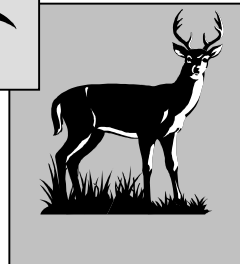
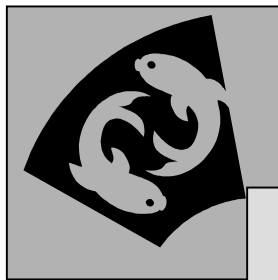


# Wildlife and Fisheries Science

School of Forest Resources  
College of Agricultural Sciences  
The Pennsylvania State University



**2009 - 2010**

## Student Handbook

<http://www.sfr.cas.psu.edu/>

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## School of Forest Resources

The School of Forest Resources is an academic unit in the College of Agricultural Sciences at Penn State. The school's mission is to provide educational opportunities and science-based information to protect, manage, and use natural resources for sustained benefits. This is accomplished through educational, research, and service programs in forestry, wildlife and fisheries, wood products, and related areas.

The School of Forest Resources offers two associate in science (A.S.) degree programs: Forest Technology (at Penn State Mont Alto) and Wildlife Technology (at Penn State DuBois); and three bachelor of science (B.S.) degree programs: Forest Science, Wildlife and Fisheries Science, and Wood Products. A minor in each of these latter three areas is also offered. In addition, the school has graduate programs at both the master's and doctorate levels. The director and faculty of the school are committed to quality teaching.

### Undergraduate Programs Office

The School of Forest Resources (SFR) Undergraduate Programs Office is housed in 113 Forest Resources Building at Penn State University Park; phone (814) 865-4237. Dr. Paola Ferreri is the associate director for academic programs, Jamie Murphy is the program coordinator, and Dana Whaley is the staff assistant.

Each student in the School of Forest Resources is assigned an academic adviser. For students at the University Park campus, advising assignments are made by the SFR Undergraduate Programs Office.

Any student enrolled in or thinking about enrolling in a major in the School of Forest Resources, regardless of campus location, is encouraged to contact the SFR Undergraduate Programs Office for additional information. Additional information regarding the school's academic programs, scholarships, student activities and professional societies, school faculty, and facilities is available on our Web site: [www.sfr.psu.edu](http://www.sfr.psu.edu).

Undergraduate Programs Office  
School of Forest Resources  
The Pennsylvania State University  
113 Forest Resources Building  
University Park, PA 16802-4301  
*phone* (814) 865-4237  
*fax* (814) 865-3725

## How to Use This Handbook

This handbook is a tool to help you plan your academic career and meet all of the requirements to complete your bachelor of science degree in Wildlife and Fisheries Science (W F S). **This handbook is not intended to replace regular meetings with your academic adviser.** It is important to follow the requirements in the handbook specific to your program year. Your program year is the year that you declared your major in W F S. This differs from your general education year, which is the year you entered Penn State as a degree student. This handbook refers to the general education and program requirements for 2009-2010. You should use the Baccalaureate Degree Programs listing online to determine your general education requirements: <http://bulletins.psu.edu/bulletins/bluebook/>. For example, the average freshman student entering Penn State in the fall of 2009 will not declare a major until 2011. Thus, this student's general education year is 2009 and his/her program year is 2011. If you are unsure of your general education or program year, please see your adviser. You can also get this information from your degree audit, which can be obtained online at <https://elion.oas.psu.edu/>.

## Wildlife and Fisheries Science Undergraduate Program

### Mission and Overview

The mission of the Wildlife and Fisheries Science program is threefold: (1) to provide a challenging and comprehensive curriculum in concepts, principles, and techniques of wildlife and fisheries science and natural resource conservation and management; (2) to educate future wildlife and fisheries professionals; and (3) to increase the awareness of students from all disciplines of the importance of wise stewardship of wildlife, fisheries, and other natural resources.

The major in Wildlife and Fisheries Science is designed for students interested primarily in conservation and management of wildlife and fish species and their habitats. The major provides a broad background in quantification, arts and humanities, physical and biological sciences, and natural resource management. Flexibility in course selection permits students to plan their programs in keeping with their specific interests, goals, and plans for the future. Graduates may pursue graduate-level training in the wildlife and fisheries sciences or careers in management, research, or information and education. The curriculum provides a firm base for graduate study and the opportunity to meet standards established by The Wildlife Society, The American Fisheries Society, and the Federal Office of Personnel Management for employment in wildlife and fisheries biology. If you are interested in pursuing these opportunities it is important that you meet regularly with an adviser to choose appropriate courses.

The Wildlife and Fisheries Science curriculum is designed to be compatible with related majors, such as Forest Science or Biology, so that simultaneous degrees and multiple majors are possible. Wildlife and Fisheries Science and Forest Science are a particularly strong combination for students interested in forest resource management. Students interested in such combined programs should talk with our program coordinator, Jamie Murphy.

Wildlife and fisheries scientists find employment as natural resource biologists, habitat managers, fish or wildlife technicians, conservation officers, environmental educators, research scientists, teachers, and administrators. Students seeking a career as a wildlife or fisheries biologist often pursue a Master's Degree. Graduates with a bachelor's degree are generally competitive for technician-level jobs in fisheries and wildlife with federal, state, and county agencies, environmental interpretation positions, and private sector jobs (e.g., environmental consultants, animal damage control, etc.).

Bachelor of Science graduates generally find jobs with state and federal agencies or with private firms. Federal agencies that employ wildlife and fisheries biologists include the U.S. Fish and Wildlife Service, Forest Service, National Park Service, Geological Survey, Bureau of Land Management, Bureau of Reclamation, Bureau of Indian Affairs, and Environmental Protection Agency. State agencies hire fisheries and wildlife biologists in departments of fish and wildlife, forestry, conservation, and environmental resources. Private firms hire fish and wildlife biologists in the areas of environmental consulting, forest management, animal damage control, and natural resource extraction (e.g., gas, oil, coal, and chemical companies). Nonprofit organizations such as The Nature Conservancy, Audubon Society, Trout Unlimited, Pheasants Forever, Quality Deer Management Association and Ducks Unlimited also hire biologists and environmental educators.

### Curriculum Requirements

The bachelor of science (B.S.) degree in Wildlife and Fisheries Science requires completion of 120-122 credits hours. Students enrolled in the B.S. program in Wildlife and Fisheries Science can choose one of two options: (1) Wildlife option – 120 credits, and (2) Fisheries option – 122 credits. This specialization is designed to prepare students to enter professional employment or graduate studies.

**Courses Required for BOTH Options** (individual course credits are given in parentheses):

\*Indicates a course requiring at least a C grade.

Penn State General Education Requirement Designations:

GWS – Writing/Speaking

GQ – Quantification

GHA – Health and Physical Activity (formerly GPE and GHS)

GN – Natural Sciences

GA – Arts

GH – Humanities

GS – Social and Behavioral Sciences

IL – International Cultures (formerly DF or GI)

US – United States Cultures

### COMMUNICATIONS

- ENGL 015 GWS – Rhetoric and Composition (3)

- ENGL 202C GWS – Effective Writing: Technical Writing (3)
- CAS 100 GWS – Effective Speech (3)
- AEE 440 – Communications Methods and Media (3), CAS 211 - Informative, Technical, and Presentational Speaking (3), ENGL 416 - Science Writing (3), or ENGL 418 - Advanced Technical Writing and Editing (3).

## QUANTIFICATION

- MATH 110 or 140 GQ – Techniques of Calculus I (4) \*
- MATH 111 or 141 GQ – Techniques of Calculus II (2-4)
- STAT 240 – Introduction to Biometry (3), or STAT 301 – Statistical Analysis I (3)
- FOR 350 – Forest Resources Biometrics (3), or STAT 460 – Intermediate Applied Statistics

## NATURAL SCIENCES and OTHER PRESCRIBED COURSES

- W F S 209 GN – Wildlife and Fisheries Conservation (3) \*
- W F S 300 – The Vertebrates (2) \*
- W F S 301 – Vertebrate Lab (2) \*
- W F S 310 – Wildlife and Fisheries Measurements (3) \*
- W F S 446 – Wildlife and Fisheries Population Dynamics (3)
- BIOL 110 GN – Biology: Basic Concepts and Biodiversity (4)
- BIOL 220W GN – Biology: Populations and Communities (4) \*
- BIOL 133 – Genetics and Evolution of the Human Species, or BIOL 222 – Genetics, or BIOL 230W GN – Biology: Molecules and Cells, or AN SC 322 – Principles of Animal Breeding (3-4)
- BIOL 240W GN – Biology: Function and Development of Organisms (4)
- CHEM 110 GN – Chemical Principles (3)
- CHEM 111 GN – Experimental Chemistry (1)
- CHEM 202 – Organic Chemistry (3)
- PHYS 250 GN – Introductory Physics I (4)
- SOILS 101 – Introduction to Soils (3)

Natural Resource Policy, Planning, Law, Administration (PPLA) and Human Dimensions (HD)  
Choose 6 credits from the following list:

- B LAW/R EST 425 – Environmental Law, Property, and Commerce (3)
- E R M 411 – Legal Aspects of Resource Management (3)
- FOR 410 – Forest Ecosystem Management (3)
- FOR 416 – Forest Recreation (3)
- FOR 480 – Forest Policy and Administration (3)
- FOR 485 – Natural Resource Decisions (3)
- RPTM 120 – Leisure and Human Behavior (3)
- RPTM 320 – Recreation Resource Planning and Management (3)
- W F S 440 – Natural Resources Public Relations

ARTS (6 credits)

- Selections from the University-approved Arts list [GA] (6)

HUMANITIES (6 credits)

- Selections from the University-approved Humanities list [GH] (6)

SOCIAL AND BEHAVIORAL SCIENCES (6 credits)

- ECON 004 GS – Introductory Macroeconomic Analysis (3)
- Selection from the University-approved Social and Behavioral Sciences list [GS] (3)

HEALTH SCIENCE AND PHYSICAL EDUCATION (3 credits)

- Selection(s) from the University-approved Health Sciences and Physical Education list [GHA, GPE, and GHS] (3)

UNITED STATES CULTURES AND INTERNATIONAL CULTURES (6 credits)

- Must select 3 credits of University-approved United States Cultures (US) and 3 credits of University-approved International Cultures (IL). This requirement can be satisfied in combination with requirements in Arts (GA), Humanities (GH), or Social and Behavioral Sciences (GS).

FIRST-YEAR SEMINAR (minimum 1 credit)

- Must select a minimum of 1 credit of First-Year Seminar. This course is AG 150, Be a Master Student, in the College of Agricultural Sciences. A student who changes colleges is not required to take another First-Year Seminar.

WRITING-INTENSIVE COURSE (3 credits)

- Must select 3 credits of writing-intensive (W) course work in your major or college of enrollment. Writing-intensive requirement is satisfied by completion of W F S 463W or 447W.

Note: Acceptable selections for Arts, Humanities, Social and Behavioral Sciences, United States and International Cultures, Health Sciences and Physical Education, and First-Year Seminar are listed in the *General Education in the Curriculum* handbook or on the Web at <http://bulletins.psu.edu/bulletins/bluebook/>.

### **Additional Courses Required for the Fisheries Option**

- W F S 410 – General Fishery Science (3)
- W F S 452 – Ichthyology (2)
- W F S 453 – Ichthyology Lab (2)
- W F S 463W – Fishery Management (3)
- Wildlife selection (Choose one course from the following list): W F S 407 – Ornithology (3), W F S 408 – Mammalogy (3), W F S 447W – Wildlife Management (3), W F S 460 – Wildlife Behavior (3), or W F S 462 -Amphibians and Reptiles (3)
- Fisheries and Aquatic Science selection (Choose one course from the following list): W F S 422 – Ecology of Fishes (3), FOR 470 – Watershed Management (3), W F S/E R M 435 – Limnology (3), or ENT 425 – Freshwater Entomology (3)
- Physiology selection (Choose one course from the following list): BIOL 141 and 142 – Physiology (3) and Physiology Laboratory (1), or BIOL 446 (3) – Physiological Ecology, or AN SC 001 – Animal Science (4)
- Physical science selection (Choose one course from the following list): GEOSC 303 – Introduction to Environmental Geology (3), GEOSC 340 – Geomorphology (3), GEOSC 412 – Water Resources Geochemistry (3), GEOSC 440 – Marine Geology (3), GEOSC 452 – Introduction to Hydrogeology (3), GEOG 160 – Mapping Our Changing World (3), GEOG 357 – Geographic Information Systems (3), or E R M/C E 475 – Water Quality Chemistry (3)
- 3 - 7 credits of Electives

### **Additional Courses Required for the Wildlife Option**

- Choose 2 of the following 3 courses (NEED 6 credits total): W F S 407 – Ornithology (3), or W F S 462 – Amphibians and Reptiles (3), or W F S 408 – Mammalogy (3)
- W F S 447W – Wildlife Management (3)
- W F S 406 – Ornithology Lab (1), or W F S 409 – Mammalogy Lab (1)
- Fisheries selection (Choose one course from the following list): W F S 410 – General Fishery Science (3), W F S 422 – Ecology of Fishes (3), W F S 452 – Ichthyology (2), W F S 453 – Ichthyology Lab (2), or W F S 463W – Fishery Management (3)
- FOR 203 – Field Dendrology (3)
- Botany selection (Choose one course from the following list): FOR 308 – Forest Ecology (3), HORT 101 – Horticultural Science (3), HORT 138 – Ornamental Plant Materials (3), HORT 445 – Plant Ecology (3), or BIOL 414 – Taxonomy of Seed Plants (3)
- 6 - 10 credits of Electives

Note: When a required course has both a lecture and practicum portion, such as PHYS 250 and PHYS 250P, students are required to take both portions.

