



Department of Ecosystem Science and Restoration Academic Year 2017-18 Assessment Report

All areas shaded in gray are to be completed by the department/program.
This document will be posted online and must be [accessible electronically](#) (including appendices).

MISSION STATEMENT

The Ecosystem Science and Restoration (ESR) Program emphasizes basic and applied ecological sciences that span microbial to global scales. The program was developed in response for the need for ecosystem ecologists to help solve the global environmental issues of the 21st century and to respond to the burgeoning demand for trained professionals in ecological restoration in Montana, the U.S., and globally. ESR students focus on aquatic or terrestrial ecosystems, and faculty work with students to tailor their experience to fit their interests and career paths. Our **mission** is to provide students with expertise in the core concepts needed to understand both how organisms and their environment interact across multiple scales of biological organization and how to assist in repairing degraded ecosystems. The program emphasizes hands-on, real-world experiences and professional communications, so that students gain experience in applying their knowledge, develop professional skills, and build professional networks that will enhance their success in the field.

DEPARTMENT ALIGNMENT WITH ACCREDITATION CORE THEMES

After listing each departmental objective, indicate which of the five core themes proposed in the [Year One Self-Evaluation Report](#) submitted March 1, 2018 to the Northwest Commission on Colleges and Universities the objective supports.

In this section, you may also briefly describe any innovative or noteworthy programs/initiatives that support the core themes.

PROGRAM (ECOSYSTEM SCIENCE & RESTORATION) OBJECTIVES and ALIGNMENT WITH CORE THEMES (see below for explicit, further consideration of how our program fits into the core themes).

1. Our program strives to foster student success through regular advising, encouragement of high levels of engagement, professional development opportunities, as well as field-based training (addresses core themes 1, 2, 3, 4, and 5).

2. Through rigorous multi-disciplinary classes and team-taught courses, students gain the knowledge and critical thinking skills to apply science to real-world situations both locally and globally. The program fosters the success and professional development of students who desire to solve an increasingly complex array of environmental and natural resource problems (addresses core themes 1, 2, 3, 4).
3. Our program provides internship, professional, and/or research experience and training that prepares students to work at local, regional and/or international scales and to address the big problems facing natural and human systems. FCFC provides financial assistance to our students through scholarships and research grants to promote these types of experiences. In addition, students have opportunities to participate in the Sustainability Fellows program that provides funding for field-learning through the recent gift from the Franke family (addresses core themes 1, 2, 3, 4, 5).
4. Our program emphasizes developing and utilizing best-practices to recruit, retain, and effectively mentor a diverse population of undergraduate students. Our faculty and program is utilizing the full range of available resources (staff, faculty, and students) to help with recruitment and retention, and to effectively mentor students (addresses core themes 4 & 5).

Core theme 1: Engage students where they are. Our students are provided a multi-tiered advising structure to help with success, including support from an award-winning student services office, an engaged program director and an individually-assigned ESR faculty advisor. Our students develop an academic plan upon admission to the program, to ensure that they have a road map through the curriculum and that their assigned faculty advisor aligns with their general interests. Our undergraduate curriculum has multiple training opportunities and prepares students to address contemporary ecosystem science and restoration challenges through innovative classroom and field-based teaching, service-learning capstone experiences with university partners (providing professional mentors) and a push for students to gain experience through internship and jobs. Finally, our student services office has trained the faculty on the ongoing changes to Degree Works to ensure students are supported during the technological changes.

Core theme 2: Invest in people and leadership. (1) Our faculty are leaders in their profession, ranking among the most productive ecological faculty at UM and in the US. (2) Our faculty actively provide leadership to professional societies as members and as editors for prominent ecological journals. (3) We develop student leaders by fostering interactions with professionals and faculty mentors. ESR students participate as officers in the Society for Ecological Restoration's Student Chapter and professional society, developing skills that translate into high job placement and leaders in the profession. (4) ESR fosters engagement by providing students with the capacity to solve environmental problems through fostering a dynamic learning environment via capstone projects with external professional partners that serve Montana.

Core theme 3: Partner with Place. Our curriculum is embedded in place. Our program (and college) studies nature and sustainability and trains students through building around local and regional case studies, field trips lead by practitioners, and service learning through local research, internships, and practicum projects. Our partnering agencies for practicums and internships include local agencies, nonprofit organizations, and consulting groups. Through guest lectures, case studies, field trips, service learning classes, internships (primarily in Montana), and our capstone

practicum experience, our student are connected to Montana’s environment, the communities, and a professional network beyond the university. In addition, many of our faculty collaborate with state, federal and nonprofit organizations to develop projects that will promote decision-making informed by the best available understanding and data. Finally, the Franke Sustainability Fellowship Program supports students who are studying or practicing sustainability projects to promote intercultural competencies globally and nationally. Our faculty work internationally, develop relationships with international universities, and are constantly continuing to internationalize campus through their connections abroad (including hosting visiting scientists, international graduate students, helping promote international experiences for undergraduates through exchanges and field work).

