THE UNIVERSITY OF ARIZONA
COLLEGE OF AGRICULTURE, LIFE & ENVIRONMENTAL SCIENCES
Environmental Science

Graduate Student Handbook

Main Campus MS

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More Information
https://envs.arizona.edu/graduate/overview

Contents

1 Introduction

This handbook is for the benefit of students enrolled in the Main Campus Master's program of the Department of Environmental Science (ENVS), but it may also be informative for those interested in matriculating into this program. The purpose of this document is to provide useful information about admission and matriculation and to clearly outline the Department's expectations for a successful completion of the ENVS MS degree.

The ENVS Graduate program provides Master's of Science (MS) and PhD programs, with its MS program being offered on UA's Online and Main Campuses. There is potential for confusion if we would provide one handbook for all these options and to better serve our current and future students, we will be distributing three ENVS Graduate Handbooks:

1. A Handbook targeted to MS students in our Online Campus. All coursework is asynchronously online.
2. **This document.** A Handbook targeted to Main Campus MS students. Nearly all coursework is "in-person", but most online courses are also accessible to Main Campus Students.
3. A handbook targeted to Main Campus PhD students.

Please make sure that you are consulting the "correct" handbook as some details vary between MS and PhD and between our Online and Main Campuses. Although this handbook consistently states the ENVS Graduate Program, it also applies to those who are still enrolled in the SWES MS program.

1.1 Contact Information for the ENVS Graduate Programs

MS Program (Main Campus and AZonline)

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2 Welcome to the ENVS Department

The Department of Environmental Science (ENVS) brings together a community of distinguished scientists, knowledgeable staff, and motivated students. All of us strive to further their understanding of soil, water, and the environment, and carry out research, policy development, advising and planning towards the solution of today's environmental and resource-use challenges. Under the leadership of ENVS interim Department Head, Dr. Joan Curry, the ENVS community consists of 50 faculty, 30 researchers, 12 administrative staff, and 20 joint, adjunct, or emeritus faculty, 70 graduate students and over 500 undergraduate students, 300 of which reside at UAs microcampus in China.

Our Mission We educate and train future generations to solve environmental issues at the intersection of biology, chemistry, physics and social sciences. We collaborate with industrial and professional partners to identify and apply practical and scientific solutions to current and emerging human-environmental challenges. Furthermore, we engage the community, including under-served populations, through extension services and citizen science. Housed in the College of Agriculture, Life, and Environmental Sciences at the University of Arizona, our faculty and research cover the full breadth and depth of environmental sciences, with strong expertise in arid and water-limited regions.

Our Commitment to Equity, Diversity, and Inclusion We view championing diversity and inclusion as the only way to equitably and successfully solve the grand challenges associated with human-environment interactions. The University of Arizona embraces and practices diversity and inclusiveness and our department supports and protects all forms of social identities, including but not limited to: age, disability status, ethnicity, gender expression, gender identity, nationality, sex, sexual orientation, race, religion and veteran status. UA Land Acknowledgement can be found at: `https://www.arizona.edu/university-arizona-land-acknowledgment`. UA is a Hispanic Serving Institution: `HispanicServingInstitution`

2.1 The Environment of The University of Arizona

The ENVS Department is a key member of The University of Arizona's School of Earth and Environmental Sciences (SEES). This federation of units produces knowledge about earth and environmental processes and human-environment interactions at all geographic and temporal scales. SEES faculty and researchers provide the scientific basis for environmental and climate policy, train the next generation of scientists, and disseminate knowledge and solutions for the benefit of society (`https://sees.arizona.edu/`). SEES includes:

- Geosciences (GEO, `http://www.geo.arizona.edu/`)

- The department of Hydrology and Atmospheric Sciences (HAS, http://has.arizona.edu/)
- The Laboratory of Tree-Ring Research (LTRR, http://ltrr.arizona.edu/)
- Environmental Science https://envs.arizona.edu/
- The School of Natural Resources and the Environment (SNRE, http://snre.arizona.edu/)
- The School of Geography, Development, Earth and Environment: https://geography.arizona.edu/
- The Arizona Institute for Resilience (AIR, https://environment.arizona.edu/aires)

SEES facilitates interdisciplinary research, teaching, and outreach/extension activities across the six departments and laboratories. Graduate students feature prominently in SEES as manifested in the campus-wide student-organized EarthWeek symposium which features the latest environmental science advances researched by Graduate Students.

The total enrollment at the University of Arizona exceeds 45,000 (including nearly 10,000 graduate students), a size that offers a wide range of academic and extracurricular programs. Tucson is a diverse metropolitan area of over a million people situated in a desert valley surrounded by temperate Sky Islands that rise to elevations of 3,000 meters. The University of Arizona is an equal opportunity employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, sex or national origin. For more detailed information about the University of Arizona please visit: http://www.arizona.edu/about.

3 Overview of the ENVS Graduate Program

The ENVS Graduate Program is grounded in a strong natural science curriculum that represents the foundation for focused studies in environmental physics, chemistry, biology and/or social science. Graduate study in the ENVS Department is open to qualified students with undergraduate preparation in biological, chemical, physical, earth, or engineering sciences. Students with other backgrounds may be accepted into the program, with course deficiencies noted (see section 4.3).

The ENVS Graduate program is designed to train and educate the future generation of environmental scientists, land and water resource managers, engineers, agricultural producers, and policymakers. Through education and relevant practical activities we provide our students with the necessary skills to address a wide range of issues facing environmental systems and their intersection with human health and well-being.

ENVS Graduates are highly employable in academia, the private sector, state, federal and international agencies and NGOs, and are well-prepared to lead productive careers and to confidently pursue their passions. They are able to address societal needs pertaining to problems of agricultural production, water quality, natural resource management, environmental remediation, and environmental justice in a changing world. Description of major research and outreach thrusts within the Department can be found at: `https://envs.arizona.edu/`

The ENVS Graduate Program offers two degrees:

- An ENVS Master of Science (MS), which is offered "in-person" at our Tucson Campus as well as asynchronously online though AZonline (`https://online.arizona.edu/`). This program requires 30 units of study and has thesis and non-thesis options. Well-prepared students can complete the ENVS MS in two years.
- An ENVS PhD, which is offered "in-person" at our Tucson Campus and requires 36 units of coursework, 18 units of Dissertation, and a Minor (usually 9 or 12 units of study). Well-prepared students can complete the ENVS PhD in four years.

Both programs offer a Major in Environmental Science with sub-plans (or tracks) in either Environmental Science (ES) or Soil and Water Science (SWS, note that the SWS track is currently not available through our Online MS program). Both tracks require a small set of core courses to ensure foundational knowledge that will serve as a framework for their future course work, research, and professional career paths. The ENVS MS and PhD programs are multidisciplinary and designed to be flexible, providing ample elective course options to meet each student's specific needs and career goals.

In addition to the ENVS MS and PhD programs, we offer the following:

- Dual Master Degrees in Environmental Science and Master of Business

Administration (MBA) from the Eller College of Management (https://eller.arizona.edu/programs/masters/dual-degrees)

- Dual Master of Science (MS) Degree in Environmental Science and Master of Arts Degree in Journalism (https://journalism.arizona.edu/node/745)
- Graduate Certificate in Aquaculture (see: https://catalog.arizona.edu/programs/AQCCRTG)
- Graduate Certificate in Water Policy (see https://catalog.arizona.edu/programs/WPLCRTG)

Please contact us (see section: 1.1) if you would like to know more about these programs.

4 General ENVS Graduate Program Policies and Procedures

4.1 Introduction

In this section we will discuss the policies and procedures that apply to all graduate students enrolled in the ENVS Graduate Program. Should there be any questions for matters related to the ENVS Graduate Program, please contact us for further information (see: 1.1).

4.2 Program Governance and Student Engagement

Day-to-day business of ENVS graduate program is administered by the ENVS Academic Advisors and the ENVS Director of Graduate Studies (DGS), under the guidance of Interim Department Head Dr. Joan Curry. Changes in ENVS graduate program policies are discussed within the ENVS Graduate Program Committee (GPC, which -in addition to the DGS and Academic Advisors- includes several ENVS faculty members, and two graduate students). Major policy changes are discussed and approved by vote during ENVS faculty meetings or bi-annual faculty retreats.

A vibrant departmental community can only be maintained by student inclusion and involvement. To this end, the Advising Team and DGS organize orientation meetings for new graduate students in the week prior to the start of the fall and spring semester. In addition, we also organize a general assembly of all ENVS graduate students at the start of the fall semester. At this meeting, graduate student representatives are chosen for several important one-year term functions:

- Two representatives for the ENVS Graduate Program Committee (preferably one MS and one PhD student).
- Two co-chairs for social events (annual departmental social events, and weekly social hours for students and faculty).
- Two to four co-chairs to organize and coordinate ENViSion portion of EarthWeek (an interdisciplinary campus-wide environmental symposium fully organized by graduate students).
- Three to five graduate students for the ENVS Graduate Council to meet periodically with the ENVS Department Head and Director of Graduate Studies.

Representatives usually self-nominate and DGS and Department head will endeavor to get a good representation across programs. Each graduate student

Course Descriptions	UA Course Numbers
General Chemistry I - (Lecture & Lab)	CHEM 141 or 151 or 161
General Chemistry II - (Lecture & Lab)	CHEM 142 or 152 or 162
Introductory Physics I (Lecture & Lab)	PHYS 102/181 or PHYS 141
General Microbiology (Lecture), or Introductory Biology I	MIC 205 A or MCB 181R
Calculus I	MATH 122B or MATH 125
Statistics	ENVS 275 or MATH 263 or MATH 363 or MGMT 276 or SBS 200
Additional Prerequisites for the Environmental Science Track	
Physical Geology (Lecture),	GEOS 251
Additional Prerequisites for the Soil and Water Science Track	
Soil Science (Lecture)	ENVS 200

Table 1: Prerequisites for the ENVS Graduate Programs.

should seriously consider active involvement in an effective student voice in graduate program affairs.

