,030	Donation
Nancy J. Clark Memorial Botany Scholarship	Various donors	$5,933	Donation
Botany Scholarship Fund	Botany Faculty & Staff	$7,720	Donation
	Botany Club	$8,500	Donation
Botany Department (plants)	Lois M. Ochs	$400	Gift in Kind

Version Date: Oct 2011

Appendix G: Complete Botany Student Portfolio and Grading Rubrics

What is a Student Portfolio?

A portfolio is a multidimensional collection of both student and faculty selected educational works. This collection contains both developmental as well as representational materials and is well-organized and readily revisable. The material represents knowledge literacy, skills mastery, and affective development. This collecting exercise empowers students while giving new dimensions to the purpose of their education. Portfolios are used for assessment purposes in addition to serving as an incentive to the student for developing good habits in assembling and organizing materials of relevance to themselves and others, such as personnel managers or graduate school selection committees. "Folder" topics of the Botany Portfolio are listed below but be mindful of the fact that some materials will be used in more than one folder, therefore, cross-reference such material rather than duplicate it.

(1) Knowledge and Comprehension

Upon graduation, Botany majors should have a thorough **knowledge and comprehension** of the **core concepts** in the discipline of Plant Biology. These include the fact that:

(a) Plants are *like* other organisms in regard to: basic metabolism, sexual reproduction, clonal reproduction, hormonally regulated development, ability to respond to the environment, diversity and evolution.

(b) Plants are *unique* organisms in: their varied life histories - especially a sporic one with alternation of generations; their role as primary producers in food webs, serving as the interface organisms between the organic and inorganic worlds *via* mineral assimilation and photosynthesis; and the oxygenation of the atmosphere.

(c) Plants serve as an important source of products: food, fiber, flavorings, feed, fuel, pharmaceuticals, etc.

- Course syllabi for all Botany and Support courses.
- Completed *"Advising Summary"* Sheet.
- Copy of the most recent *TRANSCRIPT*.
- Exit interview summary.
- Optional: If a GRE (or similar) exam is taken, a copy of the record received should be included in the portfolio.

(2) Skills Development

Upon graduation, Botany majors should have mastered a set of fundamental **skills** which would be useful to function effectively as professionals and to their continued development and learning within the field of Plant Biology. Evidence of mastery of each skill must be resented.
These skills include the following:

a. **Communication Skills:** Botany graduates will be required to demonstrate competence in communication, both written and oral, and present the results of their research in senior theses, senior capstone courses, and in all upper-division courses where such communication is expected and evaluated by both their peers and the instructor.

(i) ***Writing Skills*** - any graded written assignments, in Botany courses or other, such as poems or short stories in an English class. Included shall be date, course number and title, instructor, purpose of the assignment (if known), etc. Included here shall be an annotated reading list, with abstracts of papers, articles, or books that were both read and had a significant impact upon the student. We believe that such reflections causes us to identify with the *pivotal* impacts in our lives that changed our paradigm. This component shall also demonstrate ***critical thinking, reasoning, and effective argument skills***. CRITICAL THINKING as used here contains the following elements:

- Determining cause-and-effect relationships
- Differentiating between fact and opinion
- Recognizing and evaluating author bias and rhetoric
- Determining the accuracy and completeness of information presented
- Recognizing logical fallacies and faulty reasoning
- Comparing and contrasting information and points of view
- Developing inferential skills
- Making decisions and sound judgments by drawing logical conclusions using quantitative or statistically-based reasoning

Critical thinking does not exclude imaginative and speculative thinking as it applies to science in general and botany specifically. To the extent that critical thinking skills are discipline-specific, students should understand that science and its methodology is a way of knowing.

(ii) ***Speaking Skills*** - any oral presentation(s) given in courses or extracurricular events. Include title of talk, abstract, date, location of talk, & type of audience. Sample of evaluations using the *Oral Presentation Evaluation Form* as used by the Department of Botany should be included.

b. ***Computer Skills***- Botany graduates should be competent users of computer software including, but not limited to, wordprocessing, spreadsheet, graphing, and web-search programs. Such skills are also imperative for organizing their required portfolios. Evidence may include any courses taken or training (certificate) received. List of programs student can use, including version (WP 9.0 vs. 8.0, Mac vs. PC, etc.) Include hard copy of work.

c. ***Field and Laboratory Research Skills:*** Majors should be competent observers and experimentalists, whether such research takes place in the field or in the laboratory. They should be able to design & execute experiments, collect and analyze data, and interpret the results using logic.

d. ***Problem-Solving Skills:*** Botany majors should be competent problem-solvers. They should be able to assess the elements of a problem and develop and test a solution based on logic and the best possible information. Evidence of problem-solving skills development should appear in the capstone experience portion of the portfolio, however, draw specific attention to the evidence at this point in the portfolio.