Core theme 4: Support excellence and innovation in the curriculum. Our curriculum and capstone experience has flexibility allowing students to tailor it to their career interests. Working closely with faculty mentors, students can chose from an array of upper division classes and complete either a professional internship, group practicum project in collaboration with a local partnering organization, or senior thesis.

Core theme 5: Foster knowledge creation and innovation. ESR faculty are a critical component of the research engine of UM and necessary for achieving R1 ranking as evidenced by numerous publications in high-impact journals and very high research funding success. We strongly contribute to UM’s high ranking in ecology and will be important players in UM’s growing research reputation. The ESR degree program is well-equipped and positioned to be a leader in ecosystem science and restoration in the nation. The faculty of the Ecosystem Science and Restoration program provide students with the knowledge, skills, and abilities to address these issues head on. We are leaders in our field, our program is strong and growing, and we are poised to meet these challenges in Montana and beyond.

STUDENT LEARNING GOALS and MEASUREMENT TOOLS

Student Learning Goals	Successful completion of COMM 111, WRIT 101, Interim Writing	Completion of core coursework in Natural Sciences (BIO, CHMY, NRSM, & STATS)	Completion of courses in Social Science and Ethics	Successful completion of field based learning (NRSM 344, NRSM 495, NRSM 494)	Review of internship evaluations (students and employers). Ensure work hours are complete	Ongoing faculty advisor mentoring with students
1. Discipline specific knowledge a. Demonstrate an understanding of the natural science		X	X	X		

Student Learning Goals	Successful completion of COMM 111, WRIT 101, Interim Writing	Completion of core coursework in Natural Sciences (BIO, CHMY, NRSM, & STATS)	Completion of courses in Social Science and Ethics	Successful completion of field based learning (NRSM 344, NRSM 495, NRSM 494)	Review of internship evaluations (students and employers). Ensure work hours are complete	Ongoing faculty advisor mentoring with students
<p>and management foundations of Ecosystem Science and Restoration.</p> <p>b. Explain key ecological theories and apply them to ecosystem management practices.</p> <p>c. Explain key theories in restoration ecology and apply them to the practice of ecological restoration.</p> <p>d. Demonstrate knowledge of the human dimensions of restoration practice.</p>						
<p>2. Critical thinking skills</p> <p>a. Ability to evaluate the quality of science and information regarding ecological issues.</p>		X		X	X	X

Student Learning Goals	Successful completion of COMM 111, WRIT 101, Interim Writing	Completion of core coursework in Natural Sciences (BIO, CHMY, NRSM, & STATS)	Completion of courses in Social Science and Ethics	Successful completion of field based learning (NRSM 344, NRSM 495, NRSM 494)	Review of internship evaluations (students and employers). Ensure work hours are complete	Ongoing faculty advisor mentoring with students
<ul style="list-style-type: none"> b. Utilize scientific information and apply it to issues in ecological restoration and ecosystem management. c. Ability to integrate scientific information to form opinions on important ecological issues. 						
<p>3. Writing and verbal communication skills</p> <ul style="list-style-type: none"> a. Ability to communicate ideas through written medium using of primary sources of knowledge. b. Ability to communicate orally to a variety of audiences. 	X			X		

Student Learning Goals	Successful completion of COMM 111, WRIT 101, Interim Writing	Completion of core coursework in Natural Sciences (BIO, CHMY, NRSM, & STATS)	Completion of courses in Social Science and Ethics	Successful completion of field based learning (NRSM 344, NRSM 495, NRSM 494)	Review of internship evaluations (students and employers). Ensure work hours are complete	Ongoing faculty advisor mentoring with students
<p>4. Application of knowledge to real-world activities.</p> <ul style="list-style-type: none"> a. Develop proposals and work plans with collaborators. b. Demonstrate proficiency in field methods, data collection, and data management. c. Gain knowledge of statistics, sampling design, data synthesis and analyses. d. Ability to interpret and summarize findings to inform ecosystem understanding and/or restoration projects. 		X		X	X	
<p>5. Preparation for careers in ESR</p> <ul style="list-style-type: none"> a. Acquire knowledge about profession 				X	X	X