4.3 Program Prerequisites and Deficiencies

The ENVS Graduate Program is an interdisciplinary program that relies on students knowing the fundamentals of Chemistry, Physics, Math, Statistics, and Geoscience. The minimum undergraduate preparation for admission into the ENVS Graduate Program includes the courses listed in Table 1 (or equivalent if transferred in):

Students who lack some program prerequisites, but who are otherwise qualified, may be admitted with the missing courses listed as deficiencies. Remediation of these program deficiencies is enforced by the ENVS Graduate Program. Deficient courses must be completed during the first two semesters of graduate enrollment. A higher-level course may be used to satisfy a prerequisite with prior approval of a petition to the ENVS Graduate Program, and approval by the relevant instructor. A grade of "B" or better must be obtained to satisfy deficiency requirements. Note that Table 1 provides ENVS *Program* requirements; individual graduate level courses may impose *additional* course prerequisites for course enrollment.

4.4 Expected Graduate Program Learning Outcomes

Expected Program Learning Outcomes (PLO) for both MS and PhD students in the ENVS Graduate Programs are listed below.

- Graduates should possess sound foundational knowledge in the biological, chemical, earth, and physical sciences as related to environmental systems.
- Graduates should demonstrate critical thinking skills necessary to evaluate the scientific literature essential for their research area(s) and articulate how this research fits into and/or advances the discipline.
- Graduates should demonstrate development of creative and innovative research ideas and approaches.
- Graduates use multiple research approaches to collect scientific data related to his/her research area, and can interpret, analyze and critique their data.
- Graduates communicate their research (importance, approaches taken, summary and interpretation of results) effectively through oral presentation.

In addition to the above program learning outcomes, PhD students are expected to:

- Gain a deeper understanding of contemporary research methods and tools to be able to independently conduct cutting-edge scientific research and publish findings in top-tier peer refereed journals.
- Be capable of teaching formal courses and translating research results for public outreach.
- Be able to develop sound proposals for scientific research and design experiments, models or field-based inquiry to develop and test hypotheses.
- Participate constructively in professional activities such as manuscript and proposal review, organizing working groups or symposia, and communicating effectively across disciplinary lines.

Individual Course Learning Outcomes (CLOs, which should be listed in each course's syllabus) may expand upon these or list additional criteria. The program learning outcomes are evaluated each semester through a variety of methods, including (but not limited to): exam scores in selected core courses, thesis or dissertation quality, student performance at (comprehensive and final) exams, oral, and student presentations at the annual ENViSion component of EarthWeek, as well as student self-reporting at exit surveys after the final defense/presentation. These surveys do not affect the student's grades in any way, but are intended to evaluate the quality of the ENVS Graduate Programs by semester. The information collected by the surveys will be used for corrective action should program performance not meet the standards set by the ENVS faculty.

4.5 Policies and Procedures

Graduate Students are expected to be knowledgeable of and comply with all policies and procedures for both the UA Graduate College and for the ENVS Department. Policies are updated and announced frequently. It is the student's responsibility to comply with current policies, even if these are changed after initial enrollment as a graduate student.

General Graduate College policies can be viewed online at `https://grad.arizona.edu/policies` university policies can be found at `https://catalog.arizona.edu/policy-audience/graduate`. The Graduate College sets *minimum* program requirements, upon which each graduate program can build their own specific program requirements that can exceed Graduate college requirements.

All graduate students are expected to take initiative regarding all aspects of their graduate studies. This includes getting together frequently with their faculty advisor(s), individually or during lab meetings, and to plan and discuss their research and academic progress. Students should also take the initiative to arrange annual meetings with the ENVS Graduate Program Advisor to plan coursework and to verify that graduate program requirements are being met. Our Graduate Advising Team has access to a wealth of information that will facilitate a student's success in the graduate program. Again, we stress the importance of the graduate student's individual responsibility to be "in charge" of their program. Frequent contact with research and program advisors minimizes the chance of unexpected (and possibly expensive) delays.

ENVS graduate students are required to develop a Plan of Study by the end of the first semester and to submit this plan by the end of the second (MS) or third (PhD) semester. It is highly recommended to discuss the Plan of Study (and any subsequent modifications thereof) with the ENVS Academic Advising team for compliance with ENVS Graduate program and Grad College requirements. Graduate students are further subject to annual evaluation for satisfactory progress based on their grade point average and overall progress towards completion of degree requirements. The annual ENVS Graduate Student Progress Report form (due June 15th), the Satisfactory Progress Policy and other forms, are readily available on the ENVS website or from the ENVS Graduate Program Coordinator.

The Plan of Study is available at:

- Gradpath: `https://grad.arizona.edu/gsas/gradpath`

Departmental forms and documents are available at:

- `https://envs.arizona.edu/graduate/graduate-student-resources`

Plan of Study and Progress Reports are reviewed by the ENVS Program Coordinator and ENVS Director of Graduate Studies. Non-compliant Plans of Study will be denied by the ENVS DGS. Approved Plans of Study are forwarded to the Graduate College for further verification and approval. Insufficient or missing

Progress Reports will be addressed by a departmental letter of unsatisfactory progress (see Section 7).

ENVS graduate students are expected present at ENViSion, which is the student-organized annual departmental component of the University-wide Earth-Week symposium, which usually occurs in March or April. A poster or oral presentation of planned or ongoing research is mandatory and a good practice of the student's presentation skills. Online students will be given the opportunity to participate remotely.

It is also highly recommended to participate in the *organization* of ENViSion or Earthweek. Each year several students function in different leadership roles, such as (co-)chair, room scheduling, organization of catering, collection and distribution of poster and oral program, etc., as well as interfacing with organizers from other departments and sponsors of awards.

4.6 GradPath and Timelines

GradPath is the UA Graduate College's degree audit process that tracks and monitors student progress. Students are able to fill in and submit forms online through UAccess Student. GradPath will notify students when there is a problem with their forms (e.g., courses outside the time limit, or forms or requests are denied), and link to relevant policy. All students should make sure their GradPath records remain up-to-date.

From UAccess Student, click the dropdown menu in the Student Center section and select "GradPath forms" to see a list of forms specific to your degree program. Figure 1 includes the forms for an MS (red box) and a PhD student (blue box).

Please note that after the student submits a form through GradPath portal there is a chain of approvers. There are several within the department (e.g., major professor, minor professor, Graduate Program Coordinator, Director of Graduate studies) and several more in the UA Graduate College. It may take some time before final approval is granted by the Graduate College. For reasons of efficiency, the ENVS Graduate Program processes approvals in "batches", usually once per week. It is therefore imperative that graduate students submit forms on time, i.e., well before deadlines. For example, an approved Doctoral Plan of Study must be in place before the form for Announcement of Comprehensive Exam can be submitted. The latter form must be approved before the date of the comprehensive exam itself. Submission of approval forms after-the-fact may result in extra review and denial by the graduate college. We strongly recommend that students meet with the ENVS Advising Team well before any deadline to avoid any delays. Emergencies happen, but it is ultimately the graduate student's responsibility that GradPath forms are submitted on time.

Important Degree Dates and Deadlines imposed by The Graduate College, as well as some the general steps necessary to complete a degree may be found at:

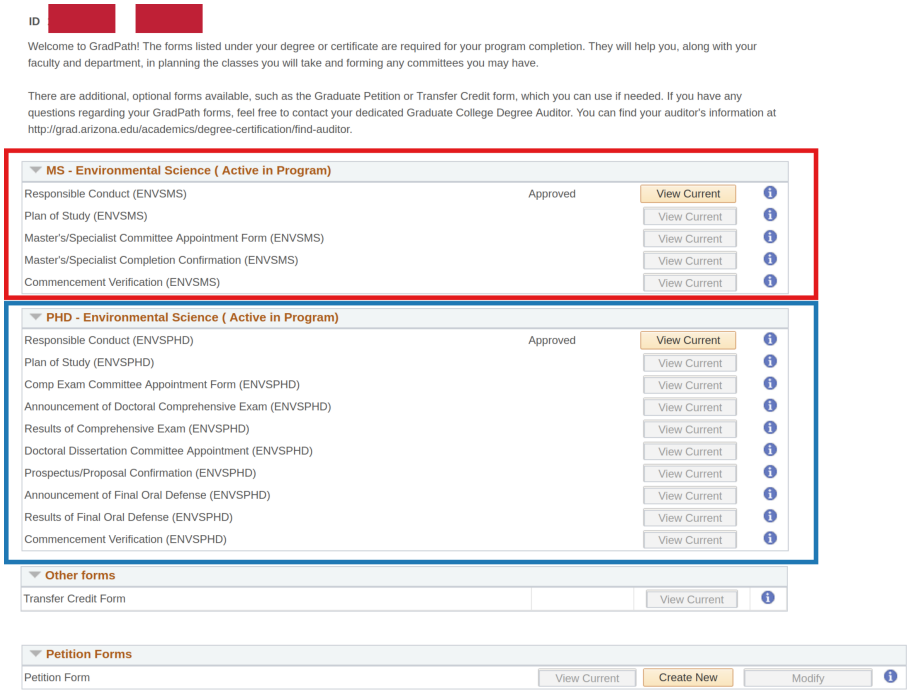

Figure 1: Example of a GradPath form for an MS student (outlined red) and a PhD student (outlined in blue). Forms for MS students are substantially simpler. This form can also be used to transfer external credit into the ENVS MS or PhD or send Graduate College Petitions. Some PhD students may still be in the SWESPHD program.

- https://grad.arizona.edu/gsas/degree-requirements/important-degree-dates-and-deadlines
- https://grad.arizona.edu/gsas/degree-requirements

Other forms that are sometimes necessary such as

- Change of Program
- Distribution Right
- Graduate Petition
- Leave of Absence
- Dissertation Formatting Guide forms

are available at https://grad.arizona.edu/forms/gsas.

4.6.1 Responsible Code of Conduct

Each student is responsible for submitting a Responsible Conduct of Research form to GradPath upon enrollment. Fostering a culture and expectation of responsible and ethical conduct of research is a critical component in the advancement of knowledge through research and scholarship. It is also a key element in the maintenance of public trust in the research enterprise. Given that ethical issues emerge when conducting research and scholarship across disciplines of all kinds, UA is committed to providing high quality instruction in responsible conduct of research to the entire campus community (https://rgw.arizona.edu/research-compliance/rcr).