\*\*All students are strongly encouraged to participate in undergraduate research experience as work study, internship, or for credit (listed as W F S 495 or 496). These credits can be used as electives through consultation with your adviser.

### **FISHERIES OPTION SELECTIONS:**

*\* denotes courses with prerequisites not included in the W F S program*

#### *Fisheries and Aquatic Science Selection:*

W F S 422 - Ecology of Fishes (3); Fall odd years  
FOR 470 - Watershed Management (3); Spring  
W F S/E R M 435 - Limnology (3); Fall  
ENT 425 - Freshwater Entomology (3); Fall even years

#### *Physical Science Selection:*

GEO SC 303 - Introduction to Environmental Geology (3); Fall and Spring  
\*GEO SC 340 - Geomorphology (3); Fall  
\*GEO SC 412 - Water Resources Geochemistry (3); Fall  
GEO SC 440 - Marine Geology (3); Spring  
\*GEO SC 452 - Introduction to Hydrogeology (3)  
GEOG 160 - Mapping Our Changing World (3; Intro to GIS and mapping); Fall and Spring  
\*GEOG 357 - Geographic Information Systems (3); Fall and Spring  
\*E R M (CE) 475 - Water Quality Chemistry (3); Spring

#### *Policy, Planning, Law, and Administration Selection (PPLA) and Human Dimensions (HD):*

FOR 410 - Forest Ecosystem Management (3); Spring  
FOR 416 - Forest Recreation (3); Fall  
FOR 480 - Policy and Administration (3); Fall  
FOR 485 - Natural Resources Decisions (3)  
W F S 440 - Natural Resources Public Relations (3); Spring  
\*E R M 411 - Legal Aspects of Resource Management (3); Fall  
RPTM 120 - Leisure and Human Behavior (3); Fall and Spring  
RPTM 320 - Recreation Resource Planning and Management (3); Fall and Spring  
\*B LAW (R EST) 425 - Environmental Law, Property, and Commerce (3); Spring

#### *Physiology Selection:*

BIOL 141 and 142 - Physiology and Physiology Lab (4); BIOL 141, Fall and Spring; BIOL 142, Fall  
BIOL 446 - Physiological Ecology (3); Spring even years  
AN SC 201 - Animal Science (4); Fall and Spring

#### *Wildlife Selection:*

W F S 407 - Ornithology (3); Spring  
W F S 408 - Mammalogy (3); Spring  
W F S 447W - Wildlife Management (3); Fall  
W F S 460 - Wildlife Behavior (3), Spring  
W F S 462 - Amphibians and Reptiles (3), Fall

\*\*All students are strongly encouraged to participate in undergraduate research experience as work study, internship, or for credit (listed as W F S 495 or 496). These credits can be used as electives through consultation with your adviser.

## **WILDLIFE OPTION SELECTIONS:**

*\* denotes courses with prerequisites not included in the W F S program*

### *Fisheries Selection:*

W F S 410 - General Fishery Science (3); Fall  
W F S 422 - Ecology of Fishes (3); Fall even years  
W F S 452 - Ichthyology (2); Fall  
W F S 453 - Ichthyology Lab (2); Fall or Spring  
W F S 463 - Fishery Management (3); Spring

### *Policy, Planning, Law, and Administration Selection (PPLA) and Human Dimensions (HD):*

FOR 410 - Forest Ecosystem Management (3); Spring  
FOR 416 - Forest Recreation (3); Spring  
FOR 480 - Policy and Administration (3); Fall  
FOR 485 - Natural Resources Decisions (3); Spring  
W F S 440 - Natural Resources Public Relations (3); Spring  
\*E R M 411 - Legal Aspects of Resource Management (3); Fall  
RPTM 120 - Leisure and Human Behavior (3); Fall and Spring  
RPTM 320 - Recreation Resource Planning and Management (3); Fall and Spring  
\*B LAW (R EST) 425 - Environmental Law, Property, and Commerce (3); Spring

### *Botany Selection:*

FOR 308 - Forest Ecology (3); Fall  
HORT 101 - Horticultural Science (3); Fall and Spring  
HORT 138 - Ornamental Plants - shrubs (3); Fall  
HORT 445 - Plant Ecology (3); Fall  
BIOL 414 - Taxonomy of Seed Plants (3)  
FOR/W F S 497?- Forest Weeds (3)

Recommended Academic Plan for Wildlife and Fisheries Science –  
**Fisheries option** starting at **University Park**, Effective Summer 2008

| Semester 1 (fall)  | Credits | Semester 2 (spring)                                   | Credits |
|--|---------|---|---------|
| <a href="#">BIOL 110</a> (GN)  | 4       | <a href="#">ENGL 015</a> or <a href="#">030</a> (GWS) | 3       |
| <a href="#">MATH 110</a> or <a href="#">140</a> (GQ)   | 4       | <a href="#">MATH 111</a> or <a href="#">141</a> (GQ)  | 2-4     |
| <a href="#">CHEM 110</a> (GN)  | 3       | <a href="#">BIOL 220W</a> (GN)                        | 4       |
| Humanities (GH)  | 3       | <a href="#">CHEM 111</a> (GN)                         | 1       |
| <a href="#">First-Year Seminar</a>   | 1-3     | <a href="#">Arts</a> (GA)                             | 3       |
|  |         | Social and Behavioral Science (GS)                    | 3       |
| Total Credits:   | 15-17   | Total Credits:  | 16-18   |
| Semester 3   | Credits | Semester 4  | Credits |
| <a href="#">BIOL 141</a> & <a href="#">142</a> , or <a href="#">BIOL 446</a> , or AN SC 201          | 3-4     | <a href="#">PHYS 250</a>                              | 4       |
| <a href="#">CHEM 202</a>   | 3       | <a href="#">BIOL 240W</a>                             | 4       |
| <a href="#">BIOL 133</a> , <a href="#">222</a> , <a href="#">230W</a> , or <a href="#">AN SC 322</a> | 3-4     | <a href="#">SOILS 101</a>                             | 3       |
| <a href="#">WFS 209</a> (GN)   | 3       | <a href="#">CAS 100</a> (GWS) <i>Effective Speech</i> | 3       |
| <a href="#">STAT 240</a> or <a href="#">301</a> (GQ)   | 3       | Humanities (GH)                                       | 3       |
| Total Credits:   | 15-17   | Total Credits:  | 17      |
| Semester 5   | Credits | Semester 6  | Credits |
| <a href="#">W F S 300</a>  | 2       | <a href="#">FOR 350</a> or <a href="#">STAT 460</a>   | 3       |
| <a href="#">W F S 301</a>  | 2       | Fisheries and Aquatic Sci. selection                  | 3       |
| <a href="#">W F S 310</a>  | 3       | Wildlife selection                                    | 3       |
| <a href="#">W F S 452</a>  | 2       | <a href="#">ECON 004</a>                              | 3       |
| PPLA/HD requirement  | 3       | PPLA/HD requirement                                   | 3       |
| Elective   | 3       |   |         |
| Total Credits:   | 15      | Total Credits:  | 15      |
| Semester 7   | Credits | Semester 8  | Credits |
| <a href="#">W F S 410</a>  | 3       | <a href="#">W F S 463W</a>                            | 3       |
| <a href="#">W F S 453</a>  | 2       | <a href="#">W F S 446</a>                             | 3       |
| <a href="#">ENGL 202C</a>  | 3       | <a href="#">Arts</a> (GA)                             | 3       |
| <a href="#">AEE 440</a> , <a href="#">CAS 211</a> , <a href="#">416</a> , <a href="#">418</a>        | 3       | Elective  | 3       |
| <a href="#">Health and Physical Activity</a> (GHA)   | 1.5     | <a href="#">Health and Physical Activity</a> (GHA)    | 1.5     |
| Physical science selection   | 3       |   |         |
| Total Credits:   | 15.5-   | Total Credits:  | 13.5    |
|  |         |   |         |

- **Bold type** indicates courses requiring a quality grade of C or better.
- *Italics* indicate courses that satisfy both major and General Education requirements.
- ***Bold Italics*** indicates courses requiring a quality grade of C or better and that satisfy both major and General Education requirements.
- GWS, GHA, GQ, GN, GA, GH, and GS are codes used to identify General Education requirements.
- US, IL, and US;IL are codes used to designate courses that satisfy University United States/International Cultures requirements.
- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.

**Program Notes:** All supporting course selections are listed on the School's Web site ([www.sfr.cas.psu.edu](http://www.sfr.cas.psu.edu)) in the Wildlife and Fisheries Science Handbook (under Current Students). Many classes are only taught once per year, in the fall OR the spring,

**Academic Advising Notes:** US and IL cultures may count twice with GA, GH, or GS course.

### **Course Scheduling Tips**

All Wildlife and Fisheries Science students should change their campus location to University Park by the start of their junior year (your fifth semester).

When a required course has both a lecture and practicum portion, such as PHYS 250 and PHYS 250P, students are required to take both portions.

Acceptable selections for Arts, Humanities, Social and Behavioral Sciences, United States and International Cultures, Health Sciences and Physical Education, and First-Year Seminar are listed in the *General Education in the Curriculum* handbook or on the Web at <http://www.psu.edu/bulletins/bluebook/gened/>. United States and International cultures requirements may double-count with a GS, GA, or GH requirement.

Please contact Jamie Murphy with any scheduling questions ([jam563@psu.edu](mailto:jam563@psu.edu) or 814-863-0362).

Recommended Academic Plan for Wildlife and Fisheries Science –

**Fisheries option** starting at **Commonwealth Campuses**, Effective Summer 2008

| Semester 1 (fall)  | Credits | Semester 2 (spring)                                   | Credits   |
|--|---------|---|-----------|
| <a href="#">BIOL 110</a> (GN)  | 4       | <a href="#">ENGL 015</a> or <a href="#">030</a> (GWS) | 3         |
| <a href="#">MATH 110</a> or <a href="#">140</a> (GQ)   | 4       | <a href="#">MATH 111</a> or <a href="#">141</a> (GQ)  | 2-4       |
| <a href="#">CHEM 110</a> (GN)  | 3       | <a href="#">BIOL 220W</a> (GN)                        | 4         |
| Arts (GA)  | 3       | <a href="#">CHEM 111</a> (GN)                         | 1         |
| First-Year Seminar   | 1-3     | <a href="#">Health and Physical Activity</a> (GHA)    | 1.5       |
|  |         | <a href="#">Social and Behavioral Sciences</a> (GS)   | 3         |
| Total Credits:   | 15-17   | Total Credits:  | 14.5-16.5 |
| Semester 3   | Credits | Semester 4  | Credits   |
| <a href="#">BIOL 141</a> and <a href="#">142</a> , or <a href="#">BIOL 446</a> , or AN SC 201        | 3-4     | <a href="#">PHYS 250</a>                              | 4         |
| <a href="#">CHEM 202</a>   | 3       | <a href="#">BIOL 240W</a>                             | 4         |
| <a href="#">BIOL 133</a> , <a href="#">222</a> , <a href="#">230W</a> , or <a href="#">AN SC 322</a> | 3-4     | Arts (GA)   | 3         |
| <a href="#">CAS 100</a> (GWS) <i>Effective Speech</i>  | 3       | <a href="#">Humanities</a> (GH)                       | 3         |
| <a href="#">STAT 240</a> or <a href="#">301</a> or <a href="#">250</a> (GQ)                          | 3       | <a href="#">ECON 004</a> (GS)                         | 3         |
| Total Credits:   | 15-17   | Total Credits:  | 17        |
| Semester 5   | Credits | Semester 6  | Credits   |
| <a href="#">WFS 209</a> (GN)   | 3       | <a href="#">FOR 350</a> or <a href="#">STAT 460</a>   | 3         |
| <a href="#">W F S 300</a>  | 2       | Fisheries and Aquatic Science selection               | 3         |
| <a href="#">W F S 301</a>  | 2       | <a href="#">SOILS 101</a>                             | 3         |
| <a href="#">W F S 310</a>  | 3       | PPLA/HD requirement                                   | 3         |
| <a href="#">W F S 452</a>  | 2       | Elective  | 3         |
| <a href="#">Humanities</a> (GH)  | 3       |   |           |
| Total Credits:   | 15      | Total Credits:  | 15        |
| Semester 7   | Credits | Semester 8  | Credits   |
| <a href="#">W F S 410</a>  | 3       | <a href="#">W F S 463W</a>                            | 3         |
| <a href="#">W F S 453</a>  | 2       | <a href="#">W F S 446</a>                             | 3         |
| <a href="#">ENGL 202C</a>  | 3       | Elective  | 3         |
| <a href="#">AEE 440</a> , <a href="#">CAS 211</a> , <a href="#">416</a> , <a href="#">418</a>        | 3       | PPLA/HD requirement                                   | 3         |
| <a href="#">Health and Physical Activity</a> (GHA)   | 1.5     | Physical science selection                            | 3         |
| Wildlife selection   | 3       |   |           |
| Total Credits:   | 15.5    | Total Credits:  | 15        |

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- W is the code used to designate courses that satisfy University Writing Across the Curriculum requirements.