Student Learning Goals	Successful completion of COMM 111, WRIT 101, Interim Writing	Completion of core coursework in Natural Sciences (BIO, CHMY, NRSM, & STATS)	Completion of courses in Social Science and Ethics	Successful completion of field based learning (NRSM 344, NRSM 495, NRSM 494)	Review of internship evaluations (students and employers). Ensure work hours are complete	Ongoing faculty advisor mentoring with students
<p>opportunities and expectations.</p> <p>b. Understand professional standards and expectations: Develop quality resumes, cover letters, and acquire skills to be successful in job interviews.</p> <p>c. Develop a professional network through experiential learning.</p>						

RESULTS and MODIFICATIONS

Learning Goal results	Modifications made to enhance learning
<p>This was our first year of the modified, more diverse options for the capstone experience, allowing students to specialize and gain a wider variety of experiences.</p>	<p>This worked well for senior thesis students working with faculty mentors. We are further defining the internship experience to help communicate opportunities to students and refine how they can achieve the key learning goals. We are also working with our UM foundation representative to build pools of private funding to help provide students and project funding for internships, travel, and /or research to further support these goals.</p>
<p>Some of our students that perform internship credit for NRSM 398 or NRSM 498 also sign up through Handshake (we are working to promote more of them signing up through Handshake). These course numbers are shared across both the ESR and Resource Conservation majors. Nineteen students signed up for credit in 2016/17 and 13 students signed up for credit in the 2017-18 year across the two majors. Student internship survey reports from these courses in the 2016/17 indicated that 100% of the students felt it enhanced their employability and felt it improved their skills and abilities. In the 2017/18 academic year (the survey changed from the previous year highlighting more outcomes related to retention and the core themes), 100% of the students indicated that the internship expanded their overall skill set and strengthened their employability, 92% affirmed that it encouraged their commitment to completing their academic program, and 77% highlighted that it offered an opportunity to connect and engage with the local or global community.</p>	<p><i>We are working to develop more of it!</i></p> <p>We are also working with our UM foundation representative to build pools of private funding to help provide students and project funding for internships (since many are volunteer positions) to further support these goals and wonderful experiences.</p> <p>We are also discussing ways within the program and across the broader college to help better develop, communicate, and facilitate getting students into internships their sophomore year to improve their professional training, build a resume earlier, and improve retention.</p>

Learning Goal results	Modifications made to enhance learning
<p>As promised in the 2015/16 report, the College has worked to develop a student survey (current) to better understand their experience with regard to classes, advising, professional mentoring and training, and what resources they find most useful.</p> <p>One consistent problem identified from previous surveys is getting students to reach out to their faculty advisors for help and professional mentoring.</p>	<p>This survey was implemented College-wide in the spring 2018. Unfortunately due to poor response rates and potential nonresponse biases, the survey results are equivocal.</p> <p>To improve our response rate and get a better understanding, we plan to implement our survey within a few key larger classes (student's answers will still be anonymous) but get completion/participation points for filling out the survey.</p> <p>(1) We have expanded orientation in order to provide time for new students to meet faculty; (2) faculty advisors come to evening advising nights to get students prepared for registration and their advisor is highlighted during that event; (3) all faculty come to the first day of the first core course in the major (NRSM 265) to introduce themselves, and (4) we send out reminder emails once a semester for the student to visit their faculty advisor.</p>
<p>Identified a need to further advance career preparation knowledge and information about graduate school.</p>	<p>To enhance our student's ability to find careers with the federal government, we previously worked with the entire W.A. Franke College of Forestry and Conservation to host an annual job application session with USA Jobs (federal government hiring portal) that included on campus training for the USA Jobs website by a hiring specialist from the US Forest Service. This has been well attended by all students, including students in our major. Our faculty continue to lead a "Getting into Graduate School" Workshop each fall.</p>

Learning Goal results	Modifications made to enhance learning
During NRSM 265 we found students were missing key concepts because they were not keeping up with the materials, asking questions in a timely manner, and just trying to memorize the material only associated with the study guides right before exams.	In NRSM 265, Elements of Ecological Restoration, we implemented regular in-class quizzes or reviews on materials and readings and previous classes, using the on-line tool Socrative.com. This encourages and holds students accountable for being prepared for class, and it helps reveal student questions and knowledge gaps, ultimately helping students stay on track with learning goals and course materials.

FUTURE PLANS FOR CONTINUED ASSESSMENT

1. Student surveys in key classes to better assess our program specifically
2. The College will implement an alumni survey to get feedback on evaluation of career preparedness and skill sets needed for jobs. This survey will be implemented January 2019.
3. Develop two assignments through Moodle (given to students in the first and last of the core courses, NRSM 265 and NRSM494, respectively) to track critical thinking skill development and application of knowledge and theory to a real-world situation. These assignments will allow us to go beyond grades and completion of classes to help us track and measure our broader learning objectives over time.

APPENDICIES

APPENDIX 1: ESR Curriculum Map

APPENDIX 2: Field Learning Summary

See appendix # for alumni survey draft for the W.A. Franke College of Forestry and Conservation to track our alumni, job placement and help us understand how we can better meet the training needs for the current profession.