e. ***Self-Assessment Skills:*** Graduates should be able to demonstrate progress in the development of their ability to make a realistic appraisal of growth in all three domains of learning (cognitive, conative, and affective). They should be able to identify, evaluate and explain major, if not pivotal, influences in their development as a botanist. Evidence of such skill development might be a statement of personal and professional goals, assessment of progress toward these goals, assessment of major accomplishments, individual strengths and weaknesses, etc. What experiences have you had that demonstrates strengths and weaknesses. Written evaluation of experiences should be made, for example: was a particular course or relevant experience useful, enjoyable, and why (include support courses as well as Botany courses.) What was science fair judging like and what did you learn from that experience? If you attended a conference and presented a paper, how did you do? How did the audience react and why? Giving this area considerable thought will pay enormous dividends.

f. ***Cooperation/Social Responsibility Skills:*** Graduates ought to understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills. Included here also is valuing: democracy, equal opportunity, work ethic and ongoing personal growth and renewal. Students might consider as evidence such things as written recommendations from those with knowledge of such skills, assessments by supervisors on cooperative work experiences, employers who have placed students in a position to gain such skills on the job, etc.

g. ***Information Seeking Skills:*** For success in college and for lifelong learning, graduates must be able: to recognize when information is needed; to identify appropriate types of information; and to locate, evaluate, and use information effectively, ethically, and legally.

(3) Special Achievements

a. Letters/Certificates of commendation, recognition, special achievements, awards, etc.
b. Newspaper clippings of articles featuring the student.
c. Anything by the student that was published - newspaper article, book review, research paper, etc.
d. Letters of recommendations which are not confidential
e. Presentation at a conference. We encourage students to participate at regional conferences like the National Undergraduate Research Conference; the National Honors Conference; Utah Academy of Arts, Letters, and Sciences; Western Regional Honors Conference; Weber State Chapter of Tri-Beta Honor Society; Weber State Chapter of Sigma Xi; West Coast Biological Sciences Undergraduate Research Conference; etc.
f. Membership in professional societies (Most student rates for membership are so low there is no reason for an interested student not to belong. Examples include Sigma Xi and Tri-Beta). Botany students have an opportunity to hold office in the local chapter of Tri-Beta or other organizations on campus.

(4) Capstone Experiences

a. **Senior Project/Thesis:** To be written according to the guidelines in the *"Botany Senior Thesis"* section of the *"Botany Student Handbook".* This shall include an annotated list or summary of pertinent papers, books, notes, diaries, letters, etc., read in conjunction with the project. Laboratory notebook(s), field notebook(s), with objectives, plans, procedures adopted, observations, measurements, graphs, tables, conclusions, etc. connected with the project should be included. Include title and abstract of oral presentation of senior project or thesis given at the

senior seminar or formal presentation before your thesis advisory committee.

b. **Other Field and Laboratory Research:** As records of field and/or laboratory research as part of senior courses are kept, select ones should be used as evidence of research skills gained. Botany majors should be competent observers and experimentalists, whether such research takes place in the field or in the laboratory. They should be able to design and execute experiments, systematically collect and analyze data, identify sources of error, and interpret the results and reach logical conclusions. They should also have a basic understanding of laboratory and field safety issues and demonstrate that such understanding has been achieved.

(5) Creativity

This folder provides the student with an opportunity to demonstrate their creative talents and individuality using whatever medium the student selects. This could be related or unrelated to Botany. Considerable overlap with other folders could be expected. If the student feels that there is no possibility for meeting this requirement, at a minimum, the student shall write a paper wherein s/he demonstrates the ability to apply some mathematical skill or principle in solving a botanical problem. Any ***Unique Skills*** development should be included here such as special training or hobby development. Evidence of any workshop attended, including subject, date, location, presenter, and synopsis. Catalogs of collections of photographic slides or prints, microscope slides, herbarium specimens, etc. could be used. Include photographs of representative samples of such work since some projects are difficult to store in a folder, such as a display made for a museum cabinet, special laboratory apparatus, etc. A particularly well maintained laboratory and/or field notebook might qualify as well.

(6) Affective Domain Development

Upon graduation, Botany majors should demonstrate significant value-added progress in developing the following **values**:

(a) *Appreciation* of the *diversity* of cultures and intellectual points of view.
(b) *Understanding* of *ethical issues* and responsibilities such as the environmental costs of excessive consumerism, impacts of technology upon society, etc.
(c) *Commitment* to the development of cultural perspectives that do not disparage others solely on the basis of an individual's or group's ethnicity, gender, religion, sexual orientation, marital status, age or disability.
(d) *Appreciation* that Botany follows the *Liberal Arts* tradition which is based upon the notion that, in a world of ideas, a person is not free or liberated from the bonds of ignorance if s/he makes decisions based upon closed-minded habits, prejudices, or unconscious emotions that preclude critical thinking. Additionally, graduates will need to demonstrate growth in their social obligation to communicate with the public on scientific and technical issues.
(e) *Appreciation* of the *aesthetic* attributes of nature, whether their studies are primarily in the field where entire ecosystems or biomes are investigated or in the laboratory where the microscope and biochemical techniques are used as tools for observing nature. Evidence of growth in the development of the affective domain is likely to be the most difficult to gather. Creativity and considerable thought will need to be exercised to meet this criterion. Experiences gained from such things as travel, either domestic or foreign; working with minority or disadvantaged groups of people; courses taken which address ethics or aesthetics,

particularly as it relates to you as a Botanist; etc. upon reflection could be written up and become supporting evidence of such growth.