**Program Notes:** All supporting course selections are listed on the School's Web site ([www.sfr.cas.psu.edu](http://www.sfr.cas.psu.edu)) in the Wildlife and Fisheries Science Handbook (under Current Students). Many classes are only taught once per year, in the fall OR the spring,

**Academic Advising Notes:** US and IL cultures may count twice with GA, GH, or GS course.

### Course Scheduling Tips

All Wildlife and Fisheries Science students should change their campus location to University Park by the start of their junior year (your fifth semester).

When a required course has both a lecture and practicum portion, such as PHYS 250 and PHYS 250P, students are required to take both portions.

Acceptable selections for Arts, Humanities, Social and Behavioral Sciences, United States and International Cultures, Health Sciences and Physical Education, and First-Year Seminar are listed in the *General Education in the Curriculum* handbook or on the Web at <http://www.psu.edu/bulletins/bluebook/gened/>. United States and International cultures requirements may double-count with a GS, GA, or GH requirement.

Please contact Jamie Murphy with any scheduling questions ([jam563@psu.edu](mailto:jam563@psu.edu) or 814-863-0362).

Recommended Academic Plan for Wildlife and Fisheries Science –  
**Wildlife option** starting at **University Park**, Effective Summer 2008

| Semester 1 (fall)  | Credits | Semester 2 (spring)  | Credits   |
|--|---------|--|-----------|
| <a href="#">BIOL 110</a> (GN)  | 4       | <a href="#">ENGL 015</a> or <a href="#">030</a> (GWS)            | 3         |
| <a href="#">MATH 110</a> or <a href="#">140</a> (GQ)   | 4       | <a href="#">MATH 111</a> or <a href="#">141</a> (GQ)             | 2-4       |
| <a href="#">CHEM 110</a> (GN)  | 3       | <a href="#">BIOL 220W</a> (GN)                                   | 4         |
| Arts (GA)  | 3       | <a href="#">CHEM 111</a> (GN)                                    | 1         |
| First-Year Seminar   | 1-3     | Social and Behavioral Sciences (GS)                              | 3         |
| Total Credits:   | 15-18   | Total Credits:   | 13-15     |
| Semester 3   | Credits | Semester 4   | Credits   |
| <a href="#">FOR 203</a>  | 3       | <a href="#">PHYS 250</a>   | 4         |
| <a href="#">CHEM 202</a>   | 3       | <a href="#">BIOL 240W</a>  | 4         |
| <a href="#">BIOL 133</a> , <a href="#">222</a> , <a href="#">230W</a> , or <a href="#">AN SC 322</a> | 3-4     | <a href="#">SOILS 101</a>  | 3         |
| <a href="#">WFS 209</a> (GN)   | 3       | <a href="#">CAS 100</a> (GWS) <i>Effective Speech</i>            | 3         |
| <a href="#">STAT 240</a> or <a href="#">301</a> (GQ)   | 3       | Humanities (GH)  | 3         |
| Total Credits:   | 15-16   | Total Credits:   | 17        |
| Semester 5   | Credits | Semester 6   | Credits   |
| <a href="#">W F S 300</a>  | 2       | <a href="#">FOR 350</a> or <a href="#">STAT 460</a>              | 3         |
| <a href="#">W F S 301</a>  | 2       | <a href="#">W F S 406</a> or <a href="#">409</a>                 | 1         |
| <a href="#">W F S 310</a>  | 3       | <a href="#">W F S 407</a> or <a href="#">408</a> or 462 (need 2) | 3         |
| Humanities (GH)  | 3       | <a href="#">ECON 004</a>   | 3         |
| PPLA/HD requirement  | 3       | PPLA/HD requirement  | 3         |
| Elective   | 3       | Health and Physical Activity (GHA)                               | 1.5       |
| Total Credits:   | 16      | Total Credits:   | 14.5      |
| Semester 7   | Credits | Semester 8   | Credits   |
| <a href="#">W F S 447W</a>   | 3       | <a href="#">W F S 407</a> or <a href="#">408</a> or 462 (need 2) | 3         |
| Fisheries selection  | 2-3     | <a href="#">W F S 446</a>  | 3         |
| <a href="#">ENGL 202C</a>  | 3       | Arts (GA)  | 3         |
| <a href="#">AEE 440</a> , <a href="#">CAS 211</a> , <a href="#">416</a> , <a href="#">418</a>        | 3       | Elective   | 3-6       |
| Botany selection   | 3       | Health and Physical Activity (GHA)                               | 1.5       |
| Total Credits:   | 14-15   | Total Credits:   | 13.5-16.5 |
|  |         |  |           |

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**Program Notes:** All supporting course selections are listed on the School's Web site ([www.sfr.cas.psu.edu](http://www.sfr.cas.psu.edu)) in the Wildlife and Fisheries Science Handbook (under Current Students). Many classes are only taught once per year, in the fall OR the spring,

**Academic Advising Notes:** US and IL cultures may count twice with GA, GH, or GS course.

### **Course Scheduling Tips**

All Wildlife and Fisheries Science students should change their campus location to University Park by the start of their junior year (your fifth semester).

When a required course has both a lecture and practicum portion, such as PHYS 250 and PHYS 250P, students are required to take both portions.

Acceptable selections for Arts, Humanities, Social and Behavioral Sciences, United States and International Cultures, Health Sciences and Physical Education, and First-Year Seminar are listed in the *General Education in the Curriculum* handbook or on the Web at <http://www.psu.edu/bulletins/bluebook/gened/>. United States and International cultures requirements may double-count with a GS, GA, or GH requirement.

Please contact Jamie Murphy with any scheduling questions ([jam563@psu.edu](mailto:jam563@psu.edu) or 814-863-0362).

Recommended Academic Plan for Wildlife and Fisheries Science –**Wildlife option** starting at  
**Commonwealth Campuses**, Effective Summer 2008

| Semester 1 (fall)  | Credits   | Semester 2 (spring)  | Credits   |
|--|-----------|--|-----------|
| <a href="#">BIOL 110</a> (GN)  | 4         | <a href="#">ENGL 015</a> or <a href="#">030</a> (GWS)            | 3         |
| <a href="#">MATH 110</a> or <a href="#">140</a> (GQ)   | 4         | <a href="#">MATH 111</a> or <a href="#">141</a>                  | 2-4       |
| <a href="#">CHEM 110</a> (GN)  | 3         | <a href="#">BIOL 220W</a> (GN)                                   | 4         |
| First-Year Seminar   | 1-3       | <a href="#">CHEM 111</a> (GN)                                    | 1         |
| <a href="#">Humanities</a> (GH)  | 3         | <a href="#">Arts</a> (GA)  | 3         |
|  |           | <a href="#">Social and Behavioral Sciences</a> (GS)              | 3         |
| Total Credits:   | 15-18     | Total Credits:   | 16-18     |
| Semester 3   | Credits   | Semester 4   | Credits   |
| <a href="#">CHEM 202</a>   | 3         | <a href="#">PHYS 250</a>   | 4         |
| <a href="#">BIOL 133</a> , <a href="#">222</a> , <a href="#">230W</a> , or <a href="#">AN SC 322</a> | 3-4       | <a href="#">BIOL 240W</a>  | 4         |
| <a href="#">CAS 100</a> (GWS) <i>Effective Speech</i>  | 3         | <a href="#">ECON 004</a>   | 3         |
| <a href="#">STAT 240</a> or <a href="#">301</a> or <a href="#">250</a> (GQ)                          | 3         | <a href="#">Humanities</a> (GH)                                  | 3         |
| <a href="#">Health and Physical Activity</a> (GHA)   | 1.5       | <a href="#">Arts</a> (GA)  | 3         |
| Total Credits:   | 13.5-15.5 | Total Credits:   | 17        |
| Semester 5   | Credits   | Semester 6   | Credits   |
| <a href="#">WFS 209</a> (GN)   | 3         | <a href="#">FOR 350</a> or <a href="#">STAT 460</a>              | 3         |
| <a href="#">W F S 300</a>  | 2         | <a href="#">W F S 406</a> or <a href="#">409</a>                 | 1         |
| <a href="#">W F S 301</a>  | 2         | <a href="#">W F S 407</a> or <a href="#">408</a> or 462 (need 2) | 3         |
| <a href="#">W F S 310</a>  | 3         | <a href="#">SOILS 101</a>  | 3         |
| <a href="#">FOR 203</a>  | 3         | Elective   | 3         |
| PPLA/HD requirement  | 3         |  |           |
| Total Credits:   | 16        | Total Credits:   | 13        |
| Semester 7   | Credits   | Semester 8   | Credits   |
| <a href="#">W F S 447W</a>   | 3         | <a href="#">W F S 407</a> or <a href="#">408</a> or 462 (need 2) | 3         |
| Fisheries selection  | 2-3       | <a href="#">W F S 446</a>  | 3         |
| <a href="#">ENGL 202C</a>  | 3         | PPLA/HD requirement  | 3         |
| <a href="#">AEE 440</a> , <a href="#">CAS 211</a> , <a href="#">416</a> , <a href="#">418</a>        | 3         | Elective   | 3-6       |
| Botany selection   | 3         | <a href="#">Health and Physical Activity</a> (GHA)               | 1.5       |
| Total Credits:   | 14-15     | Total Credits:   | 13.5-16.5 |

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**Program Notes:** All supporting course selections are listed on the School's Web site ([www.sfr.cas.psu.edu](http://www.sfr.cas.psu.edu)) in the Wildlife and Fisheries Science Handbook (under Current Students). Many classes are only taught once per year, in the fall OR the spring,

**Academic Advising Notes:** US and IL cultures may count twice with GA, GH, or GS course.

### Course Scheduling Tips

All Wildlife and Fisheries Science students should change their campus location to University Park by the start of their junior year (your fifth semester).

When a required course has both a lecture and practicum portion, such as PHYS 250 and PHYS 250P, students are required to take both portions.

Acceptable selections for Arts, Humanities, Social and Behavioral Sciences, United States and International Cultures, Health Sciences and Physical Education, and First-Year Seminar are listed in the *General Education in the Curriculum* handbook or on the Web at <http://www.psu.edu/bulletins/bluebook/gened/>. United States and International cultures requirements may double-count with a GS, GA, or GH requirement.

Please contact Jamie Murphy with any scheduling questions ([jam563@psu.edu](mailto:jam563@psu.edu) or 814-863-0362).