APPENDIX 1: CURRICULUM MAP FOR ESR

I= introduced

D = developed/reinforced, with opportunities to practice

M = mastery that is demonstrated

A=assessment evidence is collected.

Lower case letters indicate that letter only applies if certain courses are selected. 1 - includes our discipline specific knowledge, 2 - includes critical thinking skills, 3 –writing and verbal communication skills, 4- application of knowledge to real world problems, and 5 – preparation for a career in Ecosystem Science and Restoration.

Course Rubric & #	Course Title	Intended Learning Outcomes				
		1	2	3	4	5
CORE						
BIOB 160N	Principles of Living Systems	I				
BIOB 260	Cell & Molecular Biology	I				
BIOB 272	Genetics & Evolution	I				
BIOE 370	General Ecology	I, D	D	I, D		
CHMY 121N	General Chemistry	I				
CHMY 123N	Organic & Bio Chem	I				
COMX111A; or THTR 120A	Public Speaking; or Intro to Acting			I		I
FORS 201; WILD 240; or STAT 216	Forest Biometrics; Intro to Biostats; or Statistics	I	I		I	
NRSM 121S, 170, or 180	Nature of Montana; International Env. Change; or Careers in Natural Resources	I	I			
NRSM 265	Elem of Ecol Restoration	I, D	I, D	I, D	I	I, D
NRSM 465 or BIOE 347	Restoration Ecology or Ecosystem Ecology	M	M, A	M, A	M, A	
NRSM 385	Watershed Hydrology	D	M	D	D	I

Course Rubric & #	Course Title	Intended Learning Outcomes				
		1	2	3	4	5
NRSM 422	Natural Resource Policy		I, D			
NRSM 344	Ecological Restoration Capstone	D	M, A	D, A	D	D, A
NRSM 449E or 489E	Climate Change Ethics or Ethics Forestry and Conservation		I, D			M, A
NRSM 494	Seminar in Ecosystem Science & Restoration	M, A	M, A	M		M, A
NRSM 495	Ecological Restoration Practicum	M, A	M, A	M	M, A	M, A
WRIT 101	College Writing			I		I
WRIT 325; or NRSM 200	Science Writing; or Natural Resources Professional Writing			D		D
Social Elective	Students select from list		D			
AQUATIC OPTION						
BIOE 428	Freshwater Ecology	I, D			I	M
GEO 101N/102N	Intro to Physical Geology and Lab	I			I	
M 171	Calc 1	I			I	
M 172	Calc 2	I			I	
AQ Electives	Students select from list	M		D, m	d, m	
TERRESTRIAL OPTION						
BIOO 105N	Botany	I				
BIOO 335	Rocky Mtn Flora	I, D			D	
FORS 330 or 360; or BIOE 447 or 448	Forest Ecology; Range Ecology; Terr. Ecosys. Ecology; or Terr. Plant Ecology	I, D		D	D	m
M 162	Applied Calculus	I			I	
NRSM 210	Soils, water, climate	I			I	
TERR Electives	Students select from list	M		D, m	d, m	

APPENDIX 2: FIELD LEARNING: ECOSYSTEM SCIENCE AND RESTORATION PROGRAM

During the final three semesters of the Ecosystem Science and Restoration (ESR) Program, students have the opportunity to apply what they have learned in the classroom to real world activities, strengthen their field and research skills, and develop a professional network, through a three-semester field-learning experience.

Approach: The field-learning program relies on self-directed and problem-based learning. Faculty will expose students to questions to solve and organizations with which to interact. Students are responsible for making choices about their learning, including how and what they engage in, and for the consequences of their choices. Students choose among internships (service-learning with an outside agency), field practicums in which they implement restoration projects or assess the efficacy of previous restoration efforts (collaborative, service-learning with an outside agency), or thesis research (independent research under the guidance of a faculty mentor). Faculty guide student experiences, but it the students who are responsible for developing their objectives, work plans, timelines, and products for evaluation.

Overview of courses: Students enroll in three courses as part of their field earning experience, beginning spring semester of their junior year and continuing through spring semester of their senior year (Table 1). All students begin their field learning experience in the ESR Capstone course (NRS344). Their choice of projects in this initial course leads to different paths for the second course (Figure 1); thus, students have the flexibility to tailor their learning to their specific interests, learning style, and career goals. In spring of senior year, students come back together as a group for the third course (NRS494) in which they share their experiences and findings.

Table 1. Required ESR field learning courses, including semester offered and description. For learning objectives, see Table 2.