(7) Career Planning

a. ***Employment/Graduate School Assessment:*** Students shall provide evidence that they have researched the job market, have knowledge of careers for Botanists and professionals in allied plant sciences, or have researched graduate school programs and assessed their suitability for advanced degree studies relative to their own professional interests and strengths. This evidence may take various forms left to the discretion of the student.

b. ***Résumé:***
   - **(i) Work experience** - Any activity for which the student was paid, e.g. Botany LS1105 tutor, Supplemental Instructor, Forest Service summer employment, museum curating, etc. Maintain a list of dates, places, duties/assignments, etc.
   - **(ii) Volunteer service** - Science fair judging, Expanding Your Horizons conference, Science Olympiad, Botany Laboratory, Center for Environmental Services Conference, etc. are examples. This should not simply be a list of activities, but include details of when and where it was done, and what the student actually did.
   - **(iii) Extracurricular activities** - Botany Club plant sale, Botany Club officer, ECOS officer, etc. (Including achievements and duties - e.g. arranged for the following speakers, chaired the following sub-committees, etc.)

c. ***Curriculum Vita:*** A current, updated and neatly printed vita, essentially representing a selection of materials from each of the other folders would be expected of the student. This would assist greatly in future employment searches or graduate school placement.

(8) Science as Process

All students who are exposed to Botany courses (majors, minors, support, and General Education students) should **understand and appreciate**, in addition to the core knowledge of Plant Biology, the nature of science, how science is applied to everyday problems, and significant botanical achievements. Teaching majors and minors should become aware of teaching strategies that accommodate multiple learning styles of their prospective students. For this folder of the portfolio a suggested means of providing evidence of understanding and appreciation of the nature of science as a process and a way of knowing, along with applications to everyday problems might be to prepare an ***outline of a lecture***, designed for a varied audience in terms of science background that would deal with these topics. The outline would address:

What is science? How is scientific inquiry carried out? How do we apply scientific methodology to solving everyday problems? What significant botanical achievements were made using these techniques? Those students who are contemplating teaching biology should, in addition, address current teaching strategies, through lesson plans, that not only deliver life science to students but demonstrates some understanding and sensitivity to the need for multiple learning styles of these prospective students.

Portfolio Scoring Rubric

Each folder will be scored on a 0-4 scale according to the attached rubric. Each raw score is then multiplied by that particular folder's weight factor. The weighted scores are added up to give a final score and grade which correspond to the WSU 0-4 grade point scale.

Folder	**Raw Score (0-4)**	**Weight Factor**	**Weighted Score**
1.A. Botany Student Essay		0.30	
1. B-E. Course Syllabi Most Recent Transcript, GRE (optional), etc.		0.05	
2. Skills Development a. Communication Skills (i) Writing Skills (ii) Speaking Skills b. Computer Skills c. Field and Laboratory Research Skills d. Problem-Solving Skills e. Self-Assessment Skills f. Cooperation/Social Responsibility Skills g. Information Seeking Skills		0.05	
3. Special Achievements		0.05	
4. Capstone Experience a. Senior Project/Thesis b. Other Field and Laboratory Research		0.15	
5. Creativity		0.10	
6. Affective Domain (a) *Appreciation* of the *diversity* of cultures, etc. (b) *Understanding* of *ethical issues* & responsibilities (c) *Commitment* to development of cultural perspectives (d) *Appreciation* that Botany follows the *Liberal Arts t*radition (e) *Appreciation* of the *aesthetic* attributes of nature		0.05	
7. Career Planning a. employment/graduate school assessment b. résumé		0.05	
8. Science as a Process ***outline of a lecture***, designed for a varied audience		0.15	
Overall Presentation of the Portfolio		0.05	
	Total Score		

Portfolio Essay Grading Rubric

	weight	raw score (0-4)	weighted score
Mechanics	0.10		
References	0.10		
Illustrations	0.05		
Introduction and Conclusion	0.10		
Body of the Essay level depth use of specific examples accuracy 13 topics @ 0.05 each Plants are like other organisms in regard to: a. basic metabolism b. sexual reproduction c. clonal reproduction d. hormonally regulated development e. ability to respond to the environment f. diversity g. evolution Plants are unique organisms in: a. their varied life histories - especially a sporic one with alternation of generations b. their role as primary producers in food webs c. their role as the interface organisms between the organic and inorganic worlds via: i. mineral assimilation ii. photosynthesis d. the oxygenation of the atmosphere Plants serve as an important source of products: food, fiber, flavorings, feed, fuel, pharmaceuticals, etc.	0.65		
		Total	

Mechanics
4 = essentially free of typos, spelling errors, format errors, grammar errors, etc.
3 = substantially free of typos, spelling errors, format errors, grammar errors, etc. Errors do not detract from the essay.
2 = mechanical errors detract from the essay, but the narrative of the essay can still be followed.
1 = mechanical errors detract from the essay to the point that the narrative of the essay is difficult to follow.
0 = Mechanical errors render the essay unreadable.