4.7 Exceptions, Suggestions, and Concerns

Students have the right to formally request exceptions to department policies and procedures or formally appeal department decisions by submitting an ENVS Petition to the ENVS Director of Graduate Studies: https://envs.arizona.edu/graduate/graduate-student-resources. ENVS Graduate Program petitions are processed by the Department and cover matters specific to the *ENVS Graduate Program*; petitions to the Graduate college must be submitted through GradPath and cover matters *university-wide policies*. Please contact the ENVS Academic Advising team for more information or, if you are not sure whether to submit a ENVS petition or a Graduate College petition. The Grad College cannot approve Department petitions.

Specific and/or personal concerns regarding the student's progress in the ENVS graduate program can be discussed directly with the ENVS Advising Team, or in more serious cases the ENVS Director of Graduate Studies. When needed and possible, they will treat communications with confidentiality. In exceptional cases, it may be necessary to discuss matters with the ENVS Department Head, the Graduate College, or other University of Arizona offices.

Please note that University of Arizona Employees have certain mandatory reporting requirements (for example: https://www.titleix.arizona.edu/reporting_responsibility_for_employees).

4.8 Course Loads and Continuous Enrollment

The minimum required course load may depend on your personal circumstances and all students are recommended to review the Graduate College policies with regard to enrollment requirements: https://grad.arizona.edu/policies/enrollment-policies.

As a rule, students must maintain continuous enrollment which means that they must enroll in at least one graduate unit each semester. However, based on their personal circumstances they may also need to maintain full-time status, which implies that they must enroll in at least 9 units of study without Graduate Assistant (GA) support and at least 6 units of study with GA support.

All international students are required to maintain full-time status while studying in the US. To avoid violating current visa requirements international students should consult with the University of Arizona Office of Global Initiatives regarding enrollment requirements. Further information can be accessed at http://global.arizona.edu/international-students/maintaining-status and http://global.arizona.edu/international-students/summer-enrollment.

If students fail to obtain a motivated Leave of Absence to be exempt from continuous enrollment during one or two semesters, the graduate college will dismiss the student from the program. A new application and full review will be needed to be considered for a re-admission to the program.

4.9 Grades

The Graduate College has specific regulations on grades necessary for continuing in a degree program and additional scholarship requirements. Please carefully read the current UA Graduate Catalog (http://grad.arizona.edu/new-and-current-students). The ENVS department adheres to these regulations and further requirements for MS and PhD students are provided later in this document. *Should the grade point average fall below 3.00, the student will be placed on probation. If at the end of the following semester the cumulative average is still less than 3.00, the Graduate College will automatically disqualify the student from the program.* Disqualified students may apply for admission as a nondegree seeking student. Credit earned as a UA nondegree seeking student will be included into the cumulative UA graduate GPA. According to university policy, a student on academic probation cannot hold a scholarship, fellowship, assistantship, or an associateship during the period of probation (please see: https://grad.arizona.edu/policies/academic-policies/academic-probation and https://grad.arizona.edu/funding/gaships/qualifications-appointment.

4.9.1 Incomplete ("I") Grades

A grade of Incomplete (letter grade "I") is discouraged at the graduate level. Before taking or awarding an "I", students and instructors are encouraged to review the relevant Registrar information about incomplete course work: (`https://registrar.arizona.edu/faculty-staff-resources/grading/grading-policies/incomplete`). We note here that an incomplete can only be awarded if a minor part of the coursework has not been completed. An "I" may not be awarded instead of a failing grade. One or more missing exams is not likely to be minor missing part of coursework and should be awarded the proper grade at the end of the semester.

Students are encouraged to meet with their instructor *and* program advisor as soon as possible if personal circumstances prevent meaningful course participation. Instructors are encouraged to inform the program advisor(s) if a student is not performing to expectations (e.g., present grade is a "C" or less). Please note that while program advisors can see grades of previous semesters, they cannot monitor (are not able to) the student's progress in the current semester.

An incomplete grade must be remediated as soon as possible ("weeks" rather than "months"). An incomplete will default to a failing grade after 12 months.

4.10 Graduate Funding (Main Campus Only)

4.10.1 Graduate Assistants and Graduate Associates

Graduate Assistant and Graduate Associate positions ("GA") are limited-term appointments for graduate students, typically to perform instructional duties (GTA, Graduate Teaching Assistant/Associate) or to conduct research (GRA, Graduate Research Assistant/Associate). If awarded, Master's and PhD students fill assistant and associate positions, respectively, with the expectation that Teaching Associate positions require elevated responsibilities. Funding for GRA positions comes from faculty research grants, while GTA positions are funded from Departmental resources. This implies that those in GRA positions work under the guidance and mentorship of a researcher (usually the Major professor), while students in GTA position receive guidance and mentorship from an ENVS instructor (in most cases *not* the Major professor). GA positions come with partial or full tuition remission and health benefits. A comprehensive Graduate College GA Manual is posted online at `http://grad.arizona.edu/funding/ga` and the UA Student Employment Manual is online at `https://financialaid.arizona.edu/types-aid/work-study/student-employment-manual`.

PhD Students Upon admission, PhD students should be funded up to five years at 0.5 FTE (full-time equivalent, 0.5 FTE is 20 hours per week *on average*), provided that the student remains in good academic standing and makes satisfactory and timely progress toward their degree. This includes summer

support at 0.5 FTE, provided that the students continues to work on their research during this time; some faculty members increase summer support to a higher-level, commensurate with available funding and research needs. The five-year 0.5 FTE funding mandate does not apply if the student receives an equivalent level of support through a fellowship or stipend, or on UA Qualified Tuition Reduction (QTR), or is drawing salary or income elsewhere. The five-year funding mandate is also contingent upon the availability of funding. It is often difficult for faculty and departments to make financial plans that span more than two years.

The ENVS Department has limited funding to support GAs. Before we admit PhD students to the ENVS Graduate Program, we require Major Professors to provide us with a funding plan with the expectation that the majority of the funding comes from faculty resources (usually research grants). Because research funding may not always be available immediately (a grant-application/review cycle may take several months) we encourage all prospective PhD applicants to contact potential major Professors before submitting an application. A discussion between potential applicant and professor will further allow both to assess whether the student will "fit" in the professors research program. A discussion will also provide the Major Professor with adequate time to arrange funding (sometimes it is possible to do this with the student, such as NSF Graduate Research Fellowship Program, GRFP, `https://new.nsf.gov/funding/opportunities/grfp-nsf-graduate-research-fellowship-program`).

Here we note that we may be able to award a ENVS PhD Recruitment Award for competitive applicants. An ENVS PhD Recruitment Award typically includes two semesters of GTA funding at 0.5 FTE. We can only make such awards if the Major Professor submits a viable externally funded plan for the other four years of the student's program.

Master's Students No funding mandate currently exists for MS students. Many UA departments do not provide funding to their MS students. However, many main-campus ENVS MS students receive partial (0.25 FTE) or full (0.5 FTE) support from their Major Professor as GRA, or receive a one-semester GTA position from the Department. We also note that NSF Graduate Research Fellowship Program (GRFP) is open to applications from prospective MS students `https://new.nsf.gov/funding/opportunities/grfp-nsf-graduate-research-fellowship-progra`
In some cases, students enrolled through UA's Online Campus may be eligible for GA positions.

Requesting GTA Positions Each semester, the ENVS Department has a substantial need for GTAs to assist instructors of high-enrollment ENVS undergraduate courses. Filling a GTA position has several benefits for the department, graduate student, and Major Professor. From the perspective of the Department, GTAs help instructors to deliver high-quality undergraduate courses. A graduate student filling a GTA will gain valuable work experience, sometimes

with actual class-room teaching experience that would benefit the student's career after graduation. A student taking a GTA position would further temporarily relieve budget pressure on a Major Professor's grants (Major Professors sometimes are "in between" grants and have no GRA funding). Here we note that mixed GRA/GTA positions are possible, so a student can continue grant work at 0.25 FTE, but also fill a teaching position (at 0.25 FTE) at the same time. Some restrictions apply.

In exceptional cases, experienced TAs may be asked to serve as instructor of record which implies that the TA becomes partially or fully responsible for the delivery of a particular course or course-sections. Such assignments are made only by discussion among DGS, Department Head and the student. While instructor of record status does not lead to additional pay, it benefits the TA because distinct instructional and leadership experience can now be listed on the student's CV.

Per instructor enrollment-based GTA needs (FTE) and assignment of graduate students to these positions are made through the ENVS Graduate Program. We use the following broad guidelines for GTA assignments:

1. We assess the GTA budget that is available to ENVS for the present Academic Year and determine how many GTA we *can* hire.

2. Newly admitted PhD students on an ENVS PhD recruitment award (0.5 FTE) will be assigned *first*. We strive to assign the student to the same instructor for both semesters of the award.

3. Next, we consider the list of continuing students (those in year 2 or later) who requested a TA position through the ENVS Financial Support form that is circulated each mid-semester. These requests can be for a 0.25 or 0.5 FTE position and are for *one semester only*. A new request must be submitted for each semester. We cannot guarantee that requests will be honored. Our TA requirements depend on actual undergraduate enrollment and the availability of Departmental funds. In recent years, we have honored virtually all requests, though not necessarily at the requested FTE.

4. Some courses have specific instructional requirements that we must match with graduate student skills (for example, it takes a certain aptitude to assist with a microbiology or soils lab). We will therefore sometimes ask a specific graduate student whether they are available for a TA position. This situation may also occur if there are unexpected increases in enrollment at the beginning of a semester.

5. Because undergraduate enrollments vary between semesters, it is sometimes necessary to switch an already-assigned GTA to another instructor.

Workload Expectation Form All GA positions should adhere to the Graduate Assistant and Associate Workload Policy, and we highly recommend that

all students and faculty read this policy in full (https://grad.arizona.edu/funding/ga/graduate-assistant-and-associate-workload-policy). Specifically, a student in a 0.25 GA position cannot be asked to work more than 10 hours per week *on average* (or 20 hours per week on average for a 0.5 FTE appointment). The "on average" phrase recognizes that instructional or research activities may occasionally be lower or higher during a some weeks, but that over a semester these should average out to 10 or 20 hours (for 0.25 and 0.5 FTE, respectively). We note that some of our courses are delivered in 7-week semesters. Unless the student specifically agrees in the Workload Expectation Form, it is unreasonable to expect GAs not to work during the first half of a semester, but double the time in the second half. Such an arrangement should be approved by the ENVS Director of Graduate Studies.