Semester	Course	Description
Spring - junior yr.	ESR Capstone (NRS344, 5 cr.)	The course centers around development of a research, monitoring, or restoration proposal. Students develop oral and written communication skills, and begin to develop a professional network for their senior yr. project.
Summer- after junior yr. <i>OR</i> Fall - senior yr.	Students select one of the following field learning experiences based on the work done in NRS344: <ul style="list-style-type: none">• Internship (NRS498; ≥ 3 cr.)• ESR Practicum (NRS495; ≥ 3 cr.)• Senior or Honors Thesis (NRS or HONR499; ≥ 3 cr.)	Students work under the supervision of an outside organization or implement their research, monitoring, or restoration project.

Semester	Course	Description
Spring – senior yr.	ESR Seminar (NRSM 494; 1 cr.)	This one-credit seminar focuses on oral and written communication, and provides a forum for students to share the outcomes of their field learning experience and to finalize their reports and presentations.

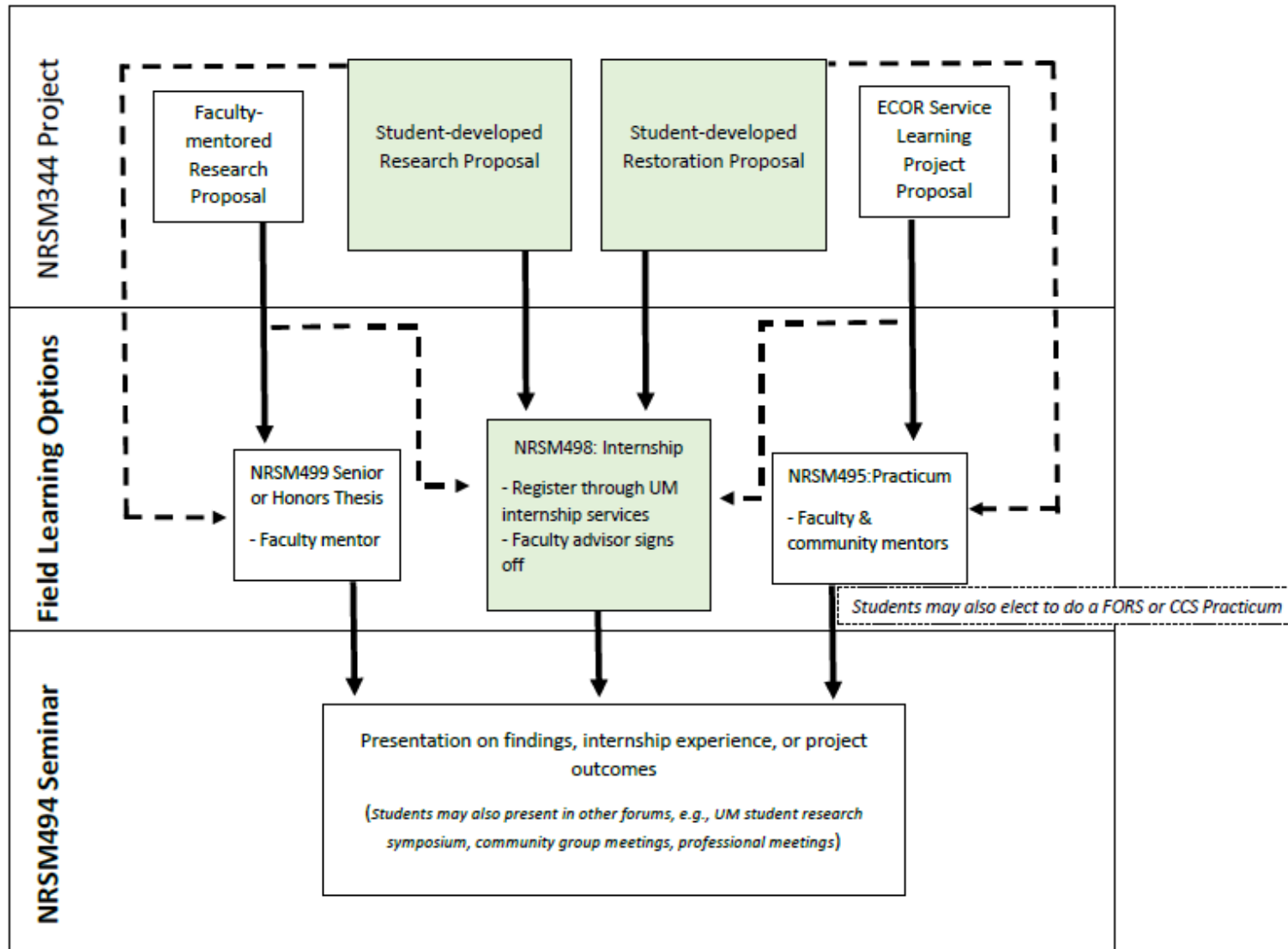
Additional required work: Prior to graduation, all students must complete at least 400 hours of work (paid or volunteer) in any area of natural resource science and management. Work conducted to fulfill field learning requirements can be counted toward these hours.