References
4 = over 20 references are cited; over 8 of the references are from the primary literature
3 = 15-20 references are cited; 5-8 of the references are from the primary literature
2 = minimum reference requirement met
1 = minimum reference requirement not met: less than five references from the primary literature; less than 15 references total
0 = no references from the primary literature

Illustrations (Figures and Tables)
4 = The illustrations enhance the essay and their reason for inclusion is clear. Illustrations are captioned and attributed.
3 = It is not clear why some of the illustrations were included. Captions and attributions are not always complete.
2 = It is not clear why some of the illustrations were included. It is apparent that additional illustrations could have been used. Captions and attributions are not always complete.
1 = Illustrations are included to avoid a score of zero.
0 = No illustrations.

Introduction and Conclusion
4 = All of the information asked for in the guidelines is present. The narrative flows easily, with smooth transitions between the subjects that need to be included.
3 = Some of the information is missing. Otherwise, as in 4.
2 = Some of the information is missing. The narrative is choppy and reads like a list. Transitions are not effective.
1 = Either the Introduction or the Conclusion is essentially missing.
0 = Both the Introduction and the Conclusion are essentially missing.

Body of the Essay
Scoring is per topic. A missing topic scores 0.
4 = The level of coverage is that which would be expected of a student who has mastered upper division course work. The student makes use of specific plants and appropriate illustrations to demonstrate the points being made about the topic. The information is accurate and referenced. The narrative flows well with smooth transitions.
3 = The level of coverage is that which would be expected of a student who has mastered upper division course work. For the most part, the student makes use of specific plants and appropriate illustrations to demonstrate the points being made about the topic. For the most part, the information is accurate and referenced. The narrative flows well with smooth transitions.
2 = The level of coverage is that which would be expected of a student who has mastered lower division course work. The student occasionally makes use of specific plants and appropriate illustrations to demonstrate the points being made about the topic. Inaccuracies detract from the essay. The information is poorly referenced. The narrative is choppy.
1 = The level of coverage is at or below that which would be expected of a student who has mastered lower division course work. The student rarely makes use of specific plants to demonstrate the points being made about the topic. Illustrations are rare. Inaccuracies detract from the essay. Information is not referenced. The narrative is choppy.
0 = The topic is either missing or very poorly covered. The level of coverage is below that which would be expected of a student who has mastered lower division course work

Appendix H. Course Assessment Data

a. DIRECT EVIDENCE of Learning: General Education Courses
(NOTE: Threshold for Evidence of Student Learning is 65%)
BOTANY LS 1203 (Plant Biology)

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1203 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: … understand that scientific knowledge is based on evidence that is repeatedly examined, … Scientific explanations differ fundamentally from those that are not scientific.	Natural Science Learning Outcome 1: Nature of Science	Measure 1: 3 multiple choice questions from Exam 1	Measure 1: 71.1% of students answered the questions correctly. (N=45)	Measure 1: Students successfully demonstrated an understanding of the nature of science.	Measure 1: Additional measures are needed.
Goal 2: …understand that all natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Natural Science Learning Outcome 2: Integration of Science	Measure 1: 6 multiple choice questions on Exams 1 & 2, 1 essay question on exam 3	Measure 1: Exam 1 (3 Q) 73.3%, Exam 2 (3 Q) 52.7%, Exam 3 (1 Q) 75.0% of the students answered the questions correctly. (N=45)	Measure 1: Students successfully demonstrated an understanding of the integration of science.	Measure 1: On Exam 2, the questions on integration of science were in the context of metabolism and biochemistry. This is a section of the course that students typically do poorly in.
Goal 3:…understand that the study of science provides explanations that have significant impact on society, …and better understanding of human influences on the earth's	Natural Science Learning Outcome 3: Science and Society	Measure 1: 8 multiple choice questions on Exams 1 & 3 and 1 essay question on exam 3.	Measure 1: Exam 1 (3 Q) 81.5%, Exam 3 (6 Q) 69.9 % of the students answered the questions correctly. (N=45)	Measure 1: Students successfully demonstrated an understanding of the impact of science on society.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2: Three summary +	Measure 2: Average score was 91.5% on	Measure 2: Students demonstrated an	Measure 2: No curricular or

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1203 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
environment.		response papers to student-selected research articles from the journal *Economic Botany*	the papers. (N=37; not all students who enroll in the class turn in the papers, even though they account for 15% of the final grade.)	understanding of how societies use plant species, both cultivated and native, and how harvesting plants from nature can affect ecosystems.	pedagogical changes needed at this time.
Goal 4:…understand that science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	Natural Science Learning Outcome 4: Problem Solving and Data Analysis	Measure 1: 4 multiple choice questions on Exams 1 & 2.	Measure 1: Exam 1 (3 Q) 56.3%, Exam 2 (1 Q) 48.8% of the students answered the questions correctly. (N=45).	Measure 1: Many students cannot (or won't) do the basic arithmetic needed to analyze data.	Measure 1: More practice might be helpful and will be incorporated into the course.
		Measure 2: Three summary + response papers to student-selected research articles from the journal *Economic Botany*	Measure 2: Average score was 91.5% on the papers. (N=37; not all students who enroll in the class turn in the papers, even though they account for 15% of the final grade.)	Measure 2: Students articulated the purpose, methodology, data, and conclusions presented in the research papers that they read.	Measure 2: No curricular or pedagogical changes needed at this time.
Goal 5:…understand that all life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.	Life Science Learning Outcome 1: Levels of Organization	Measure 1: 16 multiple choice questions on Exams 1 & 3.	Measure 1: Exam 1 (13Q) 65.1%, Exam 3 (3Q) 66.8% of the students answered the questions correctly. (N=45).	Measure 1: Students successfully demonstrated an understanding of the levels of organization.	Measure 1: Although results are acceptable, students seem to have more difficulty with chemistry.
Goal 6:…understand that living things	Life Science Learning Outcome 2:	Measure 1: 18 multiple choice	Measure 1: Exam 1 (6Q) 69.3%,	Measure 1: Most students successfully	Measure 1: These topics are complex and