|   |   |         |       |  |   |         |       |   |                  |              |       |  |  |  |  |
|---|---|---------|-------|--|---|---------|-------|---|------------------|--------------|-------|--|--|--|--|
| Student   |   |         |       | <b>Checksheet, Wildlife and Fisheries Science, Fisheries Option</b><br><i>Effective Summer 2008</i><br>122 Credits Required<br>The Pennsylvania State University<br>College of Agricultural Sciences<br>School of Forest Resources |   |         |       | Adviser   |                  |              |       |  |  |  |  |
| Student Number                                      |   |         |       |  |   |         |       | Gen. Ed. Year   |                  | Program Year |       |  |  |  |  |
| E-mail Address                                      |   |         |       |  |   |         |       | Date  |                  |              |       |  |  |  |  |
| <b>Requirements for the Major</b>                   |   |         |       |  |   |         |       | <b>General Education</b> ( <i>Effective Summer 2005</i> ) |                  |              |       |  |  |  |  |
| Sem.  | Course                                  | Credits | Grade | Sem  | Course  | Credits | Grade | Sem.  | Course           | Credits      | Grade |  |  |  |  |
| <b>Prescribed Courses for the Major (45 cr.)</b>    |   |         |       | <b>Supporting Courses for the Option (6 cr.)</b>   |   |         |       | <b>Communication (9 cr. GWS)</b>                          |                  |              |       |  |  |  |  |
|   | BIOL 110                                | 4       |       | PPLA/HD – select 6 credits from B LAW/R EST 425, E R M 411, FOR 410, 416, 480, 485, RPTM 120, 320, or W F S 440.   |   |         |       |   | ENGL 015         | 3            |       |  |  |  |  |
|   | BIOL 220W*                              | 4       |       |  |   | 3       |       |   | CAS 100A, B or C | 3            |       |  |  |  |  |
|   | BIOL 240W                               | 4       |       |  |   |         |       | and ENGL 202C GWS   |                  |              |       |  |  |  |  |
|   | CHEM 110                                | 3       |       |  |   |         |       | <b>Quantification (6 cr.)</b> MATH GQ and STAT GQ         |                  |              |       |  |  |  |  |
|   | CHEM 111                                | 1       |       |  |   |         |       | <b>Natural Sciences (9 cr.)</b> BIOL GN and CHEM GN       |                  |              |       |  |  |  |  |
|   | CHEM 202                                | 3       |       | <b>Prescribed Courses for the Option (10 cr.)</b>  |   |         |       | <b>Arts (6 cr. GA)</b>                                    |                  |              |       |  |  |  |  |
|   | ECON 004                                | 3       |       |  | W F S 410   | 3       |       |   |                  | 3            |       |  |  |  |  |
|   | ENGL 202C                               | 3       |       |  | W F S 452   | 2       |       |   |                  | 3            |       |  |  |  |  |
|   | PHYS 250                                | 4       |       |  | W F S 453   | 2       |       | <b>Humanities (6 cr. GH)</b>                              |                  |              |       |  |  |  |  |
|   | SOILS 101                               | 3       |       |  | W F S 463W  | 3       |       |   |                  | 3            |       |  |  |  |  |
|   | W F S 209*                              | 3       |       | <b>Additional Courses for the Option (12-13 cr.)</b>   |   |         |       |   |                  | 3            |       |  |  |  |  |
|   | W F S 300*                              | 2       |       |  | BIOL 141 & 142; BIOL 446; or AN SC 201                      | 3-4     |       |   |                  | 3            |       |  |  |  |  |
|   | W F S 301*                              | 2       |       |  | W F S 407, 408, 447W, 460, or 462                           | 3       |       | <b>Social and Behavioral Sciences (6 cr. GS)</b>          |                  |              |       |  |  |  |  |
|   | W F S 310*                              | 3       |       |  | GEO SC 303, 340, 412, 440, 452, GEOG 160, 357, OR E R M 475 | 3       |       |   |                  | 3            |       |  |  |  |  |
|   | W F S 446                               | 3       |       |  | W F S 422, FOR 470, W F S/E R M 435, or ENT 425             | 3       |       |   |                  | 3            |       |  |  |  |  |
| <b>Additional Courses for the Major (18-21 cr.)</b> |   |         |       | <b>A minimum cumulative GPA of 2.00 is required for graduation.</b><br><br><b>*Courses requiring at least a C grade.</b>   |   |         |       | <b>United States Cultures (3 cr. US)*</b>                 |                  |              |       |  |  |  |  |
|   | AEE 440, CAS 211, ENGL 416, or ENGL 418 | 3       |       |  |   |         |       | and ECON 004 GS   |                  |              |       |  |  |  |  |
|   | AN SC 322, BIOL 133, 222 or 230W        | 3-4     |       |  |   |         |       | <b>International Cultures (3 cr. IL)*</b>                 |                  |              |       |  |  |  |  |
|   | FOR 350 or STAT 460                     | 3       |       |  |   |         |       | * May count twice with GA, GH, or GS course               |                  |              |       |  |  |  |  |
|   | MATH 110 or 140*                        | 4       |       |  |   |         |       | <b>First-Year Seminar (1-3 cr.)</b>                       |                  |              |       |  |  |  |  |
|   | MATH 111 or 141                         | 2-4     |       |  |   |         |       |   |                  | 1-3          |       | <b>Health and Physical Education (3 cr. GHA)</b> |  |  |  |
|   | STAT 240 or 301                         | 3       |       |  |   |         |       |   |                  |              |       |  |  |  |  |
| <b>Electives (3-7 cr.)</b>                          |   |         |       |  |   |         |       |   |                  |              |       |  |  |  |  |
|   |   |         |       |  |   |         |       |   |                  |              |       |  |  |  |  |
|   |   |         |       |  |   |         |       |   |                  |              |       |  |  |  |  |

Academic Planning Notes

|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|---|---|---------|-------|--|--|---------|-------|---|------------------|--------------|-------|---|--|-----|--|---|--|--|--|
| Student   |   |         |       | <b>Checksheet, Wildlife and Fisheries Science, Wildlife Option</b><br>Wildlife and Fisheries Science, Wildlife Option<br><i>Effective Summer 2008</i><br>120 Credits Required<br>The Pennsylvania State University<br>College of Agricultural Sciences<br>School of Forest Resources |  |         |       | Adviser   |                  |              |       |   |  |     |  |   |  |  |  |
| Student Number                                      |   |         |       |  |  |         |       | Gen. Ed. Year   |                  | Program Year |       |   |  |     |  |   |  |  |  |
| E-mail Address                                      |   |         |       |  |  |         |       | Date  |                  |              |       |   |  |     |  |   |  |  |  |
| <b>Requirements for the Major</b>                   |   |         |       |  |  |         |       | <b>General Education</b> ( <i>Effective Summer 2005</i> ) |                  |              |       |   |  |     |  |   |  |  |  |
| Sem.  | Course                                  | Credits | Grade | Sem  | Course                                   | Credits | Grade | Sem.  | Course           | Credits      | Grade |   |  |     |  |   |  |  |  |
| <b>Prescribed Courses for the Major (45 cr.)</b>    |   |         |       | <b>Supporting Courses for the Option (6 cr.)</b>   |  |         |       | <b>Communication (9 cr. GWS)</b>                          |                  |              |       |   |  |     |  |   |  |  |  |
|   | BIOL 110                                | 4       |       | PPLA/HD – select 6 credits from B LAW/R EST 425, E R M 411, FOR 410, 416, 480, 485, RPTM 120, 320, or W F S 440.   |  |         |       |   | ENGL 015         | 3            |       |   |  |     |  |   |  |  |  |
|   | BIOL 220W*                              | 4       |       |  |  | 3       |       |   | CAS 100A, B or C | 3            |       |   |  |     |  |   |  |  |  |
|   | BIOL 240W                               | 4       |       |  |  | 3       |       | and ENGL 202C GWS   |                  |              |       |   |  |     |  |   |  |  |  |
|   | CHEM 110                                | 3       |       | <b>Prescribed Courses for the Option (12 cr.)</b>  |  |         |       | <b>Quantification (6 cr.)</b> MATH GQ and STAT GQ         |                  |              |       |   |  |     |  |   |  |  |  |
|   | CHEM 111                                | 1       |       |  | FOR 203                                  | 3       |       | <b>Natural Sciences (9 cr.)</b> BIOL GN and CHEM GN       |                  |              |       |   |  |     |  |   |  |  |  |
|   | CHEM 202                                | 3       |       |  | W F S 407, 408, or 462                   | 3       |       | <b>Arts (6 cr. GA)</b>                                    |                  |              |       |   |  |     |  |   |  |  |  |
|   | ECON 004                                | 3       |       |  | W F S 407, 408, or 462                   | 3       |       |   |                  | 3            |       |   |  |     |  |   |  |  |  |
|   | ENGL 202C                               | 3       |       |  | W F S 447W                               | 3       |       |   |                  | 3            |       |   |  |     |  |   |  |  |  |
|   | PHYS 250                                | 4       |       | <b>Additional Courses for the Option (6-7 cr.)</b>   |  |         |       | <b>Humanities (6 cr. GH)</b>                              |                  |              |       |   |  |     |  |   |  |  |  |
|   | SOILS 101                               | 3       |       |  | W F S 406 or 409                         | 1       |       |   |                  | 3            |       |   |  |     |  |   |  |  |  |
|   | W F S 209*                              | 3       |       |  | W F S 410, 422, 452, 453, or 463W        | 2-3     |       |   |                  | 3            |       |   |  |     |  |   |  |  |  |
|   | W F S 300*                              | 2       |       |  | FOR 308, HORT 101, 138, 445, or BIOL 414 | 3       |       | <b>Social and Behavioral Sciences (6 cr. GS)</b>          |                  |              |       |   |  |     |  |   |  |  |  |
|   | W F S 301*                              | 2       |       | <b>A minimum cumulative GPA of 2.00 is required for graduation.</b><br><br><b>*Courses requiring at least a C grade.</b>   |  |         |       |   |                  |              |       | <b>and ECON 004 GS</b>                    |  |     |  |   |  |  |  |
|   | W F S 310*                              | 3       |       |  |  |         |       |   |                  |              |       | <b>United States Cultures (3 cr. US)*</b> |  |     |  |   |  |  |  |
|   | W F S 446                               | 3       |       |  |  |         |       |   |                  |              |       |   |  | 3   |  | <b>International Cultures (3 cr. IL)*</b>         |  |  |  |
| <b>Additional Courses for the Major (18-21 cr.)</b> |   |         |       |  |  |         |       |   |                  |              |       |   |  | 3   |  | * May count twice with GA, GH, or GS course       |  |  |  |
|   | AEE 440, CAS 211, ENGL 416, or ENGL 418 | 3       |       |  |  |         |       |   |                  |              |       | <b>First-Year Seminar (1-3 cr.)</b>       |  |     |  |   |  |  |  |
|   | AN SC 322, BIOL 133, 222 or 230W        | 3-4     |       |  |  |         |       |   |                  |              |       |   |  | 1-3 |  | <b>Health and Physical Education (3 cr. GHA.)</b> |  |  |  |
|   | FOR 350 or STAT 460                     | 3       |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   | MATH 110 or 140*                        | 4       |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   | MATH 111 or 141                         | 2-4     |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   | STAT 240 or 301                         | 3       |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
| <b>Electives (5-10 cr.)</b>                         |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
|   |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |
| 8/08  |   |         |       |  |  |         |       |   |                  |              |       |   |  |     |  |   |  |  |  |

Academic Planning Notes

## Internships and Independent Study Credits

### INTERNSHIPS

Practical work experience that supplements a student's course work is a valuable asset when seeking employment after graduation. All Wildlife and Fisheries Science students should try to get related work experience through either summer jobs or internships. The importance of gaining experience in this field prior to graduation cannot be stressed enough. Academic credit can be awarded for internship work experiences, however it is not required. A handbook of guidelines for FOR/W F S/WP 495 internships is available in the SFR Undergraduate Programs Office, 113 Forest Resources Building. These guidelines must be followed before a student registers for internship credits. Students must have a minimum 2.0 GPA in order to register for internship credits. Internships credits (W F S 495) are used as Electives in the W F S major.

Internship opportunities may be found on the School of Forest Resources Web page, <http://www.sfr.cas.psu.edu/>

### INDEPENDENT STUDIES

Independent study offers students the opportunity to achieve a greater depth of knowledge in a particular topic or to explore problems or issues not covered in existing courses. Students interested in independent study must identify a subject area or project of interest and make arrangements with a Wildlife and Fisheries Science faculty member to sponsor the study. Advisers and the Undergraduate Programs Office can help identify prospective sponsors. **A minimum of 40 hours of work is required per credit.** Students must file an Independent Study form in the SFR Undergraduate Programs Office before registering for independent study credits. Independent study credits (W F S 496) are used as Electives in the W F S major.

School of Forest Resources Course Offerings by Semester at University Park  
*These offerings are subject to change as circumstances require*