ALL GA appointments are governed by a formal contract sent by the CALES-HR office, but actual duties, expectation, mentoring, and review must also be documented in the ENVS Workload Expectation Form that both student and Instructor/Supervisor **must** fill out (the online form is made available each semester). We emphasize that it is important discuss and fill out the expectations, duties, and mentoring activities accurately. This information is especially helpful should there be any disputes between student and advisor. This goes both ways: based on documentation in this form, the student can argue that the workload was too high or mentoring was not provided. A supervisor can use the documented information to claim that certain duties were not carried out, or the student did not show up for meetings. We want to stress that disputes are infrequent, but detailed Workload Expectation Forms help to adjudicate conflicts. "Student performs duties as assigned" is definitely an insufficient description of duties and responsibilities.

Workload Expectation Forms for GTAs must be filled out each semester. Supervisors and GRAs should fill out the form each academic year or period that is consistent with the actual GRA appointment contract. This includes supplementary funding for summer.

4.11 Other Types of Funding

Here we briefly provide information that may provide alternative sources of funding for graduate studies.

4.11.1 University and Extramural Funding

UA's Graduate College maintains a list of UA-specific funding opportunities: https://grad.arizona.edu/funding/opportunities
Extramural sources of funding can be found at: https://financialaid.arizona.edu/ScholarshipUniverse

We will not discuss any of these funding opportunities in detail as they often depend on a student's demographic, nationality, or socioeconomic situation. However, if you think you qualify we are more than happy to work with you. In

certain cases, you will need support/information from a Major Professor or the Department must provide certain resources. Please contact us early and do not wait until the deadline. Please be assured we will treat your information confidentially.

4.11.2 Students on Wages/Grader Jobs.

Students working on "wages" work for a limited time-period, usually as "grader" for a medium-enrollment course that does not have sufficient enrollment to qualify for TA support. This is typically a one-hour to six-hour per week job (*about* $32/hour for Graduate Assistants and about $34/hour for Graduate Associates). A Wages job does not include tuition remission or health benefits, but it could work well as supplemental income for some students. ENVS establishes these jobs on an "as-needed" basis. If the student already has a staff position at the UA, it may be impossible to employ that person as a grader. Foreign students who already have a 0.5 FTE GRA or GTA position cannot be hired as graders. Domestic students may be hired up to 0.66 FTE per semester.

5 ENVS Master's Program Policies and Procedures

5.1 General Information

The Main Campus ENVS Master of Science (MS) is delivered in an "in-person" semester-based format with day-to-day contact among students, faculty, and staff. Well-prepared students can obtain an MS degree in two academic years. We also offer an equivalent Online MS experience through AZ online which offers a set of key courses asynchronously online in 7.5-week or 16-week formats. Those interested in the online version of the ENVS Master's should consult the Online ENVS Master's Handbook for specific details and course availability.

MS students follow one of two tracks with different core requirements: Environmental Science (ES) or Soil and Water Science (SWS). The ES track has a broader environmental science focus, while the SWS track is targeted towards those students who would like to develop specific expertise in soil and water science. ES and SWS tracks have different course requirements ("core courses") and students choose electives that suit their research and/or career goals. This is discussed in section 5.3.

5.2 Entering the Program

5.2.1 Application to the ENVS MS Program

All applications must be submitted through GradApp (`https://apply.grad.arizona.edu/users/login`). We highly recommend that you thoroughly review our Departmental website before applying (`https://environmentalscience.cals.arizona.edu/`, in particular check "about", "research", "graduate", and "people") so that you become familiar with our instruction and research programs, people, and facilities.

The application page will require you to provide several pieces of information. Key input to our review process are:

- **Your statement of purpose.** In this document you should identify why you are interested in Environmental Science, our department, and what kind of career you currently have in mind. Please also discuss which kind of research and/or which ENVS faculty are closest to your interest(s)
- **Your CV (or resume) and three references.** We must have received three letters of reference before we can start our review. You cannot submit these letters yourself. Instead, the UA will contact your references. However, to avoid delays, we recommend that you remind your references to submit their letters.
- **Your Undergrad and** (if you have one) **Graduate GPA.** Note that we cannot admit applicants with a GPA below 3.0, though you may attain a

GPA of 3.0 or greater as a non-degree-seeking student. Please contact us for further information.

- **The supervising ENVS professor(s) and research topics** you would prefer (you can specify three of each). We can provide assistance if you are unsure.
- **Master's Thesis or Master's Report preference.** You can finish your ENVS MS with a Thesis or a non-thesis project (also known as Master's report). If you choose MS-thesis, one of our faculty **must** agree to advise you **before** we can admit you. If you select MS-report we will try to assign you to the Major Professor of your choice. However, if this person is not available we refer you to the ENVS MS-report Workgroup who will determine your Major Professor after you are admitted.

5.2.2 AMP Students

The ENVS Accelerated Master's Program (AMP) is for undergraduate students enrolled in the ENVS BSES program (Bachelor of Science in Environmental Science). This mechanism feeds into ENVS MS program and allows well-prepared students to complete an ENVS MS with one extra year of graduate work after the successful completion of a BSES.

While still at the undergraduate level, these students find a Major advisor and initiate a research project and take part of their course work at the graduate level. This is possible because many of the ENVS "400" undergraduate-level courses are also offered at the graduate (500) level (e.g., the core courses listed in Section 5.3). Up to twelve units "count" for the ENVS BSES as well as the ENVS MS. It is important to note that courses taken at the undergraduate ("400") level cannot be converted to graduate-level courses. A detailed overview of AMP requirements can be found at `https://grad.arizona.edu/admissions/types/accelerated-masters-programs-amp`.

Undergraduate students who are considering the AMP ENVS MS route should discuss this early with the ENVS Advising Team and enroll in relevant courses at the graduate-level. An MS degree obtained through the AMP is fully equivalent to the "traditional" MS degree. Because of the compressed timeline for the AMP program, we recommend that students pursue a Master's Report instead of a Master's Thesis.

Two applications will be needed for those interested in the ENVS AMP:

- An application to the ENVS AMP itself (minimum GPA 3.3 and 75 units of study. For further details, see Admission Requirements at: `https://catalog.arizona.edu/currently-approved-amps`). This application is submitted several semesters before the student completes their ENVS BSES. Applications in the final, or last-to-final semesters are not as beneficial to potential AMP student because of the limited amount of graduate coursework that can still be taken in the BSES program. The whole *point*

of the AMP is to count 12 units of eligible graduate coursework towards ENVS BSES and ENVS MS.

- A regular ENVS MS application. This application allows the formal entry into the ENVS MS program and is usually submitted in the last semester of the student's ENVS BSES program. Fees and letters of recommendation are waived.

We *strongly* recommend that those interested in the ENVS AMP contact the ENVS Advising Team as soon as possible.

5.3 Minimum Requirements for an ENVS Master of Science

5.3.1 General

The ENVS Department Master of Science degree requires a minimum of 30 units of graduate credit, including MS-thesis or MS-report units. There must be 15 or 18 units in the Major field (ENVS, for the thesis and non-thesis option, respectively), and at least 15 units must be from courses in which letter grades of A and B have been earned. All units of coursework for a graduate degree must be in 500-level courses or above.

Program requirements are as follows:

- **Career Coursework:** general presentation, writing, environmental science literacy, career development courses. These courses are required.
- **Core Coursework:** these courses provide solid foundations in environmental science. These courses are required.
- **Elective Coursework:** courses chosen with major professor and/or ENVS Advising Team.
- **Final Project:** ENVS 910 (MS-Thesis) or ENVS 909 (MS-report) for (nominally) six or three units, respectively, while meeting a minimum of 30 qualifying graduate units and satisfying other program requirements.
- **Final Presentation and/or Defense:** A Master's final exam in the form of a presentation of a student's Master's Report (non-thesis option) or a Master's thesis defense (thesis option) is an integral part of the ENVS MS Degree requirement.

The next subsections will provide more detail about each of these categories, but we note that Final Project and Final Presentation or Defense is overseen by a Master's Committee, chaired by your Major Professor. Although the Master's Committee will ultimately judge the quality of the students project and presentation or defense, students should consider the Committee as an important mentoring resource. We highly encourage the student to meet with the committee on a regular basis to ensure progress and the check whether expectations are met or whether the scope of the project should be adjusted.

Career Skills	Units	Course Title
ENVS 508 and	3	Scientific Writing for Environmental, Agricultural and Life Sciences
ENVS 595 and	1	Colloquium
ENVS 696A, or ENVS 696B, or ENVS 697	1	Seminar; Inclusive Mentorship in the Sciences; Seminar and Professional Development,

Table 2: Career Skills. Students are required to take five units of Career Skills in three categories.

5.3.2 Career Skills

As Table 2 shows, the ENVS MS program requires five units total in ENVS 508 (Scientific Writing for Environmental, Agricultural and Life Sciences, 3 units), ENVS 697 (Professional Development, 1 unit) and ENVS 595 (Colloquium, 1 unit). These courses are intended to expose students to a range of soft or career skills.

It is recommended to take ENVS 508 in the first or second semester since it practices the student's writing skills necessary for other activities (e.g., reports required in courses, and thesis or Master's report). ENVS 696A and 696B focus on presentation and mentoring skills, respectively. ENVS 697 practices public speaking, CV preparation, and career-related activities.

All main-campus MS students are required to take ENVS 595 (Colloquium) each semester, but can count only one unit on their plan of study. Colloquium exposes graduate students to ENVS Faculty research programs, as well as invited national and international speakers who discuss present the latest developments in Environmental Science. Colloquium speakers usually provide information about their career paths, and discuss exciting career opportunities for ENVS Graduates.

5.3.3 Core Courses

The core courses provide the student with a broad interdisciplinary foundation in either Environmental Science or Soil and Water Science. Required coursework for the ES and SWS tracks are provided in the Tables 3 and 4, respectively and is identical for the Main Campus MS and PhD programs. It is the student's responsibility to ensure that they select and complete the required core courses, otherwise their plan of study will be denied by the ENVS Graduate Program. The ES track requires nine units of core courses (three or four units each from biology, chemistry, and physics). The SWS track requires 12 units from a list of seven courses. Due to some overlap, ENVS 580 and ENVS 582 cannot both count as a core course. Some courses are shared among the ES and SWS tracks.