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1203 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
obtain and use energy, and maintain homeostasis via organized chemical reactions known as metabolism.	Metabolism and Homeostasis	questions on Exams 1 & 2.	Exam 2 (12 Q) 57.2% of the students answered the questions correctly. (N=45).	demonstrated an understanding of basic metabolism and homeostasis, but some results were below the threshold.	students will be encouraged to use internet resources for videos on photosynthesis, etc.
Goal 7:… understand that shared genetic processes and evolution by natural selection are universal features of all life.	Life Science Learning Outcome 3: Genetics and Evolution	Measure 1: 16 multiple choice questions on Exams 1 & 3, 1 essay question on Exam 3.	Measure 1: Exam 1 (13 Q) 66.2%, Exam 3 (4 Q) 72.5 % of the students answered the questions correctly. (N=45).	Measure 1: : Students successfully demonstrated an understanding of genetics, evolution, & Natural Selection.	Measure 1: The Exam 1 questions include the data analysis (math) questions that students do so poorly on. No curricular or pedagogical changes needed at this time.
Goal 8:… understand that all organisms, including humans, interact with their environment and other living organisms.	Life Science Learning Outcome 4: Ecological Interactions	Measure 1: 17 multiple choice questions on Exams 1, 2, & 3, 2 essay questions on Exam 3.	Measure 1: Exam 1 (3 Q) 82.2%, Exam 2 (5 Q) 56.7%, Exam 3 (11 Q) 70.8% of the students answered the questions correctly. (N=45).	Measure 1: On the whole, students demonstrated an understanding of ecological interactions.	Measure 1: The questions from Exam 2 focused on the role of metabolism in ecosystem interactions. No curricular or pedagogical changes needed at this time.
		Measure 2: Three summary + response papers to student-selected research articles from the journal *Economic Botany*	Measure 2: Average score was 91.5% on the papers. (N=37; not all students who enroll in the class turn in the papers, even though they account for 15% of the final grade.)	Measure 2: Students demonstrated an understanding of how human actions with regard to utilization of plants can impact the ecosystem.	Measure 2: No curricular or pedagogical changes needed at this time.

BOTANY LS 1403 (Environment Appreciation)

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1403 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: … understand that scientific knowledge is based on evidence that is repeatedly examined, … Scientific explanations differ fundamentally from those that are not scientific.	Natural Science Learning Outcome 1: Nature of Science	Measure 1: 2 T/F questions from Exam 1	Measure 1: 87% of students answered the questions correctly. (N=171)	Measure 1: Students successfully demonstrated an understanding of the nature of science.	Measure 1: Additional measures are needed.
Goal 2: …understand that all natural phenomena are interrelated and share basic organizational principles. Scientific explanations obtained from different disciplines should be cohesive and integrated.	Natural Science Learning Outcome 2: Integration of Science	Measure 1: 16 T/F or multiple choice questions on Exams 1,2,3 & 4.	Measure 1: Exam 1 (1 Q) 83.6%, Exam 2 (3 Q) 82.7 %, Exam 3 (6 Q) 78.4 %, Exam 4 (6 Q) 78.3% of the students answered the questions correctly. (N=171)	Measure 1: Students successfully demonstrated an understanding of the integration of science.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2: Group paper on Climate Change	Measure 2: Average score was 86.4% on the paper.	Measure 2: Students demonstrated an understanding of how climate change is explained by different disciplines.	Measure 2: No curricular or pedagogical changes needed at this time.
Goal 3:…understand that the study of science provides explanations that have significant impact on society, …and better understanding of human influences on the earth's	Natural Science Learning Outcome 3: Science and Society	Measure 1: 22 T/F or multiple choice questions on Exams 1,2,3 & 4.	Measure 1: Exam 1 (7 Q) 81%, Exam 2 (3 Q) 71.8%, Exam 3 (10 Q) 75.3%, Exam 4 (2 Q) 75% of the students answered the questions correctly. (N=171)	Measure 1: Students successfully demonstrated an understanding of the impact of science on society.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2:	Measure 2: Average	Measure 2: Students	Measure 2: No