| Course           | Title (cr.)                    | Fall<br>2009 | Spring<br>2010 | Fall<br>2010 | Spring<br>2011 | Fall<br>2011 | Spring<br>2012 | Fall<br>2012 | Spring<br>2013 |
|------------------|--------------------------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|
| FOR 200W         | Careers in For Resources (3)   | X            |                | X            |                | X            |                | X            |                |
| FOR 203          | Field Dendrology (3)           | X            |                | X            |                | X            |                | X            |                |
| FOR 204          | Dendrology (2)                 |              | X              |              | X              |              | X              |              | X              |
| FOR 308          | Forest Ecology (3)             | X            |                | X            |                | X            |                | X            |                |
| FOR 320          | Forest Fire Mgmt (2)           |              | X              |              | X              |              | X              |              | X              |
| FOR 339          | Timber Harvesting (3)          |              |                |              |                |              |                |              |                |
| FOR 350          | For Resources Biometrics (3)   |              | X              |              | X              |              | X              |              | X              |
| FOR 366          | For Res Measurements (4)       |              | X              |              | X              |              | X              |              | X              |
| FOR 401          | Urban Forest Mgmt (3)          | X            |                | X            |                | X            |                | X            |                |
| FOR 409          | Tree Physiology (2)            |              |                |              | X              |              |                |              | X              |
| FOR 410          | Forest Ecosystem Mgmt (3)      |              | X              |              | X              |              | X              |              | X              |
| FOR 416          | Forest Recreation (3)          | X            |                | X            |                | X            |                | X            |                |
| FOR 418          | Agroforestry (3)               |              | X              |              |                |              | X              |              |                |
| FOR 421          | Silviculture (3)               | X            |                | X            |                | X            |                | X            |                |
| FOR/W F S<br>430 | Conservation Biology (3)       | X            |                | X            |                | X            |                | X            |                |
| FOR 440          | Forest Econ & Finance (3)      |              | X              |              | X              |              | X              |              | X              |
| FOR 455          | Rem Sens & Spa Dat (3)         | X            |                | X            |                | X            |                | X            |                |
| FOR 466W         | For Resource Mgmt (3)          |              | X              |              | X              |              | X              |              | X              |
| FOR 470          | Watershed Management (3)       |              | X              |              | X              |              | X              |              | X              |
| FOR 471          | Watershed Mgmt Lab (1)         |              | X              |              | X              |              | X              |              | X              |
| FOR 475          | Forest Soils Mgmt (3)          |              | X              |              | X              |              | X              |              | X              |
| FOR 480          | Policy & Administration (3)    | X            |                | X            |                | X            |                | X            |                |
| FOR 485          | Natural Resource Decisions (3) |              |                |              |                |              |                |              |                |
| FOR 488Y         | International Forestry (3)     |              |                |              | X              |              |                |              | X              |
| FOR 496A         | Nat Res GIS – 1                | X            | X              | X            | X              | X            | X              | X            | X              |
| FOR 496B         | Nat Res GIS – 2                | X            | X              | X            | X              | X            | X              | X            | X              |
| FOR 497A         | German Forest Tour             |              |                |              | X              |              |                |              | X              |
| FOR 508          | Forest Ecology (3)             |              | X              |              |                |              | X              |              |                |
| FOR 517          | Forest Microclimatology (3)    |              |                |              |                |              |                |              |                |
| FOR 518          | Hydrologic Measurements (2)    |              |                |              |                |              |                |              |                |
| FOR 519          | Forest Hydrology (3)           |              |                |              |                |              |                |              |                |
| FOR 520          | Snow Hydrology (2)             |              |                |              |                |              |                |              |                |
| FOR 521          | Advanced Silviculture (3)      |              | X              |              | X              |              | X              |              | X              |
| FOR 530          | Conservation Genetics          |              | X              |              |                |              | X              |              |                |
| FOR 550          | Mltvar Anal For Res (3)        |              |                |              |                |              |                |              |                |
| FOR 555          | Multispec Rem Sens (3)         |              |                |              |                |              |                |              |                |
| FOR 570          | Watershed Stwd. Prac. I (3)    | X            |                | X            |                | X            |                | X            |                |
| FOR 571          | Watershed Stwd. Prac. II (5)   |              | X              |              | X              |              | X              |              | X              |
| FOR/W F S<br>590 | Colloquium (1)                 | X            | X              | X            | X              | X            | X              | X            | X              |
| FOR 591A         | Watershed Issues Seminar (1)   | X            |                | X            |                | X            |                | X            |                |
| FOR 591B         | Watershed Planning             |              | X              |              | X              |              | X              |              | X              |

| Course           | Title (cr.)                      | Fall 2009 | Spring 2010 | Fall 2010 | Spring 2011 | Fall 2011 | Spring 2012 | Fall 2012 | Spring 2013 |
|------------------|----------------------------------|-----------|-------------|-----------|-------------|-----------|-------------|-----------|-------------|
|                  | Seminar (1)                      |           |             |           |             |           |             |           |             |
| W F S 209        | Wild/Fish Conservation (3)       | X         | X           | X         | X           | X         | X           | X         | X           |
| W F S 300        | The Vertebrates (2)              |           |             | X         |             | X         |             | X         |             |
| W F S 301        | Vertebrate Laboratory (2)        | X         |             | X         |             | X         |             | X         |             |
| W F S 310        | W F S Measurements (3)           | X         |             | X         |             | X         |             | X         |             |
| W F S 406        | Ornithology Lab (1)              |           | X           |           | X           |           | X           |           | X           |
| W F S 407        | Ornithology (3)                  |           | X           |           | X           |           | X           |           | X           |
| W F S 408        | Mammalogy (3)                    |           | X           |           | X           |           | X           |           | X           |
| W F S 409        | Mammalogy Lab (1)                |           | X           |           | X           |           | X           |           | X           |
| W F S 410        | Fisheries Science (3)            | X         |             | X         |             | X         |             | X         |             |
| W F S 422        | Ecology of Fish (3)              |           |             | X         |             |           |             | X         |             |
| W F S 424        | Aquaculture (2)                  |           |             |           |             |           |             |           |             |
| W F S/FOR 430    | Conservation Biology (3)         | X         |             | X         |             | X         |             | X         |             |
| W F S/E R M 435  | Limnology (3)                    | X         |             | X         |             | X         |             | X         |             |
| W F S 440        | NatRes Public Relations (3)      |           | X           |           | X           |           | X           |           | X           |
| W F S 446        | Wildl Fish Pop Dyn (3)           |           | X           |           | X           |           | X           |           | X           |
| W F S 447W       | Wildl Management (3)             | X         |             | X         |             | X         |             | X         |             |
| W F S/ E R M 450 | Wetlands Conservation (3)        | X         |             | X         |             | X         |             | X         |             |
| W F S 452        | Ichthyology (2)                  | X         |             | X         |             | X         |             | X         |             |
| WFS 460          | Wildlife Behavior (3)            |           | X           |           | X           |           | X           |           | X           |
| W F S 462        | Amphibians and Reptiles (3)      | X         |             | X         |             | X         |             | X         |             |
| W F S 453        | Ichthyology Lab (2)              | X         |             | X         |             | X         |             | X         |             |
| W F S 463W       | Fishery Management (3)           |           | X           |           | X           |           | X           |           | X           |
| W F S 500        | Professionalism in Nat. Res. (3) | X         |             | X         |             | X         |             | X         |             |
| W F S 529        | Fish Pop Dynam (3)               |           |             |           |             |           |             |           |             |
| W F S 525        | Comm in Natural Resources (3)    |           |             |           |             |           |             |           |             |
| W F S 530        | Conservation Ecology (3)         |           |             | X         |             |           |             | X         |             |
| W F S 536        | Freshwater Field Ecology (3)     |           |             |           |             |           |             |           |             |
| W F S 542        | Systematics (3)                  | X         |             |           |             | X         |             |           |             |
| W F S 551        | Wildl Biometrics (3)             |           | X           |           |             |           | X           |           |             |
| W F S 552        | Syst & Evol Fish (3)             | X         |             |           |             | X         |             |           |             |
| W F S 560        | Population Estimation (4)        |           |             |           |             |           |             |           |             |
| W F S/FOR 590    | Colloquium (1)                   | X         | X           | X         | X           | X         | X           | X         | X           |
| W P 200W         | Careers in Forest Res (3)        | X         |             | X         |             | X         |             | X         |             |
| W P 203          | Anatomical Prop Wd (1)           | X         |             | X         |             | X         |             | X         |             |
| W P 337          | Wood Technology (2)              |           | X           |           |             |           | X           |           |             |
| W P 400          | Properties of Wood (3)           |           |             |           | X           |           |             |           | X           |
| W P 411          | Wood-Environ Relations (4)       |           |             | X         |             | X         |             | X         |             |
| W P 412          | Wood in Structures (3)           |           |             |           | X           |           |             |           | X           |
| W P 413          | Chemistry of Wood (4)            | X         |             |           |             | X         |             |           |             |
| W P 416          | Wood Industries Mgt Dev (3)      | X         |             |           |             | X         |             |           |             |
| W P 417          | W P Mfr Sys and Proc (4)         |           | X           |           |             |           | X           |           |             |

| Course   | Title (cr.)                          | Fall<br>2009 | Spring<br>2010 | Fall<br>2010 | Spring<br>2011 | Fall<br>2011 | Spring<br>2012 | Fall<br>2012 | Spring<br>2013 |
|----------|--------------------------------------|--------------|----------------|--------------|----------------|--------------|----------------|--------------|----------------|
| W P 418  | Chem Proc of Wood (4)                | X            |                | X            |                | X            |                |              |                |
| W P 423  | Deterior and Protect (2)             |              |                |              | X              |              |                |              | X              |
| W P 435  | W P Prod Mgmt (3)                    |              |                |              | X              |              |                |              | X              |
| W P 437W | Wood Ind Mktg Mgmt (4)               |              | X              |              |                |              | X              |              |                |
| W P 438  | Bus Concepts in Wood<br>Mfg (4)      |              |                | X            |                |              |                | X            |                |
| W P 460  | W P Ind Envir Ctrl (3)               |              |                |              |                |              |                |              |                |
| W P 490  | W P Colloquium (1)                   |              |                |              | X              |              |                |              | X              |
| W P 502  | Wood Fibers (3)                      |              |                |              |                |              |                |              |                |
| W P 511  | Phys Prop Wood & Fiber<br>(3)        |              |                |              |                |              |                |              |                |
| W P 513  | Wood Chemistry (3)                   | X            |                |              |                | X            |                |              |                |
| W P 515  | Wood Comp Proc Para (3)              |              | X              |              |                |              | X              |              |                |
| W P 530  | W P Indl Mktg Mgmt (3)               |              | X              |              |                |              | X              |              |                |
| W P 531  | Mchl Behav Wood (3)                  |              |                |              |                |              |                |              |                |
| W P 532  | Theory of Adhesion (3)               |              |                |              | X              |              |                |              | X              |
| W P 537  | Intnl WP Mktg and Trade<br>(3)       |              |                |              | X              |              |                |              | X              |
| W P 560  | W P Industry Environ.<br>Control (3) |              |                |              |                |              |                |              |                |
| W P 590  | Colloquium (1)                       | X            | X              | X            | X              | X            | X              | X            | X              |
|          |                                      |              |                |              |                |              |                |              |                |

### Minors Offered by the School of Forest Resources

The School of Forest Resources provides non-majors the opportunity to minor in Forest Science, Wildlife and Fisheries Science, or Wood Products Marketing. The requirements for each minor are listed below. **A grade of C or better is required for all courses in a minor.**

#### **Forest Science Minor**

The Forest Science minor is offered for students who wish to seek employment or achieve a basic competency in forestry without qualifying as professional foresters.

Students must complete 14 credits in Prescribed Courses and 5 or more credits selected from applied fields of study.

Prescribed Courses (14 credits):

|             |   |                               |
|-------------|---|-------------------------------|
| FOR 203 (3) | - | Field Dendrology              |
| W P 203 (1) | - | Anatomical Properties of Wood |
| FOR 308 (3) | - | Forest Ecology                |
| FOR 366 (4) | - | Forest Resources Measurements |
| FOR 421 (3) | - | Silviculture                  |

Students must also select at least 5 credits from the following list, of which 3 credits must be at the 400 level:

|             |   |  |
|-------------|---|--|
| FOR 320 (2) | - | Forest Fire Management                   |
| FOR 416 (3) | - | Forest Recreation                        |
| FOR 430 (3) | - | Conservation Biology                     |
| FOR 440 (3) | - | Forest Economics and Finance             |
| FOR 455 (3) | - | Remote Sensing and Spatial Data Handling |
| FOR 470 (3) | - | Watershed Management                     |
| FOR 475 (3) | - | Principles of Forest Soils Management    |
| FOR 480 (3) | - | Policy and Administration                |

Students may select other FOR courses by petition to the Forest Science faculty

#### **Wildlife and Fisheries Science Minor**

The Wildlife and Fisheries Science minor provides non-majors with an introduction to the principles and practices of wildlife and fisheries conservation, research, and management.

Student must complete a minimum of 18 credits from the following list to complete the minor:

Prescribed Courses (6 credits):

|               |   |                                     |
|---------------|---|-------------------------------------|
| W F S 209 (3) | - | Wildlife and Fisheries Conservation |
| W F S 430 (3) | - | Conservation Biology                |

Students must select a minimum of 12 credits from the following additional courses:

\* Please note the 2 credit classes; students must select a minimum of 12 credits

|                      |                                      |
|----------------------|--------------------------------------|
| W F S 300 (2)*       | - The Vertebrates                    |
| W F S 407 (3)        | - Ornithology                        |
| W F S 408 (3)        | - Mammalogy                          |
| W F S 410 (3)        | - General Fishery Science            |
| W F S 422 (3)        | - Ecology of Fishes                  |
| W F S/ERM 435 (3)    | - Limnology                          |
| W F S 440 (3)        | - Natural Resources Public Relations |
| W F S 447W (3)       | - Wildlife Management                |
| W F S/ E R M 450 (3) | - Wetland Conservation               |
| W F S 452 (2)*       | - Ichthyology                        |
| W F S 463W (3)       | - Fishery Management                 |
| W F S 460 (3)        | - Wildlife Behavior                  |
| W F S 462 (3)        | - Amphibians and Reptiles            |

Students may select other W F S courses by petition to the W F S faculty

### **Wood Products Marketing Minor**

The Wood Products Marketing minor offers students in other majors, especially those oriented toward business, science, or engineering, an opportunity to develop a basic competency in wood products marketing and processing. Students will obtain knowledge and skills particularly helpful for those who wish to seek employment in sales, as a specifier of wood-based materials for construction and design, or in other related fields in the wood products industries.

Students must complete 15 credits in Prescribed Courses and 3 or more credits in additional Wood Products courses, for a minimum total of 18 credits.