ES Track	Units	Select one course per category
Environmental (Soil) Physics		
ENVS 520	3	Environmental physics, or
ENVS 570	4	Soil Physics
Environmental (Micro) Biology		
ENVS 525	3	Environmental Microbiology
ENVS 574	3	Aquatic Plants & the Environment
ENVS 577	3	Principles of Ecotoxicology
WSM 552	3	Dryland Ecohydrology and Vegetation Dynamics
Environmental (Soil) Chemistry		
ENVS 562	3	Environmental Soil & Water Chemistry
ENVS 564	3	Environmental Organic Chemistry

Table 3: Core Courses in the Environmental Science (ES) Track. Students are required to take one course from each physics, biology, and chemistry category.

SWS Track	Units	Select four Courses
ENVS 502	3	Nutrient Dynamics in Soils
ENVS 525	3	Environmental Microbiology
ENVS 531	4	oil Genesis, Morphology, and Classification and Lab
ENVS 562	3	Environmental Soil & Water Chemistry
ENVS 570	3	Soil Physics and Lab
ENVS 580 **or** ENVS 582	3	Environmental Assessment of Contaminated Lands **or** Reclamation and Redevelopment of Impacted Lands

Table 4: Core Courses in the Soil and Water Science (SWS) Track. Students are required to take four courses.

5.3.4 Electives

Electives give students the freedom to specialize within the field of Environmental Science, or to obtain relevant knowledge from other fields. These courses can be chosen out of personal interest, or because the knowledge provided is relevant for the student's final project and/or career. ENVS offers a broad range of graduate courses that can serve as electives and the full range and description is available at: `https://studentcenter.arizona.edu/app/ui/public/ps/course-catalog?tab=DEFAULT`. Not all courses may be offered due to availability of an instructor, or because course availability alternates between semesters or years. Excess core-courses (those taken beyond the minimum required in the ES and SWS tracks) can count as electives. Students can also take qualifying courses in other programs. Please see our ENVS program advisors if you need help selecting electives.

The number of elective units to be taken depends on the program and track (ES or SWS). For example, a minimum of 30 qualifying units are required for the ENVS MS:

- A MS student on the ES track with an MS-report will take 5 units in Career Skills, 9 units in core-courses and 3 units in the MS-report (ENVS 909). This implies this student needs to take a minimum of 30-(5+9+3)=13 units in electives.
- A MS student in the SWS track with an MS-thesis will take 5 units in Career Skills, 12 units in core-courses and 6 units in the MS-report (ENVS 909). This student must take 30-(5+12+6)= 7 units in electives.

PhD students have 36 in the ENVS major, 18 dissertation units (ENVS 920), plus the number of units in the minor, which is 9 units (some minor programs) or 12 units (ENVS and other departments). The number of electives for PhD students purely depends on whether the SWS track or ES tracks is taken. For example:

- A PhD student on the ES track will take 7 units in Career Skills, 9 units in core courses. This student needs to take 36-(7+9)=20 units in electives.
- A PhD student on the ES track will take 7 units in Career Skills, 12 units in core courses. This student needs to take 36-(7+12)=17 units in electives.

It is strongly recommended that students choose electives after consulting advising faculty and program advisors.

Internship and Independent Study We also offer ENVS 593 (Internship 1-3 units) and ENVS 599 (Independent Study, 1-4 units) for situations where students want to gain work experience in a specific setting (e.g., commercial or non-profit lab, etc.) or wants to gain specific knowledge for which no equivalent course is available. ENVS593 and ENVS 599 must be motivated by the student

and approved in advance by the graduate program before the work can be started. Independent study units (ENVS 599, or ENVS 699) must be identifiably distinct from activities performed under ENVS 910 and be must be approved in advance by the ENVS DGS. Activities carried out under ENVS 599 or ENVS 699 should not appear in the Master's Thesis or Master's Report.

5.3.5 Major Professor and Master's Committee

A student's Major Professor will be the ENVS faculty member who has agreed to supervise the student's thesis project or report project. With the help of the Major Professor, the student will identify two additional members from appropriate areas to complete the student's Master's Committee. The Major Professor is typically the student's thesis advisor and chair of the Master's Committee and is usually the faculty member identified during the admission of the student to the ENVS program. At least two members of the Master's Committee must hold graduate faculty appointments in the ENVS Department. The student may also have a co-director or committee member outside the ENVS Department, provided that he or she has credentials acceptable to the ENVS Department and the Graduate College. We refer to Graduate College regulations regarding the composition of the Master's Committee `https://grad.arizona.edu/policies/academic-policies/graduate-student-committee-service#graduate-committees`.

If the student has been admitted on an MS-report preference and no advising faculty member was identified during the admission process, advising duties will initially be delegated to the ENVS Masters Report Workgroup (EMRW). This group of ENVS faculty will work with the student to identify a suitable MS-report project and recommend a Master's Committee. The members from the Master's Committee can come from the EMRW, ENVS faculty, or qualifying non-ENVS faculty.

The Master's Committee is responsible for guiding the student's research program and final examination. A common role of the Major Professor and Master's Committee is to suggest relevant courses for the student's Plan of Study. It is important to verify that the Plan of Study complies with the requirements of the ENVS MS program; non-compliant Plans of Study will be rejected by the ENVS DGS or the Graduate College. Please contact the ENVS Academic Advising team for more information.

In many cases, MS students will become part of the Major Advisor's Research Group. This group may meet on a regular basis ("lab-meetings") and/or require additional activities. These are technically not program requirements, but advising conditions set by the Major Advisor. The time investment involved with these research group activities should not be excessive. The ENVS Department prefers that such activities should not exceed more than 45 hours per semester (equivalent to one unit of study). If more time is required this should be done in the context of a paid Graduate Assistant/Associate position, or for credit, such as independent study (ENVS 599 or 699).

5.3.6 Final Project and Final Presentation of Defense

Students have two options to complete an ENVS MS Degree: a thesis-based MS, and a non-thesis MS (also called a Master's Report). The main difference between the two is that the thesis-based MS includes more research units and may require access to a lab for research. A Master's obtained through the non-thesis option is equivalent to the thesis-based MS and typically pursued by those for whom a career with a continued record of publications is not important or form whom an MS-thesis project is not practical. Irrespective of whether a student chooses a Master's Thesis or Master's Report, a minimum of 30 qualifying graduate units are required for an ENVS MS.

Each ENVS MS student must complete a Master's Thesis and successfully pass a Thesis Defense **or** complete a Master's Report and successfully present the work in a public presentation. Thesis and non-thesis options therefore both have written and presentation (or presentation plus defense) parts, but the requirements for each is slightly different, as described below.

A successful defense or presentation results in a Departmental submission of the Master's Completion of Degree Requirements form. If the candidate fails the final exam, a second exam may be granted no sooner than four months from the date of the first exam.

Master's Thesis By the end of the second semester in residence, a research topic should be chosen by the student in consultation with their Major Professor and Master's Committee. Six units of ENVS 910 (Thesis) can be earned for the preparation of the thesis. The exact nature of the scope of the project (which sometimes evolves over time) is discussed with the Major Professor. The final product of a thesis-based Master's consists of two parts:

1. A Thesis that accurately reports the work done and is equivalent to one peer-reviewed manuscript. The thesis can either consist of a publication-ready paper that is included as an appendix to the thesis, which should include a comprehensive broader literature review, hypothesis, and synthesis/conclusions. A traditional chapter-based MS thesis is also possible, in which case the actual work is included as one or more chapters. The thesis is subject to Graduate College rules regarding formatting and submission `https://grad.arizona.edu/gsas/dissertations-theses`.

2. An MS-defense, as discussed below. We note here that the MS-defense can occur when the Masters Committee has decided that the work is "defensible", which typically means that the work is well-written and mostly complete, but not *necessarily* final. In a considerable number of cases, additional edits are required by the committee that must be completed *after* the defense. Once these edits are complete the Major Professor must approve and notify the ENVS Advising team that they can submit the Master's Completion Confirmation on GradPath.

A full Master's defense consists of a public presentation and an exam by the committee behind closed doors without the public. The presentation is approximately 30 minutes long and should cover the student's research. The public is permitted to ask questions after the presentation; the committee does not usually ask questions at this point. The public question session is ended in a timely manner and the audience is asked to leave.

The student *may* be asked to also leave the room for a few minutes to allow the committee to discuss procedural matters (e.g., the order in which questions will be asked). The student is readmitted to the room and the committee commences with the question session. The questions should primarily cover the student's Thesis but may also cover broader aspects of the research, if relevant. Committee members typically get of slot of time (e.g., 20 minutes) in which they ask their questions, though this may vary by committee. A general suggestion is that an MS defense should not take longer than two hours, including the public part.

After the question-response session is over, the student is asked to leave the room again and the committee confers about pass or fail and whether additional modifications or alterations of the student's Thesis are needed. The student is called back into the room and a) "pass", b) "pass with changes", or c) "fail" is communicated by the chair of the committee. If changes to the thesis are required, clear instructions should be given to the student as to what alterations should be made and in what time frame these are expected. Depending on the scope of the modifications, these revisions can take days to several months.

To avoid lengthy revisions, the ENVS Graduate Program recommends that the student works closely with the Master's committee prior to submitting the final version for the defense. The student should also avoid scheduling the defense too close to the end-of-term deadline by which a final version of the Thesis must be submitted to the Graduate College (see `https://grad.arizona.edu/degree-services/degree-requirements/important-degree-dates-and-deadlines`).

Master's Report The Graduate College requires a "synthesizing experience" for students who choose to pursue a Master's Report (`https://grad.arizona.edu/gsas/degree-requirements/masters-degrees#final-exam`). A Master's Report (or non-thesis option) requires 3 units of ENVS 909 (Master's report). The scope of this Master's report is typically smaller than an MS-thesis project. Although a well-written MS-report is expected, a publication-ready work (e.g., a journal article) is not required.