Table 2. Curriculum map for each ECOR field learning course. Highlighting the ability to achieve our key field learning objectives across tracks.

“I”= introduced; “D” = developed/reinforced, with opportunities to practice; “M” = mastery that is demonstrated.

ESR Field-learning Objectives	NRSM344: Capstone	NRSM398 Internship	NRSM495: Practicum	NRSM/HONR499: Thesis	NRSM 494: Seminar
Evaluate research proposals and project plans developed by others	D				
Write research, monitoring, or project implementation proposals	D				
Identify potential funding sources and submit proposals	I, D, M				
Submit a professional-level job application	I, D, M				
Develop a professional network	I	D	D	D	M
Effectively manage time associated with executing a project	I	M	M	M	M
Use peer-reviewed literature appropriately, including reference software	D	D	D	D	M
Develop experimental and sampling methods	I, D		M	M	
Participate in ecosystem research or management projects		D	D, M		
Implement a research, monitoring, or management project			D, M	D, M	
Analyze and summarize data	I		D, M	D, M	M
Archive research and monitoring data using best practices	I		D	D	M
Organize, lead, and engage students and the public in field tours and activities	I, D		M		
Communicate results to the public via social or earned media (press)	I, D		D, M	D, M	
Work effectively as part of a team			D		M
Participate in service learning		D	D		M
Deliver a professional scientific or management presentation	I, D				M
Engage in a professional manner with natural resource scientists and professionals	I	D	D	D	M
Write a report summarizing research findings, project results, or state of knowledge in the field		D	D	D	M

Figure 1. Potential student paths through the field learning program based on the type of proposal developed in the ESR Capstone course (NRSM344)



DESCRIPTIONS OF THE THREE FIELD LEARNING OPTIONS

OPTION 1: Ecological Science and Restoration Internships (NRSM 398)

The goal of the Ecological Science and Restoration (ESR) Internship is to provide students with a hands-on experience in some aspect of ecological science and/or restoration to enhance their professional network and broaden their skills. The internship could consist of a job, volunteer service, or an undergraduate research experience. Although the range of possible activities can be broad, the internship should be linked to the student's interests, and should expand their skill set and knowledge base in ecosystem science and restoration. Below we provide examples of activities that would qualify as internships.

Procedure for enrollment: If you are considering an internship, you should begin by working with an ESR faculty member (normally your faculty advisor), who will serve as your faculty internship advisor. Your faculty advisor can provide you with help and advice, but **the student** has the final responsibility for arranging and organizing the internship.

Once you have identified an internship that you have discussed with both your faculty advisor and your prospective internship supervisor, you should log on to the [Internship Services website](#) and enter the information for your internship on the Learning Agreement which will be submitted for approval by your work supervisor and faculty mentor. You also need to register for internship credits on Cyberbear.

Credits: Variable; minimum of 3 credits, with 45 hours of work required per credit (e.g., 3 credits require 135 hours and 6 credits require 270 hours of work). Six credits is the maximum number of credits that can count towards graduation requirements.

Requirements: All of the following must be completed before a grade (CR/NCR) can be assigned.

- a) An initial meeting with an ESR faculty member, normally your faculty advisor. During this meeting you should discuss the activity you are proposing as an internship with your faculty advisor/member. Your faculty advisor/member needs to approve the internship. It is your responsibility to initiate these meetings and discuss any concerns or questions you may have during the internship.
Identify someone at the organization where your internship will take place who will serve as your internship supervisor.
- b) Work with your faculty internship advisor to complete a description of the Learning Objectives based on the job description of the internship. This should include the learning goals for your internship.
- c) During the internship, you need to keep track of your major activities and hours spent performing them. This needs to be reported (i.e., emailed) to your faculty mentor at the end of the internship period.
- d) As part of the internship, you will write a paper reviewing a topic or issue related to your experience. You should discuss the topic of your paper with your advisor before you start so that you both understand its focus and scope. For 2 credits, this paper should be about 6-10 pages long, and should include at least 10 peer-reviewed papers from the primary literature. For example, you might review the science behind and success of particular restoration techniques that you encountered during your internship.
- e) Both the internship work supervisor and your faculty mentor must evaluate your performance.
- f) All materials must be turned in to their faculty advisor **no later than** the last week of classes, before Finals Week.
- g) The paper will be reviewed and presented in NRSM 494 the following semester.

Evaluation: Credit/No credit only based on a satisfactory report by the field/work supervisor, submission of an acceptable draft of a paper, and your internship description (activities and hours).