Prescribed Courses (15 Credits):

|              |   |
|--------------|---|
| W P 411 (4)  | - Wood-Environmental Relationships              |
| W P 417 (4)  | - Wood Prod. Manufacturing Systems & Processes  |
| W P 435 (3)  | - Wood Products Production and Sales Management |
| W P 437W (4) | - Wood Industries Marketing Management          |

Students must also select 3 credits from the following list:

|              |  |
|--------------|--|
| W P 200W (3) | - Professional Careers in Forest Resources       |
| W P 203 (1)  | - Anatomical Properties of Wood                  |
| W P 337 (2)  | - Wood Technology                                |
| W P 411 (4)  | - Wood Products and Processing                   |
| W P 412 (3)  | - Wood in Structures                             |
| W P 413 (3)  | - Chemistry of Wood                              |
| W P 418 (4)  | - Chemical Processing of Wood                    |
| W P 423 (2)  | - Deterioration and Protection of Wood Products  |
| W P 460 (3)  | - Wood Products Industrial Environmental Control |
| W P 490 (1)  | - Wood Products Colloquium                       |
| FOR 203 (3)  | - Field Dendrology                               |

## **Graduation Requirements**

Knowing about and completing degree requirements is the student's responsibility. The *Baccalaureate Degree Programs Bulletin* and *Policies and Rules: A Handbook for Students* include information for which the student is responsible. This W F S program handbook is intended to supplement, and not replace, these sources of information.

To graduate, a candidate must complete the course requirements for the candidate's major and:

1. Earn at least a C (2.00) cumulative grade-point average for all courses taken at the University and
2. Earn at least a C grade in each major course designated by the major as a C-required course (starred on the checksheets).

### **Study Abroad at the University of Freiburg**

<http://www.sfr.cas.psu.edu/Students/Freiburg/>

School of Forest Resources students have the opportunity to participate in a study abroad program with the Albert-Ludwigs-Universität Freiburg (University of Freiburg) in Germany. Our programs include:

- German Forestry Tour – a biennial 10-day trip open to all School of Forest Resources juniors and seniors
- Semester or Year Abroad – open to Forest Science majors with a basic proficiency in the German language

#### **German Forestry Tour (FOR 497; 3 credits)**

The biennial 10-day German Forestry Tour is sponsored by the School of Forest Resources and University of Freiburg. Juniors and seniors in Forest Science, Wildlife and Fisheries Science, and Wood Products may apply for this unique opportunity to learn about forestry, conservation, and the German culture. This course may be used as a supporting course for the Forest Management and Forest Biology options and as an elective in the Urban Forestry, and Watershed Management options of the Forest Science program. No foreign language skill necessary. The next scheduled tour will be in the Spring of 2010.

### **Other Study Abroad Opportunities**

As an undergraduate student in the College of Agricultural Sciences, you can find accessible and affordable study abroad opportunities. Staff in the Office of International Programs can help you put together the right program and identify financial support. Learn more at <http://international.cas.psu.edu/Default.htm>.

The Penn State University Education Abroad Office also offers help in planning an international experience. Penn State has more than 180 summer, semester and full-year programs in over 45

countries! Over 60 of these programs are either specially designed, semester-length programs or are reciprocal exchange programs with an international university. Education Abroad offers numerous other short-term, faculty-led programs. With all these options, it is possible for students in nearly any discipline to study abroad! A listing of these programs may be found at <http://www.international.psu.edu/>. In addition, Penn State accepts transfer credits from many other programs.

## Professional Certification

### The Wildlife Society

The Wildlife Society (TWS), a nonprofit, scientific and educational organization devoted to stewardship and enlightened appreciation of wildlife and its environments, is committed to the premise that these objectives can be achieved best with the guidance of well-educated, experienced, and dedicated wildlife biologists. The Wildlife Society has sought to promote and strengthen professional standards in all activities devoted to wildlife resources. To this end, the society has developed a professional certification program designed to evaluate the education and professional experience of wildlife biologists.

A professional wildlife biologist is a person with demonstrated expertise in the art and science of applying the principles of ecology to the sound stewardship and management of the wildlife resource and its environment. An applicant for professional certification who demonstrates this expertise through education and is judged to be able to represent the profession as an ethical practitioner may be certified. Two certification categories exist:

**Certified Wildlife Biologist (CWB)**--Persons who have completed acceptable educational and experience requirements.

**Associate Wildlife Biologist (AWB)**--A preliminary step designed for persons who have completed the educational requirements, but not the experience requirements.

### I. Education

Applicants must have completed a course of study in a college or university leading to a bachelor of science, or bachelor of arts, or equivalent, or higher degree, and should have the following, or equivalent, course work listed below. All courses must be taken for credit and passed. Each application for certification is individually reviewed. **Penn State courses understood to meet these requirements are listed; however, it is important to note that courses are not pre-approved and the acceptability of specific courses to TWS can, and does, change.**

1. **Biological Sciences:** Thirty-six (36) semester hours in biological sciences are required and must include courses in the following subcategories (Note: the sum of hours required in subcategories a-e is 33; the remaining 3 hours may be in any of these five subject areas):

- a. Wildlife Management: Courses emphasizing the principles and practices of wildlife management. **Course descriptions are required** and should demonstrate training in understanding and manipulating habitat relationships and population dynamics in the context of objectives and influences established by human concerns and activities (6 hours).

|   |   |
|---|---|
| W F S 447W – Wildlife Management                | 3 |
| W F S 209 – Wildlife and Fisheries Conservation | 3 |
| W F S 310 – Wildlife and Fisheries Measurements | 3 |
| <i>Total</i>                                    | 9 |

- b. Wildlife Biology: Courses in the biology and behavior of birds, mammals, reptiles, or amphibians. **Course descriptions are required**. Courses should demonstrate training in understanding the biology of wildlife species and their habitat relationships as the basis for management and must include at least one course dealing with the science of mammalogy, ornithology, or herpetology (6 hours).

|                                  |   |
|----------------------------------|---|
| W F S 407 – Ornithology          | 3 |
| W F S 408 – Mammalogy            | 3 |
| W F S 409 – Mammalogy Laboratory | 1 |
| <i>Total</i>                     | 7 |

- c. Ecology: Courses in general plant or animal ecology (excludes human ecology) (3 hours). **Course descriptions are required**.

|   |   |
|---|---|
| BIOL 220W – Populations and Communities | 4 |
| <i>Total</i>                            | 4 |

- d. Zoology: Courses in the taxonomy, biology, behavior, physiology, anatomy, and natural history of vertebrates and invertebrates. **Course descriptions are required**. Courses in genetics, nutrition, physiology, disease, and other biology or general zoology courses are accepted. Ichthyology or fisheries biology courses are accepted (9 hours).

|  |   |
|--|---|
| AN SC 322, BIOL 133 or 222 – Genetics/Breeding | 3 |
| W F S 300 – The Vertebrates                    | 2 |
| BIOL 110 – Basic Concepts and Biodiversity     | 2 |
| BIOL 240W – Function and Development Organisms | 2 |
| <i>Total</i>                                   | 9 |

- e. Botany: Courses in general botany, plant anatomy, plant genetics, plant morphology, plant physiology, or plant taxonomy (9 hours). **Course descriptions are required**. **Beginning 1 January 2006, at least one course must deal with plant taxonomy or identification.**

|  |           |
|--|-----------|
| FOR 203 – Dendrology                           | 3         |
| Botany Selection                               | 3         |
| BIOL 110 – Basic Concepts and Biodiversity     | 2         |
| BIOL 240W – Function and Development Organisms | 2         |
| <i>Total</i>                                   | <i>10</i> |

2. Physical Sciences: Nine (9) semester hours in physical sciences such as chemistry, physics, geology, or soils, with at least two disciplines represented.

|                                   |           |
|-----------------------------------|-----------|
| CHEM 110 – Chemical Principles    | 3         |
| CHEM 111 – Experimental Chemistry | 1         |
| CHEM 202 – Organic Chemistry      | 3         |
| PHYS 250 – Introductory Physics   | 4         |
| SOILS 101 – Introduction to Soils | 3         |
| <i>Total</i>                      | <i>14</i> |

3. Quantitative Sciences: Nine (9) semester hours in quantitative sciences that must include:

- a. Basic Statistics: A course in basic statistics (3 hours). **Course descriptions are required.**

|                                      |          |
|--------------------------------------|----------|
| STAT 240 – Introduction to Biometry  | 3        |
| FOR 350 – Forest Resource Biometrics | 3        |
| <i>Total</i>                         | <i>6</i> |

- b. Quantitative Sciences: Courses in calculus, biometry, advanced algebra, systems analysis, mathematical modeling, sampling, computer science, or other quantitative science (6 hours). GIS courses do not count in this category. **Course descriptions are required.**

|                               |            |
|-------------------------------|------------|
| MATH 110 or 140 – Calculus I  | 4          |
| MATH 111 or 141 – Calculus II | 2-4        |
| <i>Total</i>                  | <i>6-8</i> |

4. Humanities and Social Sciences: Nine (9) semester hours in humanities and social sciences, such as economics, sociology, psychology, political science, government, history, literature, or foreign language.

|  |           |
|--|-----------|
| GS and GH General Education requirements | 12        |
| <i>Total</i>                             | <i>12</i> |

5. Communications: Twelve (12) semester hours in courses designed to improve communication skills such as English composition, technical writing, journalism, public speaking, or use of mass media. **Course descriptions are required.** A maximum of three (3) semester hours each will be allowed for a completed master's

thesis and Ph.D. dissertation. Term papers, class projects, and seminars in non-communication courses will not count toward this category.

|   |           |
|---|-----------|
| ENGL 015 – Rhetoric and Composition       | 3         |
| ENGL 202C – Technical Writing             | 3         |
| CAS 100 – Effective Speech                | 3         |
| AEE 440 – Communication Methods and Media | 3         |
| <i>Total</i>                              | <i>12</i> |

Policy, Administration, and Law: Six (6) semester hours **documented with descriptions.** Courses that demonstrate significant content or focus on natural resource policy and/or administration, wildlife or environmental law, or natural resource/land use planning will apply; as will courses that document contributions to the understanding of social, political and ethical decisions for wildlife or natural resource management. Up to three (3) semester hours in classes dealing with human dimension issues may count in this category depending on course content. Conservation Biology courses that effectively integrate legal and policy aspects of conservation planning will count toward this category. Courses that are tools supporting professional practice, e.g., photogrammetry, Land-Sat mapping, GIS techniques, or more general courses such as environmental science, resource management, law enforcement, criminology, political science, and introductory survey courses in conservation will not apply.

|  |          |
|--|----------|
| Policy, Planning, Law, and Administration (PPLA)<br>and Human Dimensions selections (HD) | 6        |
| <i>Total</i>   | <i>6</i> |

Professional experience in lieu of educational requirements:

Professional experience may be used to satisfy the educational requirements where specific deficiencies exist. Examples may include published papers or a completed thesis to meet course requirements in English composition or technical writing. Also, documentation of demonstrated professional competence through experience may meet the requirements for such courses as botany, resource policy, administration, land use planning, or public speaking. Such documentation should be supported by letters of reference from professional wildlife biologists. In many cases candidates would be best served by preparing a written explanation of why they feel that their formal and continuing education course work and work experience, taken as a whole, qualify them to be certified as a wildlife biologist. In unusual cases a special examination may be required. The form, content, and administration of such an examination shall be at the discretion of the Certification Review Board (CRB) and shall be conducted without discrimination. The CRB shall evaluate the examination and shall determine, in its sole discretion, to grant or deny certification.

II. Experience:

In addition to the educational requirements, the Certified Wildlife Biologist must have a minimum of five (5) years of professional experience gained within the ten (10) years prior to applying for certification.

For detailed information and application forms visit: <http://www.wildlife.org/professional/> or contact: The Wildlife Society, 5410 Grosvenor Lane, Bethesda, MD 20814-2197; phone (301) 897-9770.

### The American Fisheries Society

The American Fisheries Society (AFS) Professional Certification Program evaluates the education and professional experience of fisheries workers. Successful applicants are awarded certification on a two-tiered system. Applications are evaluated on an ongoing basis, and applicants do not have to be AFS members. Certification may be used as (1) a basis for evaluation for employment or promotion; (2) demonstration of expertise; (3) continuing professional activities; and (4) education and verification of professionalism. The Professional Certification Program also serves to promote and strengthen the field's professional standards. A copy of the guidelines for professional certification can be obtained from the American Fisheries Society, 5410 Grosvenor Lane, Bethesda, MD 20814-2199. Additional information is available at <http://www.fisheries.org/afs/certification.html>.

**Penn State courses understood to meet these requirements are listed, however it is important to note that courses are not pre-approved and the acceptability of specific courses to AFS can, and does, change.**

Three tiers of certifications are available:

**Tier I - Fisheries Professional Associate (FP-A)** - an applicant who satisfies coursework degree requirements (indicated below) but has insufficient or no experience may become an Associate Fisheries Professional;

**Tier II - Fisheries Professional Certified (FP-C)** - in addition to satisfying coursework and degree requirements, an applicant must have the requisite number of years of qualifying experience and the requisite number of professional development quality points (PDQPs) to become a Certified Fisheries Professional;

**Tier III - Fisheries Professional Emeritus (FP-E)** - an applicant who has held the FP-C designation for at least twenty (20) years (need not be consecutive) and is employed less than full time or is retired, may become a Fisheries Professional Emeritus (FP-E). This allows them to maintain their FP-C status without the renewal requirement.