Major advisor and student must agree on the scope of the project, which has two milestones:

1. A report that documents the work that was done. We suggest that this is a "traditional" introduction-hypothesis-materials-results-discussion-conclusion type of work with sufficient references. The work should amount to at least 25 pages of text (single-spaced equivalent). The Master's Report

must be approved by the committee one week before the presentation (point 2). Once this approval is granted no further changes to the MS-report can be requested by the committee.

2. A public presentation of the work. This presentation can only be held if the committee has approved the MS-report. The entire committee is required to be present at the presentation which is open to the public with time allocated for questions from the public and/or the committee (a suggestion is no more than 20 to 30 minutes). After the presentation, the committee meets in private and a pass/fail is communicated to the student by the Major Professor. Since the report is already approved, this pass/fail primarily judges the quality of the presentation. Should the student fail, another presentation should be scheduled for a later date. This second presentation can be done behind closed doors if deemed necessary.

The Major Professor must notify the ENVS Advising team of the completion of these two milestones, so that they can submit the Master's Completion Confirmation on GradPath. If the student successfully completed both products, it would be improper to also expect the student to deliver a publication-ready edit of the work. Publication of ENVS MS-report work is encouraged, but cannot be a condition for graduation.

General Guidelines for Final Thesis Defense or Final Report Presentation
Prior to the exam the student must:

- Complete the research and writing activities required by the Major Professor under ENVS 909 or 910. Experience indicates that frequent meetings with the Major Professor and occasional meetings with the Master's committee are beneficial for an efficient completion of the required work. The student must discuss the MS-thesis or MS-report with their Major Professor prior to sending it to the Master's committee and make relevant alterations and improvements as requested. The student should submit the final version of the thesis or report to the Master's committee no later than two weeks prior to the defense or presentation.

- It is recommended to schedule the actual defense/presentation date well (months) in advance and to make sure that the committee is indeed available on this date (reminders are very useful). Students should be aware that faculty have limited availability during the summer months and breaks when classes are not in session. Also be aware of Graduate College hard deadlines (`https://grad.arizona.edu/gsas/degree-requirements/important-degree-dates-and-`
  Delays happen. It is not recommended to plan defenses/presentations close to their Graduate College deadlines.

- Students are required to discuss a planned defense/presentation date with the ENVS Advising Team at least three weeks in advance (but preferably earlier). This has several reasons:

◦ The defense/presentation must be announced to the Department at least 48 hours before the event takes place.

◦ The defense/presentation must be entered into GradPath.

◦ The ENVS Advising Team can verify that the student indeed fulfilled *all* other ENVS MS Degree requirements. This helps to mitigate any unforeseen problems.

◦ The ENVS Advising Team can assist the student with room scheduling.

◦ The ENVS Advising Team will ask the student to fill out an ENVS Graduate Program Exit Survey which is invaluable for improving the ENVS Graduate Program.

- Submit a well-written Master's thesis or Master's Report to the Master's committee which adheres to academic standards. Formatting requirements are available at: `https://grad.arizona.edu/gsas/dissertations-theses/dissertation-and-thesis-formatting-guides`. Additional help with writing and structuring can be obtained at the Graduate Writing Institute (`https://wsip.arizona.edu/`).

5.4 Plan of Study

With advice from their Major Professor and Graduate Student Support Coordinator, the student is responsible for developing a written Plan of Study by the end of the first semester. The plan of study must identify:

1. Courses the student intends to transfer from other institutions (if any). A maximum of six units may be transferred in per Graduate College regulations (`https://catalog.arizona.edu/policy/courses-credit/credit/graduate-transfer-credit`)

2. Courses already completed at The University of Arizona that the student intends to apply toward the graduate degree.

3. Additional courses the student plans to complete to fulfill the degree requirements.

A new plan of study must be submitted as soon as the student decides to use different courses for their degree completion (usually different electives, or a change from thesis units to report units). Approval of an updated plan of study is usually a formality, as long as it complies with the ENVS MS degree requirements. We highly recommend consulting the ENVS Academic Advising team. Plan of Study is to be submitted to GradPath by the end of first (AMP) or the second semester (two year MS) in residence.

Below we list a general non-specific schedule who enter the MS through the AMP (Table 5) and those who applied to the two-year program (Table 6). Some guidance for the MS thesis and non-thesis (Master's Report) options is indicated.

Milestones – MS Degree (AMP)	
While in BSES	Submit AMP application at least *two* semesters before graduation. Take up to 12 units of qualifying ENVS Graduate units (500+ level). It is strongly suggested to take courses that qualify as core-requirements for ENVS MS and can be counted toward ENVS BSES. Select and meet with Major Professor and ENVS Graduate Advisor to develop preliminary research topic and plan of study. Submit application to transition to ENVS MS (most items and fee are waived because of prior ENVS AMP application).
1st Semester	Attend ENVS orientation. Required + elective coursework; submit Plan of Study (POS), MS-thesis/MS-report research.
2nd Semester (MS-report)	Take remaining courses on POS. Establish MS-report committee (3 members) and submit on Gradpath. Conclude research and complete MS-report, submit to MS-report committee for approval. Hold final presentation.
2nd-3rd Semester (MS-thesis)	MS research and writing. Establish MS-thesis committee (3 members) and submit on GradPath. Meet with committee. Present and defend Thesis (equivalent to one peer-reviewed manuscript formatted according to Grad College guidance).

Table 5: Milestones for MS Degree with AMP entry.

Milestones – MS Degree (Traditional/2 year)	
1st Semester	Attend ENVS orientation. Required and elective coursework; meet with Major Professor to develop preliminary Plan of Study (POS), and conduct MS-thesis/MS-report research. Take program deficiencies.
2nd Semester	Required coursework; MS-research; Establish graduate committee members in consultation with the Major Professor; Submit POS and Committee Appointment Forms on GradPath. Complete program deficiencies.
3rd Semester	Elective coursework; submit research proposal to committee, schedule and hold a committee meeting; MS research.
4th Semester	Conclude research and complete MS-report/MS-thesis, submit to MS-report committee for review and approval. Hold final presentation or defense.

Table 6: Milestones for Traditional 2-year MS Degree (Main Campus or Online).

5.4.1 Transfer Units

Transfer of units to the ENVS MS degree requirements is limited and subject to the following conditions. Please consult `https://catalog.arizona.edu/policy/courses-credit/credit/graduate-transfer-credit` for the latest UA policies.

- Students who wish to transfer credit must submit a Transfer Credit form in GradPath before the end of their first year of study.
- No more than 12 units of coursework taken in graduate nondegree seeking status may be used toward a master's degree.
- Transfer from another institution may not exceed six units of credit.
- Transfer credit can be applied to an advanced degree only upon satisfactory completion of deficiencies.
- Grades of transfer credits are not used in computing the student's UA grade-point average.
- The transferred course earned graduate credit at the home institution and is comparable to University of Arizona graduate level work;
- The student earned a grade of A or B in the course (or the equivalent, if another grading system were used);

- The course was not applied toward an undergraduate degree (approved AMP units exempted); and
- The major or minor advisor and program director approve the acceptance of the transfer course(s).

5.4.2 Time Limits

Master's students are expected and required to complete their coursework and graduate with in six years from the date of the first course on their plan of study. Students who do not meet these time limits are required to petition for an extension of time to complete degree. Master's students whose coursework is more than 6 years old may be required to take additional coursework (see: `https://grad.arizona.edu/policies/academic-policies/time-degree`). The ENVS Satisfactory Progress Policy is described in Section 7

5.5 Continuing to a PhD

Program requirements for the ENVS PhD overlap with those of the ENVS MS, allowing a seamless transition from one program to the other and allowing the transfer of a considerable number of units from the ENVS MS to the ENVS PhD. Up to 30 qualifying units of graduate credit earned at UA or elsewhere may be counted toward the Ph.D requirements. For limitations and exceptions we refer to: `https://grad.arizona.edu/gsas/degree-requirements/doctor-philosophy#Credit%20Requirements,%20Transfer%20Credit,%20Prior%20Learning`

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6 ENVS Certificate Programs

6.1 Graduate Certificate in Aquaculture

6.1.1 Description

The University of Arizona Graduate Certificate in Aquaculture supports research, development, and training in aquatic food production systems with special interest in arid environments and developing countries. Current research includes rearing fish and shrimp in irrigation systems, fish, and shrimp nutrition and pathology, re-use of effluents as fertilizers for field crops and improving soils with fish wastes, and sustainable systems including aquaponics and integrated multi-trophic aquaculture. The certificate is especially designed for working professionals and international students who may want additional graduate experience on a flexible or reduced timescale.

All students must submit a formal application to the UA Graduate College to be considered for admission to the ENVS Graduate Certificate in Aquaculture. Further details about this graduate certificate including its admission requirements may be obtained at: `https://catalog.arizona.edu/programs/AQCCRTG`.

6.1.2 Certificate Requirements

The Graduate Certificate in Aquaculture requires completion of a minimum of 12 units of graduate credit. Courses may be added or removed from this list over time. Students should confirm that a particular course will be offered in a particular semester by checking the University of Arizona's Schedule of Classes. Certificate units may also be applied to degree programs; and up to six units of transfer credit may be used. For the latest requirements, please consult: `https://catalog.arizona.edu/programs/AQCCRTG`. Certificate units may also be applied to degree programs; and up to six units of transfer credit may be used.

6.2 Graduate Certificate in Water Policy

6.2.1 Description

The University of Arizona's Graduate Certificate in Water Policy offers breadth and depth of education. The Certificate is intended for two different and complementary groups of people who want to build their expertise in water policy: working professionals pursuing the Certificate only and UA graduate students concurrently enrolled in a graduate degree program. There is flexibility in both

course selection and schedule, to meet the specific needs and interests of a variety of students. The program is interdisciplinary. Although there are some administrative details that differ between working professionals and UA graduate students, all people admitted to the program must fulfill the same substantive requirements.

To earn the Water Policy Certificate, students must successfully pass 12 units of graduate credit, which is typically equivalent to four semester-long courses. These courses can be taken during a single semester of full-time study or spread out over two or three years. Much of the course-work emphasizes local and regional water policy issues in Arizona and the Southwestern U.S. However, students can also focus on broader national and international issues.