Examples of Previous Internships: Many activities can be used to successfully satisfy the internship requirement. A partial list of some of the sorts of activities that are appropriate for internships includes:

- Serve as a summer field research assistant for a professor or graduate student project on an ecosystem science or restoration project.
- Work with governmental agencies such as the US Forest Service, US Fish and Wildlife Service, Bureau of Land Management, Montana Fish Wildlife and Parks, and Montana Department of Natural Resource Conservation as a field assistant related to ecosystem science or restoration work.
- Work with a conservation organization such as Trout Unlimited, Five Valleys Land Trust, the Nature Conservancy, or Clark Fork Coalition on relevant projects.

Although students will likely choose internships that involve fieldwork, depending on their interests and professional goals, some students may choose to complete outreach/education, policy, or synthesis based internships. All are acceptable, as long as the internship experience focuses on some aspect of ecosystem science and restoration. Additionally, internships associated with the Climate Change minor can also count as long as the required academic assignment (the paper) is completed.

OPTION 2: Ecosystem Science and Restoration Practicum (NRSM 495)

The goal of this service-learning practicum is for students to gain real-world experience in the practice of ecological restoration through direct engagement with local organizations and agencies. Students will collaboratively design and implement aspects of a restoration, monitoring, or research plan as a service learning project for a community partner (private entity, nonprofit group, management agency or other sponsor). The scope of work for the practicum must be developed in collaboration with a potential sponsor (ideally as the final project for NRSM344 *Ecosystem Science and Restoration Capstone*) and can include any aspect of restoration work or restoration-relevant research. The faculty mentor will provide advice on potential practicum projects, but final responsibility for collaborating with the community partner, and for establishing meeting times and locations, rests with the student. Students will only be able to register after faculty approval of the proposal. The practicums are typically done over the summer and fall of the student's junior year but can continue for more than one semester. After completing all practicum credits, students are expected to enroll in NRSM494 *Seminar in Ecological Restoration* in which they will revise their practicum report and reflect on their practicum experience and findings.

Prerequisites and requirements for enrollment: Enrollment in this course requires senior standing in the Ecosystem Science and Restoration major and formal consent of instructor. Prior to enrollment, students **MUST** have:

- completed NRSM265 Elements of Ecological Restoration and NRSM344 Ecosystem Science and Restoration Capstone;
- at least a 3.0 cumulative Grade Point Average;
- a faculty-approved practicum proposal; and
- a practicum contract signed by the student, instructor, and sponsor, that details: 1) expectations for specific work to be done, 2) requirements for the final paper (see requirements section, below), and 3) process or rubric for evaluation.

Once these pre-requisites and requirements have been met, the student may obtain an override registration form from the instructor to enroll in the course.

Credits: Variable; minimum of 3, with 45 hours of work required per credit (e.g., 3 credits require 135 hours and 6 credits require 270 hours of work). Six credits is the maximum number of credits that can count towards graduation requirements.

Definition of Service Learning: This course has the "Service Learning" designation. Service Learning is a method of teaching and learning in which students, faculty and community partners work together to enhance student learning by

applying academic knowledge in a community-based setting. Student work addresses the needs of the community, as identified through collaboration with community or tribal partners, while meeting instructional objectives through faculty-structured service work and critical reflection meant to prepare students to be civically responsible members of the community. At its best, service learning enhances and deepens students' understanding of an academic discipline by facilitating the integration of theory and practice, while providing them with experience that develops life skills and engages them in critical reflection about individual, institutional, and social ethics.

Requirements: All of the following must be completed before credit can be assigned.

- Bi-weekly meeting with the course instructor to discuss project progress and reflect on the service learning experience.
- At least three meetings with the sponsor to develop the practicum work and to reflect on the practicum experience: 1) an initial meeting during the first two weeks of the semester to finalize the contract (see below), 2) a midway check-in during which the student provides a status report and reflects on experience, and 3) an exit interview. [It is the student's responsibility to initiate these meetings and to come to the instructor with any concerns or questions during the practicum.]
- A student-led volunteer work day.
- At least one press release concerning the practicum work.
- A final report of activities performed and hours worked based on the scope of work set forth in the contract.
- A **final paper** summarizing practicum findings and/or projects; this paper must include a significant amount of literature research. Its length and format should be determined by the instructor and sponsor prior to the start of the practicum. A first draft of the paper must be submitted to the instructor and sponsor at least three weeks before the end of classes for review and required revision.
- A written self-assessment by the student, reflecting on the practicum experience and his/her self-evaluation of performance.
- A letter from the sponsor evaluating the student's performance. Students should ask the sponsor to send this letter directly to the course instructor.