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1403 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
environment.		Group paper on Climate Change	score was 86.4% on the paper.	demonstrated an understanding of how human actions impact the ecosystem.	curricular or pedagogical changes needed at this time.
		Measure 3: Group paper on *Tragedy of the Commons* & population growth/control.	Measure 3: Average score was 81.8%.	Measure 3: Students demonstrated and understanding of how human population affects global resources.	Measure 3: No curricular or pedagogical changes needed at this time.
Goal 4:…understand that science relies on empirical data, and such data must be analyzed, interpreted, and generalized in a rigorous manner.	Natural Science Learning Outcome 4: Problem Solving and Data Analysis	Measure 1: 12 T/F or multiple choice questions on Exam 1.	Measure 1: Exam 1 (12 Q) 72.7% of the students answered the questions correctly. (N=171).	Measure 1: Students successfully demonstrated an ability to interpret data.	Measure 1: Although results are acceptable, more practice might be helpful.
Goal 5:…understand that all life shares an organization that is based on molecules and cells and extends to organisms and ecosystems.	Life Science Learning Outcome 1: Levels of Organization	Measure 1: 13 T/F, multiple choice, or matching questions on Exam 1.	Measure 1: Exam 1 (13Q) 66.9% of the students answered the questions correctly. (N=171).	Measure 1: Students successfully demonstrated an understanding of the levels of organization.	Measure 1: Although results are acceptable, students seem to have more difficulty with chemistry.
Goal 6:…understand that living things obtain and use energy, and maintain homeostasis via	Life Science Learning Outcome 2: Metabolism and Homeostasis	Measure 1: 11 T/F, multiple choice, or matching questions on Exams 2 & 3.	Measure 1: Exam 2 (8Q) 70.6%, Exam 3 (3 Q) 65.8% of the students answered the questions	Measure 1: Students successfully demonstrated an understanding of basic metabolism and	Measure 1: These topics are complex and students will be encouraged to use internet resources for

Evidence of Learning: General Education Courses – please complete one table for each GE course					
BTNY LS1403 Program Learning Goal Students will…	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
organized chemical reactions known as metabolism.			correctly. (N=171).	homeostasis.	videos on photosynthesis, etc.
Goal 7:… understand that shared genetic processes and evolution by natural selection are universal features of all life.	Life Science Learning Outcome 3: Genetics and Evolution	Measure 1: 9 T/F or multiple choice questions on Exams 2 & 4.	Measure 1: Exam 2 (5 Q) 70%, Exam 4 (4 Q) 83.3 % of the students answered the questions correctly. (N=171).	Measure 1: : Students successfully demonstrated an understanding of genetics, evolution, & Natural Selection.	Measure 1: No curricular or pedagogical changes needed at this time.
Goal 8:… understand that all organisms, including humans, interact with their environment and other living organisms.	Life Science Learning Outcome 4: Ecological Interactions	Measure 1: 25 T/F, multiple choice, or matching questions on Exams 2 & 3.	Measure 1: Exam 2 (19 Q) 67.2%, Exam 3 (6 Q) 78.4% of the students answered the questions correctly. (N=171).	Measure 1: Students demonstrated an understanding of ecological interactions.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2: Group paper on Climate Change	Measure 2: Average score was 86.4% on the paper.	Measure 2: Students demonstrated an understanding of how human actions impact the ecosystem.	Measure 2: No curricular or pedagogical changes needed at this time.

b. <u>Direct Evidence of Learning: Courses within the Major</u> (NOTE: Threshold for Evidence of Student Learning is 75%)

E. Evidence of Learning: Courses within the Major					
BTNY 2104 Plant Form and Function, 2010-11 Note: data based on 40 students in two sections who completed the class with a mean percentage of 77.8 and a standard deviation of 12.1	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: See Section D. Botany Department/ Program Learning Outcomes (D. I. 1.a-c)	Learning Outcome 1: Knowledge and comprehension	Measure 1: Four exams, including a cumulative final. The exams are a mixed format of multiple choice, short answer, essay, and lab practical	Measure 1: Mean percentage for all exams by students who completed the class = 77.0 with a standard deviation of 13.5	Measure 1: Students successfully demonstrated knowledge and comprehension	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Essay on 10 plant challenges	Measure 2: Mean score (4 point scale equivalent to GPA) for essays by students who completed the class = 2.91 with a standard deviation of 0.96	Measure 2: Students successfully demonstrated knowledge and comprehension	Measure 2: No curricular or pedagogical changes needed at this time
Goal 2: See Section D. Botany Department/ Program Learning Outcomes (D. I. 2. a-d, & g)	Learning Outcome 2: Skills	Measure 1: Seven collected lab exercises	Measure 1: Mean percentage for all seven exercises by students who completed the class = 84.5 with a standard deviation of 8.8	Measure 1: Students successfully demonstrated development of laboratory and problem solving skills	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Three lab exercises	Measure 2: Mean percentage for	Measure 2: Students successfully	Measure 2: More practice in data