All students must submit a formal application to the UA Graduate College to be considered for admission to the ENVS Graduate Certificate in Water Policy. Further details about this graduate certificate including its admission requirements may be obtained at: `https://catalog.arizona.edu/programs/WPLCRTG`

6.2.2 Certificate Requirements

The Graduate Certificate in Water Policy requires completion of a minimum of 12 units of graduate credit as provided at `https://catalog.arizona.edu/programs/WPLCRTG`. Courses may be added or removed from this list over time. Students should confirm that a particular course will be offered in a particular semester by checking the University of Arizona's Schedule of Classes. Certificate units may also be applied to degree programs; and up to six units of transfer credit may be used.

7 ENVS Graduate Student Satisfactory Progress Policy

Graduate students in the Environmental Science Department are subject to annual evaluation for satisfactory progress based on their grade point average and overall progress towards completion of degree requirements.

A high level of performance is expected of all students in the ENVS graduate degree programs. Students must maintain a minimum of a 3.0 cumulative GPA throughout the program. Students failing to meet GPA requirements will be placed on probation by the Graduate College for one semester. If the cumulative GPA is not raised to the required minimum in the following semester, the student will be disqualified from the program by the Graduate College.

No later than one month after final grades are posted for spring semester, all graduate degree seeking students must submit their annual progress report online. The progress reports will be prescreened by the graduate coordinator and in case of obvious deficiencies forwarded to the graduate committee for further evaluation. Students who fail to make satisfactory academic or research progress will be notified in writing of their status (with a copy of the letter going to the Graduate College). They will be asked to develop and submit a remediation plan signed by the faculty advisor. **Students must be in good standing with the ENVS Department to be eligible for financial aid (including GTAs and GRAs) and enrollment in individual studies course work.**

7.1 Time to Completion and Dismissal

It is in the best interest of both the students and the ENVS Department for degrees to be earned in a timely manner. MS students who have not completed degree requirements within 4 years.

If a DUP is sent to a student (and Major Professor) it will clearly outline what degree requirements must be completed during the next semester. Students and their Major Professor are required to submit a letter to the ENVS DGS to outline what action will be taken to accomplish meaningful progress towards the student's degree. This letter should be received by the DGS no later than 1 month after receipt of the DUP. If extreme extenuating circumstances prevent a student in good standing (i.e., GPA $\geq$ 3.0) from completing the degree requirements within the year, *one* leave of absence for one or two semesters may be requested.

Students who fail to meet the deadline(s) set in the DUP will be sent a Notice of Unsatisfactory Progress (NUP) (`https://grad.arizona.edu/policies/academic-policies/satisfactory-academic-progress`) with a copy going to the Graduate College. This letter will set explicit milestones that **must** be met within the next regular semester. If the student fails to meet **any single** deadline, the ENVS DGS or Department Head will request that the Graduate College dismisses the student from the ENVS graduate or certificate program. Students who receive

a NUP may appeal with the ENVS DGS, the ENVS Department Head, or the Graduate College (see prior link).

If a student is dismissed from the ENVS graduate program they may apply again to the ENVS graduate program after two Academic Years have passed since their dismissal. This application will be considered a **new** application under the admission policies active at the time the application is received. There is no guarantee of admission.

When a dismissed student applies to the ENVS Graduate Program, they should clearly address in their statement of purpose

- How the cause for dismissal (as stated in the DUP and NUP) will be remediated.
- What will be done to progress towards the degree. This should include a detailed schedule, including the semesters when the degree will be completed, For dismissed PhD students we also require the semester when the ENVS comprehensive exam will be taken (if no longer valid, or if never taken).

The applicant should be aware that ENVS graduate policies may have changed and that past graduate coursework or research may no longer be applicable to ENVS degree requirements in force at the time of the new application. In addition, the ENVS department will require a affirmative statement of an ENVS faculty member that they are willing to advise (and where relevant: fund) the student in light of past dismissal. For applications to the ENVS PhD program, ENVS will also request this for the UA faculty member who represents the Minor area of study, if his was previously declared. Upon positive reviews, the ENVS department will discuss admission with UA Graduate College representatives and establish a mentoring plan if needed.

Glossary

AMP: Accelerated Master's Program. Mechanism to obtain an ENVS MS with one year of graduate studies after the ENVS BSES.

Career Courses: Required classes that all MS and PhD students must complete to fulfill the ENVS MS or ENVS PhD requirements.

Core Courses: Classes in the Major Track that all ENVS students must complete from the program curriculum.

Deficiency: Prerequisite coursework for the major that must be completed before the end of the first year of graduate study.

Director of Graduate Studies (DGS): ENVS faculty who oversees the ENVS Graduate Program, including setting and changing Graduate Program Policies. This position is currently filled by Dr. Marcel Schaap. Most Graduate Program-related questions should be directed to the Graduate Student Support Coordinator.

Elective Courses: Addition courses in the major that apply directly to the program curriculum.

GPA: Grade Point Average. Average Grade obtained in educational system. International grading systems are converted in the US 4-point system by UA's Graduate College. Applicants to the ENVS MS and ENVS PhD should have a GPA of 3.0 or greater (4-point scale). AMP applicants must have a GPA of 3.3 or greater.

Graduate Program Committee (GPC): Committee that advises DGS, Department Head and Faculty on Graduate Program Matters. Also reviews some applications to the graduate program. Members include five faculty members (including DGS who is chair), Graduate Student Support Coordinator and two students (ideally one MS and one PhD student).

GradApp: The UA Graduate College's paperless Graduate Program application system. All applications to the ENVS MS and ENVS PhD must be submitted through this system.

GradPath: The UA Graduate College's paperless degree audit process accessed via UAccess Student and allowing tracking and monitoring of student progress. Required graduate forms are filled out and submitted online.

Graduate Student Support Coordinator/Graduate Advisor: ENVS staff who carries out day-to-day administration of the ENVS Graduate Program, including academic advising of students. This document may also use "ENVS Advising Team".

Graduate Faculty: ENVS faculty who are qualified to serve on a graduate student's committee (Masters Committee, and PhD Comprehensive Exam committee, PhD Dissertation Committee). Some restrictions apply for career track graduate faculty.

GA (Main Campus only): Graduate Assistant (MS) or Graduate Associate (PhD). These are temporary appointments in which the student fulfills research duties (GRA) or assists and instructor in the ENVS Undergraduate Program (GTA).

Major: When MS and PhD degree requirements are fulfilled, ENVS students will obtain an MS or PhD degree in Environmental Science.

Major Professor: ENVS Graduate Faculty supervisor who accepts a graduate student into their field of research and acts as their mentor.

Minor Professor: (PhD only) Tenure track faculty from the minor area of study who is a member of the Dissertation Committee.

Special Member: Qualified experts who do not hold Graduate Faculty status but who would be valuable members of a Graduate student's committee. Needs approval from the Graduate College.

Track: The ENVS MS and PhD programs have core course requirements relevant for a general Environmental Science focus (ES track), and a Soil and Water Science Focus (SWS track).

ENVS Graduate Courses

This list is for informational purposes only and contains a possibly outdated and abbreviated summary of the courses. For an accurate listing of courses, semester offered, instructor, and prerequisites, please see: `https://uaccess.schedule.arizona.edu/psp/pubsaprd/UA_CATALOG/HRMS/h/?tab=DEFAULT` (select "E" and then "ENVS")

ENVS 501. Sustainable Management of Arid Lands and Salt-Affected Soils (3) Principles and practices of soil, water and crop management under arid and semiarid conditions, the use of diagnostic procedures for evaluating soils and waters, reclamation, and economics of irrigation project development. Spring semester. TBD.

ENVS 502. Nutrient Dynamics in Soils (3) Nutrient uptake by plant roots, soil microbial ecology, and soil chemical reactions affecting nutrients will be discussed and applied to environmental challenges related to nutrient cycling in arid land soils. Fall semester.

ENVS 506. Modeling of Mass and Energy Flow in Soils (3) Water flow in soils; closely related problems of solute, pollutant, and heat transfer. Fall semester. TBD

ENVS 508. Scientific Writing for Environmental, Agricultural and Life Sciences (3) This course will cover in-depth technical writing skills needed for scientific writing success, ranging from how to perform comprehensive reviews of the scientific literature, to performing peer reviews of the writing of fellow students. Spring semester.

ENVS 510. Microbial Biogeochemistry and Global Change (3) In this interdisciplinary undergraduate and graduate class we will cover major microbial bio-geochemical cycles, and how these cycles are impacted by, and feedback to, global change. Spring semester.

ENVS 515. Translating Environmental Science (3) In this course students learn journalism techniques to translate environmental science topics into language a layperson could appreciate. Spring semester.

ENVS 518. Introduction to Human Health Risk Assessment. (3) The purpose of this course is to enhance students knowledge and skills related to environmental risk assessment, including hazard assessment, exposure assessment, toxicity assessment, and risk characterization. Graduate-level requirements include conducting a case study that will require them to collect secondary data in the field. Fall semester.

ENVS 520. Environmental Physics (3) This course emphasizes conceptual understanding of mechanisms, data sets and modeling techniques and uses elementary math and physics principles to guide student to a comprehensive, but practical, understanding of the physical aspects of the environment of planet Earth. Fall and Spring semester.

ENVS 525. Environmental Microbiology (3) Current concepts in water quality, aerobiology, and microbial biogeochemistry. Fall semester.

ENVS 526. Environmental Microbiology Laboratory (2) Basic techniques for isolation and characterization of environmental soil and water micro-flora including methods for enumeration and measurement of physiological activity. Fall semester.

ENVS 528R Microbial Genetics (3) **ENVS 528R** Laboratory (2). Prokaryotic gene structure and function; methods of gene transfer and mapping, DNA structure, replication, transcription, and translation. Hands-on computer analysis of DNA sequences and gene cloning strategies. Principles of regulation of gene expression. Graduate-level requirements include a DNA sequence of an entire operon from any one of a variety of bacteria and additionally analyze one product from the operon using several GCG protein analysis programs plus an extensive exam. Fall semester.

ENVS 530R. Environmental Monitoring and Remediation (3) **ENVS 530L** (1) Lab. Basic statistics, data quality, field surveying, near-surface air measurement, automated data acquisition, soil, vadose zone and groundwater sampling and monitoring; soil and water biological properties, including pathogen monitoring and remote sensing. This course focuses on hands-on, laboratory and field experiences design to help the student better understand the principles of and the tools necessary for environmental monitoring. Fall and Spring semester.