Evaluation: Student performance will be evaluated by the level of initiative exhibited and the quality of work completed during the practicum (including the final paper). The final grade will be assigned by the instructor in consultation with the sponsoring organization. The rubric for evaluation will be included in the practicum contract (see above); 10% of the final grade is based on the final report of activities and self-assessment.

Examples of Previous Practicum

- Assessing the effectiveness (level of precision achieved) of an existing program for monitoring the efficacy of herbicide treatments in the Great Burn Study Area, and proposing more efficient sampling designs (Sponsor, Great Burn Study Group; Funding provided by Great Burn Study Group).
- Assessing degradation to Missoula County Conservation Parks and prioritizing restoration needs in these parks (Sponsor, Missoula County; Funding from a Missoula County Capital Improvement Grant)
- Assessing degradation and developing a revegetation plan for the Rock Creek Confluence Property (Sponsor, Five Valley's Land Trust; Funding from Montana Department of Natural Resources HB 223 Grant)
- Assessing the effects of restoration of the Ninemile Watershed on aquatic macroinvertebrates and in-stream habitat (Sponsor, Trout Unlimited; students did not obtain funding)

OPTION 3: Ecosystem Science and Restoration Senior Thesis (NRSMD/HONR 499)

Students opting to pursue a Senior Thesis (NRSMD 499) credit will conduct an independent study with the approval of a faculty mentor. The Senior Thesis option is distinct from Independent Study. It can be done in conjunction with an Honor's College senior project (HONR 499). In general, the Senior Thesis option is most appropriate for students who show evidence that they are budding ecologists, and the thesis should help them achieve related goals. At a minimum, students should be interested in and show an aptitude for question-oriented research, and should be willing to work independently to solve a problem.

A Senior Thesis may involve a variety of different types of activities, such as the collection of original data, secondary data analysis, and/or ecological or policy analysis. Students opting to conduct a senior are usually motivated to attend graduate school, but some may simply want to hone their own independent problem-solving skills. Ideally, the work should be targeted so that it could ultimately be publishable in an ecological or natural resource journal.

Prerequisites and requirements for enrollment: Enrollment in this course requires formal consent of instructor. Prior to enrollment, students MUST have:

- completed NRSMD344 Ecosystem Science and Restoration Capstone;
- at least a 3.0 cumulative Grade Point Average; and
- faculty approved thesis proposal.

Once these pre-requisites and requirements have been completed, the student may obtain an override registration form from the instructor to enroll in the course.

Credits: Variable. The requirement is a minimum of 3 credits, with 45 hours of work required per credit (e.g., 3 credits require 135 hours and 6 credits require 270 hours of work). Six credits is the maximum number of credits that can count towards graduation requirements.

Evaluation: Student performance will be evaluated by the level of initiative exhibited and the quality of work completed during the research period (including the final thesis). This will be traditionally graded. A student will get an "N" or continuation until all of the above requirements have been completed.

Requirements

- (1) Meet with a potential faculty thesis mentor before or during your spring semester junior year to identify common interests and opportunities.
- (2) Submit a formal written proposal to your faculty mentor (developed in NRSMD 344). The format of the proposal will be discussed in NRSMD 344 but should include an introduction section that includes: background information and provides the context for the proposed work and the specific question that the student wishes to address, and how an answer to that specific question will refine our understanding of the broader issue described in the introduction, and the

methods to be employed. A faculty mentor-approved proposal is necessary before work can begin. If the proposal is approved by the faculty mentor and necessary funding is available, the student will move forward on the thesis project.

- (3) Enroll in and continue work on the final written thesis in Senior Ecosystem Science and Restoration Seminar (NRSM 494). In addition, students must present a summary of the problem and his or her findings in NRSM 494. We strongly encourage that student present their work in an additional appropriate venue (UMCUR and/or local professional meeting).
- (4) Complete a written thesis that is approved by their faculty mentor and submitted to the program director.
- (5) Submit a mentor-approved short summary and photo that could be posted on the website. Each summary should be no longer than 250 words and should focus on the student's research experience during the senior thesis. These will be submitted to the communication coordinator for CFC and used for marketing, website, and promotional materials.

Note: There may be opportunities to apply for external funding to support student research projects. To find the most up-to-date listing, please check scholarships associated with the Honors College, the W.A. Franke College of Forestry and Conservation (Irene Evers Scholarships), and the Institute of the Environment.

Examples titles of Previous ESR Senior Thesis Projects

- Effects of herbicides on native plants at the seed stage (funding: Missoula County Weed District Undergraduate Research Scholarship, Montana Native Plant Society Student Research Award, and Irene Evers Undergraduate Research Award).
- Reproductive output of whitebark pines at tree-line (funding: Society for Ecological Restoration Student Research Grant and Irene Evers Undergraduate Research Award).