E. Evidence of Learning: Courses within the Major					
BTNY 2104 Plant Form and Function, 2010-11 Note: data based on 40 students in two sections who completed the class with a mean percentage of 77.8 and a standard deviation of 12.1	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
		requiring data analysis with spreadsheet	all three exercises by students who completed the class = 74.1 with a standard deviation of 19.2	students who completed all sections of these three labs demonstrated development of problem solving and computer skills	analysis with spreadsheets
		Measure 3: Library assignment	Measure 3: Mean percentage for assignment by students who completed the class = 79.9 with a standard deviation of 12.6	Measure 3: Students successfully demonstrated development of information seeking skills	Measure 3: No curricular or pedagogical changes needed at this time
		Measure 4: Four case studies	Measure 4: Mean percentage for all four case studies by students who completed the class = 81.6 with a standard deviation of 18.5	Measure 4: Students successfully demonstrated development of problem solving and critical thinking skills	Measure 4: No curricular or pedagogical changes needed at this time
		Measure 5: Essay on 10 plant challenges	Measure 5: Mean score (4 point scale equivalent to GPA) for essays by students who completed the class =	Measure 5: Students successfully demonstrated communication, information seeking, and critical thinking	Measure 5: No curricular or pedagogical changes needed at this time

E. Evidence of Learning: Courses within the Major					
BTNY 2104 Plant Form and Function, 2010-11 Note: data based on 40 students in two sections who completed the class with a mean percentage of 77.8 and a standard deviation of 12.1	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
			2.91 with a standard deviation of 0.96	skills	
	Learning Outcome 3: Affective domain	Not specifically addressed or assessed in this class			

E. Evidence of Learning: Courses within the Major					
BTNY 3303 Plant Genetics, Fall 2010 Note: three students completed the class with a mean percentage of 84.3 and a standard deviation of 1.3	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: See Section D. Botany Department/ Program Learning Outcomes (D. I. 1.a-c)	Learning Outcome 1: Knowledge and comprehension	Measure 1: Three exams (two proctored, one take home), mix of story problems (including literature-based problems) and essay	Measure 1: Mean percentage for all exams = 81.1 with a standard deviation of 1.3	Measure 1: Students successfully demonstrated knowledge and comprehension	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Eight open note quizzes	Measure 2: Mean percentage for all quizzes = 86.8 with a standard deviation of 8.1	Measure 2: Students successfully demonstrated knowledge and comprehension	Measure 2: No curricular or pedagogical changes needed at this time
		Measure 3: Essay on genetics-related topics for portfolio	Measure 3: Mean score (4 point scale equivalent to GPA) = 2.81 with a standard deviation of 0.62	Measure 3: Students successfully demonstrated knowledge and comprehension	Measure 3: No curricular or pedagogical changes needed at this time
Goal 2: See Section D. Botany Department/ Program Learning Outcomes (D. I. 2. a-d, & g)	Learning Outcome 2: Skills	Measure 1: Eight lab exercises and assignments	Measure 1: Mean percentage for all eight lab exercises and assignments = 89.5 with a standard deviation of 1.4	Measure 1: Students successfully demonstrated development of laboratory and problem solving skills	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Essay on genetics-	Measure 2: Mean score (4 point	Measure 2: Students successfully	Measure 2: No curricular or

E. Evidence of Learning: Courses within the Major					
BTNY 3303 Plant Genetics, Fall 2010 Note: three students completed the class with a mean percentage of 84.3 and a standard deviation of 1.3	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
		related topics for portfolio	scale equivalent to GPA) = 2.81 with a standard deviation of 0.62	demonstrated communication, information seeking, and critical thinking skills	pedagogical changes needed at this time
		Measure 3: Eight open note quizzes	Measure 3: Mean percentage for all quizzes = 86.8 with a standard deviation of 8.1	Measure 3: Students successfully demonstrated problem solving skills	Measure 3: No curricular or pedagogical changes needed at this time
		Measure 4: Book review of *The Double Helix*	Measure 4: Mean score (out of 50 points): 44.8 with a standard deviation of 2.3	Measure 4: Students successfully demonstrated communication and critical thinking skills	Measure 4: No curricular or pedagogical changes needed at this time
	Learning Outcome 3: Affective domain	Not specifically addressed or assessed in this class			

E. Evidence of Learning: Courses within the Major					
BTNY 3454 Plant Ecology, Fall 2010 (N=5)	Measurable Learning Outcome Students will…	Method of Measurement Direct and Indirect Measures*	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: Students will increase their understanding of how plants are similar to other organisms, how they are unique and some of the products we get from plants.	Learning Outcome 1: Knowledge and Comprehension	Measure 1: 4 essay quizzes and 2 essay exams with some multiple choice questions	Measure 1: Averages: Quiz 1: 82%, Quiz 2: 69%, Quiz 3: 90%, Quiz 4: 87.5%, Exam 1: 87.4% Exam 2: 92.4%	Measure 1: Students demonstrated an understanding of the plant ecology principles taught, both in lecture and field techniques.	Measure 1: No curricular or pedagogical changes needed at this time.
Goal 2: Students will gain experience in oral presentation, scientific writing, plant community sampling, experimental design, conducting field experiments, creating a scientific poster, and group skills.	Learning Outcome 2: Skills	Measure 1: 2 formal lab reports on 2 of the labs conducted, either field or greenhouse studies.	Measure 1: Average = 85.5%.	Measure 1: Students demonstrated skills in data collection, interpretation, and formal lab writing.	Measure 1: No curricular or pedagogical changes needed at this time.
		Measure 2: Oral presentation of a recent journal article.	Measure 2: Average = 92.8% based on rubric. Students evaluate each other with instructor assigning grade.	Measure 2: Students demonstrated good skills in finding experimental articles and presenting them orally.	Measure 2: No curricular or pedagogical changes needed at this time.
		Measure 3: Group project includes designing a field study, conducting it, collecting & analyzing data, and creating & presenting a PowerPoint poster.	Measure 3: Average = 100%	Measure 3: Students demonstrated the ability to work as a group to design, conduct and present a plant field experiment.	Measure 3: No curricular or pedagogical changes needed at this time.