ENVS 531R+L. Soil Genesis, Morphology, and Classification and Lab. Theory and practice of describing characteristics of soils; principles of soil classification and the classification systems; making soil interpretations for selected land uses. Field trips. Fall semester.

ENVS 531A Traditional Ecological Knowledge (3)An introduction to the growing literature on traditional ecological knowledge and its relationships to the ecological and social sciences. Graduate-level requirements include preparing for and leading a class discussion on a specific topic. Fall semester.

ENVS 536A Fundamentals of the Atmospheric Sciences. (3) Broadly covers fundamental topics in the atmospheric sciences. Topics include composition of the atmosphere, atmospheric thermodynamics, atmospheric chemistry, cloud physics, radiative transfer, atmospheric dynamics, and climate. Graduate-level requirements include additional questions on homework and exams plus a term paper on a specialized research topic. Spring semester.

ENVS 541 Soils and Landscapes of Arizona/Advanced Soil Genesis (3) Physical and chemical processes and mineralogy of weathering and soil formation; quantitative pedology; the soil as part of the ecosystem. Field trips. Spring semester (odd years only).

ENVS 541A Natural Resource Management in Native Communities. (3) This course is a survey of basic issues and concepts in natural resource management and the environment in Native communities using integrated case studies

that survey all the major varieties of environmental issues in Indian Country in the 21st century. A central theme will be developing tribally-specific solutions to rebuilding the resiliency of degraded ecosystems. We will consider particular case studies such as: tribal sovereignty, land tenure, reserved rights and Native claims; Native knowledge systems and Western science; co-management and restoration; water; fish and wildlife; agriculture and range-land management; energy, mining and nuclear waste; and global climate change. Graduate-level requirements include Increased length of writing assignments. Fall and Spring semesters.

ENVS 550 Green Infrastructure (3) The course provides an overview as well as more in-depth coverage of the science, practical context, and creation of Green Infrastructure. The built environment of arid regions is emphasized, with Tucson Case Studies providing practical focus to content and learning objectives. Fall semester.

ENVS 554 Water Harvesting (3) Focuses on water harvesting principles and techniques at a variety of scales and settings. Students participate in hands-on implementation of water harvesting projects on the UA campus. Spring semester.

ENVS 561 Soil and Water Conservation (3) Consideration of major world soil and water conservation problems and solutions; principles of soil and water degradation by erosion, ground water overdraft, chemical transport in surface and ground water and their effects on world food production and environmental problems. Offered during Pre-session. Field trips.

ENVS 562 Environmental Soil and Water Chemistry (3) An introduction to the principal chemical constituents and processes occurring in soils and sediments. The objective of the course is to provide students with a conceptual framework for understanding chemical reactions in heterogeneous natural systems. Spring semester.

ENVS 564 Environmental Organic Chemistry (3) Physical and chemical processes influencing the behavior of contaminants in the subsurface environment; equilibrium and kinetic theory of solubilization-dissolution, volatilization, sorption, hydrolysis, photolysis, surface catalysis, and radioactive decay. Fall semester.

ENVS 565 Contaminant Transport in Porous Media (3) The emphasis is on developing a thorough understanding of the critical processes and factors that influence transport and fate, including advection, dispersion, interphase mass transfer, transformation reactions, and physical and bio-geochemical heterogeneity of porous media. Spring semester (odd years only).

ENVS 566 Soil and Groundwater Remediation (3) This course examines the characterization and remediation of contaminated hazardous waste sites. The course is focused on the scientific and engineering principles supporting site characterization and remediation activities. Spring semester (even years only).

ENVS 567 Introductory Statistics and Multivariate Statistics with R. (3) The course (3 unit class) will teach the fundamentals of coding and programming using the R language (`https://www.r-project.org/`). The students will use code examples and practice problems to understand the statistical as well as the scientific viewpoint. Using R, students will explore and visualize real-world data and derive meaningful interpretations. The course will cover introductory statistics (descriptive statistics, hypothesis testing, t-test, ANOVA, correlation, regression) and multivariate statistics with a focus on ecological analyses (diversity, cluster analysis, unconstrained ordination, constrained ordination). Spring,

ENVS 570 Soil Physics (3) Theoretical and practical bases for understanding and quantifying physical and hydrological properties of soils; hydro-physical processes taking place near the Earth's surface emphasizing mass and energy exchange, and transport processes in saturated and partially-saturated soils at multiple scales; coupling of the atmosphere and the role of plants in the hydrological cycle; modern measurement methods and analytical tools for hydrological data collection and interpretation. Spring semester.

ENVS 572 Interfacial Chemistry of Biomolecules in Environmental Systems (3) Introduction to the chemical and adhesive properties of macromolecules at interfaces and inter-particle adhesion. Topics such as surface tension, self-assembly, adsorption of polymers and biomolecules, and bacterial cell adhesion will be discussed with emphasis on environmental applications. Spring semester (even years only).

ENVS 574 Aquatic Plants and the Environment (4) The role of riparian areas, estuaries, and constructed wetlands in the environment; emphasis on plants as wildlife habitat, nutrient cycling, and bioremediation. Spring semester.

ENVS 575 Freshwater and Marine Algae (4) Systematics, ecology, and evolution of planktonic and benthic species; field techniques and lab culture. Spring semester.

ENVS 577 Principles of Ecotoxicology, (3) and **ENVS 577L** Ecotoxicology Lab. Ecotoxicology is the study of the biochemical and molecular effects of chemical toxicants and non-chemical stressors, singly or in mixtures, on biological organization ranging from the individual to assemblages and ecosystems. Some of the detrimental effects of toxicants and stressors are acute causing immediate ecological and physiological harm, while many others are insidious and chronic causing long-term damage to populations over multiple generations. This course will provide knowledge to students of the very broad range of anthropogenic stressors and toxicants as well as their physiological and sometimes, behavioral, effects on individuals and populations of organisms.

ENVS 579 Boundary Layer Meteorology & Surface Processes, (3) Designed for students in the atmospheric sciences, hydrology and related fields. It provides a framework for understanding the basic physical processes that govern mass and heat transfer in the atmospheric boundary layer and the vegetated

land surface. In addition to the theoretical part of the course, there is a strong focus on modeling and students will be required to program numerical codes to represent these physical processes. Spring semester (even years only),

ENVS 580 Environmental Assessment for Contaminated Sites (3) Advances students' knowledge of various concepts and methods used in assessing human-impacted resources such as contaminated sites, waste places, and disturbed sites to ensure efficient and effective remediation and restoration programs. Fall Semester.

ENVS 582 Reclamation and Redevelopment of Impacted Lands (3) Introduces the concepts and methods governing the sustainable management, restoration, and redevelopment of human-impacted lands. The topics covered include: soil quality concepts; the energy-water-food nexus; redevelopment of brownfields and other impacted lands; reclamation of mining and other resource-extraction sites; natural-disaster cleanup; urban agriculture and community gardens. Spring semester.

ENVS 583 Geographic Applications of Remote Sensing. (3) Use of aircraft and satellite imagery for monitoring landforms, soils, vegetation and land use, with the focus on problems of land-use planning, resource management and related topics. Graduate-level requirements include the completion of a project report. Main campus: Spring Online campus: Spring semester.

ENVS 590 Remote Sensing for the Study of Planet Earth. (3) Remote Sensing for the Study of Planet Earth introduces basic and applied remote sensing science as a means to explore the diversity of our planetary environments (biosphere, atmosphere, lithosphere and hydrosphere) within the radiometric, spectral, spatial, angular and temporal domains of remote sensing systems. This survey course strikes a balance between theory, applications and hands-on labs and assignments. We explore how you can download, process, analyze and interpret multi-sensor data and integrate online remotely sensed data sources/products into your research of interest. Fall semester, Smith.
ENVS 595. Colloquium (1) The exchange of scholarly information and/or secondary research. Instruction often includes lectures by several different persons. Fall and Spring semester.

ENVS 596B Water Policy In Arizona and Semi-arid Regions (3) This course focuses on current water policy in Arizona, the Colorado River Basin, and other semi-arid regions from a multi-disciplinary perspective. Through readings, research, discussion and presentations, the student is exposed to major, current water resource issues and policies to address them. Spring semester.

ENVS 641 Water Law. The course in Water Law traditionally emphasizes state law rules that govern rights to use surface water and groundwater throughout the country. Although we will give ample attention to the prior appropriation doctrine, riparian water rights, and various systems for regulating groundwater use, this course will also emphasize how federal law may impact water rights. Increasingly, environmentalists and others claim that there are public rights

to water that may take precedence over rights under the prior appropriation system. Spring semester.

ENVS 696A Seminar (1) Topics in Soil, Water and Environmental Science. Development and exchange of scholarly information, usually in a small group setting; the scope of work shall consist of research by course registrants, with the exchange of the results of such research through discussion, reports/or papers. Fall and Spring semester.

ENVS 696N Indigenous Food Energy Water Security and Sovereignty Seminar (1) discuss research and extension on tribal lands. Additional faculty working on tribal natural resources challenges will be invited as needed. This seminar will be live-streamed to Dine College and NTU. First year PhD trainees will discuss preparation strategies for internships. Topics include career paths, Indige-FEWSS internship opportunities, written and oral mechanisms of scientific communication to reach disciplinary, cross-disciplinary and lay audiences, and work place expectations. Second year PhD trainees will prepare to work with Dine College and NTU faculty and teach FEWS modules. Topics include: inquiry based Fall and Spring semesters.

ENVS 696P Hazardous Waste Risk and Remediation in the US Southwest (1), Interdisciplinary trainees who participate in a colloquium, professional development activities and research translation/community engagement activities. Fall and Spring semesters.

ENVS 697 Graduate Seminar and Professional Development (1) ENVS graduate students will develop and practice oral and poster presentations in front of an audience (and camera), practice chairing a session of a professional meeting, and develop a relevant resume/CV appropriate for a professional career in their field. Students will appraise and critique the presentations of their fellow students. Students will also practice a simulated job interview, based on the CV they develop.