#### I. Education:

1. Fisheries and aquatic sciences courses. A minimum of four (4) courses, for a total of twelve (12) semester hours. Of the four (4) courses, at least two (2) must be directly related to fisheries science (e.g., fisheries science, ichthyology, fisheries management, fish ecology, aquaculture or fish culture, fish diseases, etc.), and at least one (1) must cover principles of fisheries science and management. Therefore, a maximum of two (2) nonfisheries, aquatic science courses (e.g., limnology, aquatic entomology, stream ecology, etc.) can be used in this category.

|                                     |           |
|-------------------------------------|-----------|
| W F S 410 – General Fishery Science | 3         |
| W F S 422 – Ecology of Fishes       | 3         |
| W F S 452 – Ichthyology             | 2         |
| W F S 453 – Ichthyology Lab         | 2         |
| W F S 463W – Fishery Management     | 3         |
| <i>Total</i>                        | <i>13</i> |

2. Other biological sciences courses. Twelve (12) semester hours that, when added to the preceding courses, total to thirty (30) semester hours.

|   |           |
|---|-----------|
| BIOL 110 – Basic Concepts and Biodiversity  | 4         |
| BIOL 220W – Populations and Communities     | 4         |
| BIOL 240W – Function and Develop. Organisms | 4         |
| BIOL 133 or 222 – Genetics                  | 3         |
| Physiology Selection                        | 3         |
| <i>Total</i>                                | <i>18</i> |

3. Physical sciences courses. Fifteen (15) semester hours.

|                                   |           |
|-----------------------------------|-----------|
| CHEM 110 – Chemical Principles    | 3         |
| CHEM 111 – Experimental Chemistry | 1         |
| CHEM 202 – Organic Chemistry      | 3         |
| PHYS 250 – Introductory Physics   | 4         |
| SOILS 101 – Introduction to Soils | 3         |
| Physical Science Selection        | 3         |
| <i>Total</i>                      | <i>17</i> |

4. Mathematics and statistics courses. Six (6) semester hours, including one (1) calculus and one (1) statistics course or two (2) statistics courses.

|  |              |
|--|--------------|
| MATH 110 or 140 – Calculus I             | 4            |
| MATH 111 or 141 – Calculus II            | 2-4          |
| STAT 240 – Introduction to Biostatistics | 3            |
| FOR 350 – Forest Resource Biometrics     | 3            |
| <i>Total</i>                             | <i>12-14</i> |

5. Communications courses. Nine (9) semester hours. Three (3) semester hours may be taken in communication-intensive courses if officially designated as such by the university or college at which they were taken.

|   |           |
|---|-----------|
| ENGL 015 – Rhetoric and Composition       | 3         |
| ENGL 202C – Technical Writing             | 3         |
| CAS 100 – Effective Speech                | 3         |
| AEE 440 – Communication Methods and Media | 3         |
| <i>Total</i>                              | <i>12</i> |

6. Human dimensions courses. Six semester hours.

|  |          |
|--|----------|
| Policy, Planning, Law, and Administration (PPLA)<br>and Human Dimensions selections (HD) | 6        |
| <i>Total</i>   | <i>6</i> |

### **Employment Resources**

Career Services: <http://www.sa.psu.edu/career/>

Penn State's Career Services, located in the MBNA Career Center, offers employment assistance to students. Nearly 1000 companies per year recruit students through this office. In addition they offer seminars and advising on job search strategies, resume and cover letter writing, and interviewing. Career Services hosts several career fairs throughout the year.

### School of Forest Resources

Your faculty and advisers can be your best contact for job information. Establishing early and frequent contact with them will assist you in your job search and help you to develop professional references.

The School of Forest Resources (SFR) maintains an employment web page to assist you in your job search. This page includes job, internship, and graduate assistantship openings, as well as links to natural resources employers. It is important to remember that this is only one resource available to you and that an effective job search must utilize a variety of sources. The SFR employment Web page is: <http://www.sfr.cas.psu.edu/Employment/Employment.html>.

Some of these resources are reserved for SFR students and alumni and require a password to access them. Passwords are periodically distributed through the student listservs. If you need a password or if you are not on the Wildlife and Fisheries Science student listserv, please email Dana Whaley at [dlg5035@psu.edu](mailto:dlg5035@psu.edu) and ask to be added. If you are a current SFR student please include your student id number and major/option. Job postings are also available in the Student Lounge, 113 Forest Resources Building, and on the bulletin boards in the Forest Resources Building.

For more detailed information, refer to the School of Forest Resources Employment Handbook, available in 113 Forest Resources Building or on the Web at <http://www.sfr.cas.psu.edu/Employment/EmploymentHandbook.pdf>.

## Graduate Study

### Admission to the School of Forest Resources Graduate Program

Graduate degrees conferred by the School of Forest Resources are:

Forest Resources – Ph.D., M.S., M.F.R., and M.Agr. (includes forest science and wood products)  
Wildlife and Fisheries Science – Ph.D., M.S., M.F.R., and M.Agr.

Graduate programs are designed to give students an understanding of the biology and management of wildlife or fish species and their environments, and include training in: ecology, nutrition, physiology, systematics, behavior, and pathology of a species or species groups; study of successional stages, land use, and management of various habitats and their impact on wildlife and fisheries populations; dynamics and manipulation of animal populations; and studies of recreational, aesthetic, and socioeconomic values of wildlife and fishes. Most programs of study are strengthened by including appropriate courses offered by related departments. A thesis is required for both the M.S. and Ph.D. degrees and an original paper for the M.F.R. The Ph.D. degree in Wildlife and Fisheries Science allows specialization in wildlife and fisheries ecology, management, and systematics at the doctoral level.

For admission, an applicant should have at least a 2.75 grade point average, at least a 3.00 junior-senior average, and courses that are basic to the individual's field of specialization. Ordinarily these include: 18 credits in forest science, wildlife and fisheries science, wood products; 12 credits in calculus, statistics, computer science; 12 credits in writing and speaking; 12 credits in economics, social sciences, humanities; 8 credits in chemistry and/or physics; and 8 credits in biology, botany, zoology. Graduate Record Examination (GRE) and Test of English as a Foreign Language (TOEFL) scores, three reference letters, and a brief statement describing the applicant's academic goals, career interests, and special qualifications are required. Exceptions to admission requirements may be made for students with special backgrounds, abilities, and interests.

Normally it takes about two years to complete the M.S./M.F.R. and three to five years to complete the Ph.D. Applicants with some deficiencies may be admitted but will need more time to satisfy degree requirements. If you are interested in an academic career, it is strongly recommended that you complete your doctorate at a different institution from the immediately previous degree.

For more details on application procedures, please pick up a copy of the Graduate Studies Handbook, available in 113 Forest Resources Building.

### Suggestions for Applying to Graduate School

1. Apply early – November/December. Sometimes early decisions will be made on a project before the majority of applicants have applied.
2. To focus your list of schools, use university catalogs (often found on the World Wide Web), specific position announcements, faculty contacts, and listings of faculty interests available from many departments.

3. Well-written letters of inquiry, including a resume, can be sent to specific faculty members or departments before you officially apply. Letters should have the following characteristics:

- a. typed neatly
- b. well-edited
- c. properly addressed
- d. informative – why you want to attend graduate school; several specific and general areas of research interest; advertise particular skills that may be of interest to a given faculty member or department.

4. Learn something about your particular research interests and the faculty who work in that area by reviewing the literature, particularly Science Citation Index.

5. Only apply officially if you are sincerely interested. Do not waste peoples' time or your money. Get applications and related transcripts, GRE scores, etc. in on time. Plan ahead. Ask permission to use people as references. Inform them early if they have to write a letter of recommendation.

6. Your application materials are generally your only form of representation, so take the time and do it right.

7. After sufficient time has passed, request the status of your application, but do not be annoying. If you do not have an offer by spring, keep in touch with Penn State W F S faculty who may hear from colleagues about positions that become available in the summer.

8. Funding is desirable, but consider “proving” yourself for a semester in hopes of finding a project that becomes available later.

## Wildlife and Fisheries Science Faculty

### Director of the School of Forest Resources

**MESSINA, MICHAEL, G.** ~ Director of the School of Forest Resources

Interests: Silviculture, Forest Ecology  
Degree: Ph.D., North Carolina State University (1983)  
Office: 121 Forest Resources Building  
Phone: (814) 865-7093  
E-mail: mgm20@psu.edu

### Chair, Wildlife and Fisheries Science Faculty

**BRAITHWAITE, VICTORIA A.** ~ Professor of Fisheries and Biology

Interests: Envir. Behavior and cognition in fish; fish welfare; fish reintroductions  
Degree: D.Phil. Oxford University UK (1993)  
Office: 410 Forest Resources Building  
Phone: (814) 865-4675  
E-mail: vab12@psu.edu

### University Park Campus

**BRITTINGHAM, MARGARET C.** ~ Professor of Wildlife Resources; Extension Wildlife Specialist

Interests: Avian ecology; effects of habitat fragmentation on bird populations  
Degree: Ph.D., University of Wisconsin (1987)  
Office: 409 Forest Resources Building  
Phone: (814) 863-8442  
E-mail: mxb21@psu.edu

**CARRICK, HUNTER R.** ~ Assistant Professor of Aquatic Ecology

Interests: Aquatic ecosystems, limnology, food web dynamics  
Degree: Ph.D., The University of Michigan (1990)  
Office: 434 Forest Resources Building  
Phone: (814) 865-9219  
E-mail: hjc11@psu.edu

**DIEFENBACH, DUANE R.** ~ Adjunct Associate Professor of Wildlife Ecology

Interests: Biometrics; population ecology  
Degree: Ph.D., University of Georgia (1992)  
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Phone: (814) 865-3992  
E-mail: drd11@psu.edu

**FERRERI, PAOLA** ~ Associate Professor of Fisheries Management

### Associate Director of the School of Forest Resources

Interests: Fisheries population dynamics, fish/habitat relationships, management  
Degree: Ph.D., Michigan State University (1995)  
Office: 408 Forest Resources Building  
Phone: (814) 863-2095  
E-mail: cpf3@psu.edu

**GRANT, JACQUALINE B.** ~ Senior Lecturer in Wildlife and Fisheries Science

Interests: Natural history, behavioral observation, molecular markers, GIS

Degree: Ph.D., Cornell University (2005)  
Office: 405 Forest Resources Building  
Phone: (814) 863-0135  
E-mail: jbg13@psu.edu

**SAN JULIAN, GARY J.** ~ Professor of Wildlife Resources

Interests: Animal damage control, envir. ed., urban wildlife, deer management  
Degree: Ph.D., Colorado State University (1978)  
Office: 401 Forest Resources Building  
Phone: (814) 865-4287  
E-mail: jgs9@psu.edu

**SHERWIN, LYSLE.** ~ Instructor in Watershed Stewardship; Director, Center for Watershed Stewardship

Interests: Community-based watershed stewardship  
Degree: M.S., West Virginia University (1975)  
Office: 7 Hamer/Heinz Building  
Phone: (814) 865-5736  
E-mail: lss9@psu.edu

**STAUFFER, JR., JAY R.** ~ Professor of Ichthyology

Interests: Systematics, behavior, and zoogeography of freshwater fishes  
Degree: Ph.D., Virginia Polytechnic Institute and State University (1975)  
Office: 420 Forest Resources Building  
Phone: (814) 865-0645  
E-mail: vc5@psu.edu

**TZILKOWSKI, WALTER M.** ~ Associate Professor of Wildlife Science

Interests: Biometry, population dynamics, wildlife biology and management  
Degree: Ph.D., University of Massachusetts (1980)  
Office: 411 Forest Resources Building  
Phone: (814) 863-1598  
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**WAGNER, Tyler** ~ Adjunct Assistant Prof. of Fisheries Ecology,

Assistant Unit Leader, PA Coop. Fish and Wildlife Research Unit  
Interests: Fisheries ecology, multiple spatial-scale assessment of aquatic resources, land-water interactions, hierarchical modeling  
Degree: Ph.D., Michigan State University (2006)  
Office: 402 Forest Resources Building  
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E-mail: [txw19@psu.edu](mailto:txw19@psu.edu)

**YAHNER, RICHARD H.** ~ Prof. of Wildlife Conservation; Assistant Director for Outreach

Interests: Ecology of birds and mammals, conservation biology  
Degree: Ph.D., Ohio University (1977)  
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Phone: (814) 863-3201  
E-mail: rhy@psu.edu

Penn State DuBois

**HUMMER, JOSEPH W.** ~ Instructor in Wildlife Technology

Interests: Ecology/preservation of natural areas, wetlands management  
Degree: M.S., The Pennsylvania State University (1970)  
Office: 1 Multi-Purpose Building  
Phone: (814) 375-4746  
E-mail: jwh5@psu.edu

**ROEN, KEELY** ~ Instructor in Wildlife Technology

Interests: Avian scavenger foraging behavior, forest fragmentation  
Degree: M.S., The Pennsylvania State University (2002)  
Office: 2 Multi-Purpose Building  
Phone: (814) 372-3003  
E-mail: kat175@psu.edu

**SCHAADT, CHARLES P.** ~ Assistant Professor of Wildlife Technology

Interests: Ethology, evolutionary ecology, natural history of vertebrates  
Degree: Ph.D., McGill University  
Office: 2 Multi-Purpose Building  
Phone: (814) 375-4747  
E-mail: cps2@psu.edu

## Course Descriptions

AEE 440. COMMUNICATIONS METHODS AND MEDIA (3) Mass media techniques for reporting and promoting extension and related programs, including message preparation, presentation, and strategy development. Prerequisites: 3 credits in communication.