E. Evidence of Learning: Courses within the Major					
BTNY 4980 Portfolio Summative Assessment, 2010-11 Note: four students completed the class with a mean score (4 point scale equivalent to GPA) of 3.28 and a standard deviation of 0.48	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1: See Section D. Botany Department/ Program Learning Outcomes (D. I. 1.a-c)	Learning Outcome 1: Knowledge and comprehension	Measure 1: Final Botany Knowledge and Comprehension Essay	Measure 1: Mean score= 2.55 with a standard deviation of 0.71	Measure 1: Students successfully demonstrated knowledge and comprehension	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Science as a Process Folder	Measure 2: Mean score= 3.00 with a standard deviation of 0.51	Measure 2: Students successfully demonstrated knowledge and comprehension	Measure 2: No curricular or pedagogical changes needed at this time
Goal 2: See Section D. Botany Department/ Program Learning Outcomes (D. 2. a-g)	Learning Outcome 2: Skills	Measure 1: Skills Folder	Measure 1: Mean score= 4.00 with a standard deviation of 0.00	Measure 1: Students successfully demonstrated development of laboratory and problem solving skills	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Capstone Folder	Measure 2: Mean score= 3.40 with a standard deviation of 0.42	Measure 2: Students successfully demonstrated communication, information seeking, and critical thinking skills	Measure 2: No curricular or pedagogical changes needed at this time
Goal 3: See Section D. Botany Department/ Program Learning	Learning Outcome 3: Affective domain	Measure 1: Affective Domain Folder	Measure 1: Mean score= 3.28 with a standard deviation of	Measure 1: Students successfully demonstrated	Measure 1: No curricular or pedagogical changes

E. Evidence of Learning: Courses within the Major					
BTNY 4980 Portfolio Summative Assessment, 2010-11 Note: four students completed the class with a mean score (4 point scale equivalent to GPA) of 3.28 and a standard deviation of 0.48	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Outcomes (D. I. 3. a-e)			1.32	development the affective domain	needed at this time
		Measure 2: Creativity Folder	Measure 2: Mean score= 3.43 with a standard deviation of 1.15	Measure 2: Students successfully demonstrated development the affective domain	Measure 2: No curricular or pedagogical changes needed at this time

E. Evidence of Learning: Courses within the Major					
BTNY 4990 Botany Senior Seminar, 2010-11 Note: two students gave seminars, with a mean score (4 point scale equivalent to GPA) of 3.64 and a standard deviation of 0.46	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
Goal 1:	Learning Outcome 1: Knowledge and comprehension	Measure 1: Final Botany Knowledge and Comprehension Essay	Measure 1: Mean score= 2.55 with a standard deviation of 0.71	Measure 1: Students successfully demonstrated knowledge and comprehension	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Science as a Process Folder	Measure 2: Mean score= 3.00 with a standard deviation of 0.51	Measure 2: Students successfully demonstrated knowledge and comprehension	Measure 2: No curricular or pedagogical changes needed at this time
Goal 2:	Learning Outcome 2: Skills	Measure 1: Skills Folder	Measure 1: Mean score= 4.00 with a standard deviation of 0.00	Measure 1: Students successfully demonstrated development of laboratory and problem solving skills	Measure 1: No curricular or pedagogical changes needed at this time
		Measure 2: Capstone Folder	Measure 2: Mean score= 3.40 with a standard deviation of 0.42	Measure 2: Students successfully demonstrated communication, information seeking, and critical thinking skills	Measure 2: No curricular or pedagogical changes needed at this time
	Learning Outcome 3: Affective domain	Measure 1: Affective Domain Folder	Measure 1: Mean score= 3.28 with a standard deviation of 1.32	Measure 1: Students successfully demonstrated development the affective domain	Measure 1: No curricular or pedagogical changes needed at this time

E. Evidence of Learning: Courses within the Major					
BTNY 4990 Botany Senior Seminar, 2010-11 Note: two students gave seminars, with a mean score (4 point scale equivalent to GPA) of 3.64 and a standard deviation of 0.46	Measurable Learning Outcome	Method of Measurement	Findings Linked to Learning Outcomes	Interpretation of Findings	Action Plan/Use of Results
		Measure 2: Creativity Folder	Measure 2: Mean score= 3.43 with a standard deviation of 1.15	Measure 2: Students successfully demonstrated development the affective domain	Measure 2: No curricular or pedagogical changes needed at this time