AN SC 201. ANIMAL SCIENCE (4) Scope of animal and poultry science; genetic, physiological, nutritional, and health factors in food production.

AN SC 322. PRINCIPLES OF ANIMAL BREEDING (3) The fundamental principles of genetics as applied to breeding farm animals.

B LAW/R EST 425. ENVIRONMENTAL LAW, PROPERTY, AND COMMERCE (3) Examines the impacts of major federal environmental laws on business relations and property interests. Prerequisite: B A 243, B LAW 243, or E R M 151.

BIOL 133 GN. GENETICS AND EVOLUTION OF THE HUMAN SPECIES (3) Human heredity and evolution, individual and social implications. The course is for non-majors; students who have passed BIOL 222, 230W, B M B 251 or any upper-division biology course may not schedule this course.

BIOL 110 GN. BIOLOGY: BASIC CONCEPTS AND BIODIVERSITY (4) A study of the evolution of the major groups or organisms including the fundamental concepts of biology.

BIOL 141 GN. INTRODUCTORY PHYSIOLOGY (3) Explanation of the normal structure and function of the animal body, with special emphasis on human body systems. Students who have passed BIOL 472 may not schedule this course.

BIOL 142. PHYSIOLOGY LABORATORY (1) Experiments demonstrating basic physiological principles, with special reference to man. Prerequisite or concurrent: BIOL 141.

BIOL 220W GN. BIOLOGY: POPULATIONS AND COMMUNITIES (4) A study of the structures and functions of organismic interactions from simple populations to complex ecosystems. Prerequisite: BIOL 110.

BIOL 222. GENETICS (3) Variation and heredity in plants and animals, including man; relationships of genetical knowledge to evolution and breeding practices. Prerequisites: 3 credits in biological science.

BIOL 230W GN. BIOLOGY: MOLECULES AND CELLS (4) A study of cellular phenomena including molecular genetics and metabolic interactions. Prerequisites: BIOL 110, CHEM 110.

BIOL 240W GN. BIOLOGY: FUNCTION AND DEVELOPMENT OF ORGANISMS (4) A study of the development and physiological processes at the organismic level. Prerequisites: BIOL 110, CHEM 110.

BIOL 414. TAXONOMY OF SEED PLANTS (3) Basic principles and procedures in the practice of angiosperm systematics. Prerequisites: BIOL 240W.

BIOL 435. ECOLOGY OF LAKES AND STREAMS (3) Physical, chemical, and biological characteristics of freshwater environments, with special emphasis on factors regulating productivity in freshwater ecosystems. Prerequisite: BIOL 220W.

CAS 100 GWS. EFFECTIVE SPEECH (3) Introduction to speech communication, formal speaking, group discussion, analysis and evaluation of messages. W F S students may take CAS 100A, 100B or 100C.

CAS 211. INFORMATIVE SPEAKING (3) Planning, organizing, adapting, and presenting informative speeches and oral reports on technical/scholarly projects, both by manuscript reading and extemporaneously. Prerequisite: CAS 100.

CHEM 110 GN. CHEMICAL PRINCIPLES (3) Basic concepts and quantitative relations. The following combinations of courses must be taken to receive General Education credit in chemistry: CHEM 110 GN (or CHEM 106 GN) and CHEM 111 GN; CHEM 112 GN and CHEM 113 GN. Prerequisite: satisfactory performance on the Chemistry and Math FTCAP tests-- i.e., placement beyond the level of CHEM 101 and MATH 022; or CHEM 101, and MATH 022 or MATH 041.

CHEM 111 GN. EXPERIMENTAL CHEMISTRY (1) Introduction to quantitative experimentation in chemistry. The following combinations of courses must be taken to receive General Education credit in chemistry: CHEM 110 GN (or CHEM 106 GN) and CHEM 111 GN; CHEM 112 GN and CHEM 113 GN. Prerequisite or concurrent: CHEM 110 or CHEM 106.

CHEM 202. FUNDAMENTALS OF ORGANIC CHEMISTRY (3) Introduction to organic chemistry, with emphasis on the properties of organic compounds of biochemical importance. Because of duplication of subject matter, students may not receive credit for both CHEM 202 and 210. Prerequisite: CHEM 101, 110, or 106.

E R M 411. LEGAL ASPECTS OF RESOURCE MANAGEMENT (3) Legal systems and lawmaking processes; property rights in land, water, and wildlife resources; jurisdictional problems in planning resource use. Prerequisite: E R M 151.

C E 475. WATER QUALITY CHEMISTRY (3). Chemistry applicable to the understanding and analysis of water quality, pollution, and treatment. Prerequisite: C E 370, CHEM 110, CHEM 111.

ECON 004 GS. INTRODUCTORY MACROECONOMIC ANALYSIS AND POLICY (3) National income measurement; aggregate economic models; money and income; policy problems.

- ENGL 015 GWS. RHETORIC AND COMPOSITION (3). Instruction and practice in writing expository prose that shows sensitivity to audience and purpose. Prerequisite: ENGL 004 or satisfactory performance on the English proficiency examination.
- ENGL 202C GWS. EFFECTIVE WRITING: TECHNICAL WRITING (3) Writing for students in scientific and technical disciplines. (A student may take only one course for credit from ENGL 202A, 202B, 202C, and 202D.) Prerequisite: ENGL 015 or ENGL 030; fourth-semester standing.
- ENGL 416. SCIENCE WRITING. (3 per semester, maximum of 6) Prepares scientists and writers to gather, interpret, and present scientific information to the layman with clarity and accuracy. Prerequisite: COMM 260W, ENGL 202C, 210, 215, or 421.
- ENGL 418. ADVANCED TECHNICAL WRITING AND EDITING (3 per semester, maximum of 6) Preparing and editing professional papers for subject specialists and for other interested in careers as writers or editors. Prerequisite: ENGL 202A, 202B, 202C, 202D, or 215.
- ENT 425. FRESHWATER ENTOMOLOGY (3) Collection and identification of insects and other arthropods in freshwater ecosystems; field study of habitats.
- FOR 203. FIELD DENDROLOGY (3) Field identification of native and introduced trees and shrubs by leaf, fruit, twig, and bark.
- FOR 308. FOREST ECOLOGY (3) Effect of environment, spacing, and age in trees; forest influences; origin and development of forest communities. Prerequisite or concurrent: FOR 203.
- FOR 350. FOREST RESOURCES BIOMETRICS (3) Quantitative approaches for characterization and comparison of natural resources in forested landscapes. Prerequisite: One course each in calculus, statistics, and computers.
- FOR 410. ELEMENTS OF FOREST ECOSYSTEM MANAGEMENT (3) Fundamentals of forest ecosystem management for goods and services. Prerequisite: 3 credits in both ecology and biology.
- FOR 416. FOREST RECREATION (3) The management and administration of multiple-use forest lands and wilderness for forest recreational experiences, with emphasis on public forests. Prerequisite: 3 credits in social or behavioral science.
- FOR 470. WATERSHED MANAGEMENT (3) Management of wild land watersheds for control of the amount and timing of water yield, water quality, erosion, and sedimentation. Prerequisite: 3 credits in Soils.
- FOR 480. POLICY AND ADMINISTRATION (3) Forest resources policy objectives; criteria and goals of society; policy implementation by ownership classes; planning, administration, and evaluation of programs. Prerequisite: FOR 200W, 3 credits of social or behavioral science.

FOR 485. NATURAL RESOURCE DECISIONS (3) Application of previous courses and experience to decision making on forest land management and natural resource policy issues. (Students should have completed or be taking concurrently W F S 447, 463; FOR 410, 421, or 466.) Prerequisite: sixth-semester or higher standing, 12 credits in Forestry or Wildlife and Fisheries Science.

GEOG 160 GS. MAPPING OUR CHANGING WORLD (3) Fundamental concepts of GIS, cartography, remote sensing, and GPS in the context of environmental and social problems.

GEOG 363. GEOGRAPHIC INFORMATION SYSTEMS (3) Principles and use of geographic information; emphasis is on data acquisition and techniques for computer-aided analysis. Prerequisite: GEOG 160.

GEOSC 303. INTRODUCTION TO ENVIRONMENTAL GEOLOGY (3) Origin of earth and earth materials; natural resources, geologic barriers and hazards, and relationships to human use of the environment. (This course includes from one to several field trips for which an additional charge will be made to cover transportation.)

GEOSC 340. GEOMORPHOLOGY (3) Physical and chemical processes operating at the earth's surface and their resulting landforms. This course has one or more required field trips for which a fee is charged to the student. Prerequisite: GEOSC 001; fifth-semester standing.

GEOSC 412. WATER RESOURCES GEOCHEMISTRY (3) Aqueous geochemistry of silica, alumina, carbonate minerals, and selected metals; organic species in water; isotope geochemistry applied to water. Prerequisite: CHEM 110, CHEM 112.

GEOSC 440. MARINE GEOLOGY (3) Chemical and physical processes affecting the topography and sediments of the sea floor. Prerequisite: fourth-semester standing.

GEOSC 452. HYDROGEOLOGY (3). Hydrologic cycle: occurrence, movement, quality, and quantity of groundwater; quantitative geologic and hydrologic methods; role of water in geologic processes. Prerequisite: CHEM 112; GEOSC 001, GEOSC 020, GEOSC 071, MATH 140 OR MATH 110.

HORT 101 GN. HORTICULTURAL SCIENCE (3) Introduction to horticulture with emphasis on plant domestication, morphology, classification, world food crops, commodities, gardens, propagation, and agrochemicals.

HORT 138. ORNAMENTAL PLANT MATERIALS (2-3) Identification and description under spring conditions; discussion of cultural and aesthetic aspects of shrubs of value in ornamental plantings.

HORT 445. PLANT ECOLOGY (3). Advanced lectures on plant ecology that stress integration of physiological, population-level, and community-level phenomena, and ecology in agriculture. Prerequisites: BIOL 220W, FOR 308, or HORT 315.

MATH 110 GQ. TECHNIQUES OF CALCULUS I (4) Functions, graphs, derivatives, integrals, techniques of differentiation and integration, exponentials, improper integrals, applications. Students may only take one course for credit from MATH 110, 140, 140A, and 140B. Prerequisite: MATH 022 or satisfactory performance on proficiency examination.

MATH 111 GQ. TECHNIQUES OF CALCULUS II (2) Analytic geometry, partial differentiation, maxima and minima, differential equations. Prerequisite: MATH 110.

MATH 140 GQ. CALCULUS WITH ANALYTIC GEOMETRY I (4) Functions, limits; analytic geometry; derivatives, differentials, applications; integrals, applications. Students may only take one course for credit from MATH 110, 140, 140A, and 140B. Prerequisite: MATH 022, MATH 026; or MATH 040 or MATH 041; or satisfactory performance on the mathematics proficiency examination.

MATH 141 GQ. CALCULUS WITH ANALYTIC GEOMETRY II (4) Derivatives, integrals, applications; sequences and series; analytic geometry; polar coordinates. Students may take only one course for credit from MATH 141 and 141B. Prerequisite: MATH 140, MATH 140A, or MATH 140B.

PHYS 250 GN. INTRODUCTORY PHYSICS I (4) Selected topics in mechanics, heat, and sound. Prerequisite: MATH 022, MATH 026; or MATH 040; or MATH 041 or satisfactory performance on math proficiency exam. W F S students must take both lecture and practicum.

RPTM 120 US/IL. LEISURE AND HUMAN BEHAVIOR (3) Leisure from historical and contemporary perspectives, including forces shaping leisure behavior, and relationships among leisure, the environment, and social institutions.

RPTM 320. RECREATION RESOURCE PLANNING AND MANAGEMENT (3) Relationship between leisure behavior and natural environment. Exploration of natural resources that enhance leisure.

SOILS 101. INTRODUCTION TO SOILS (3) A study of the characteristics of soils and their influence on land use, environmental quality, plant growth, and society/culture.

STAT 240 GQ. INTRODUCTION TO BIOMETRY (3) Statistical analysis, sampling, and experimentation in the agricultural sciences; data collection, descriptive statistics, statistical inference, regression, one factor AOV, probability. Students may take only one course from STAT 200, 220, 240, 250 for credit. Prerequisite: 3 credits in mathematics.

STAT 301 GQ. STATISTICAL ANALYSIS I (3) Probability concepts; nature of statistical methods; elementary distribution and sampling theory; fundamental ideas relative to estimation and testing hypotheses. Prerequisite: 3 credits of calculus.

STAT 460. INTERMEDIATE APPLIED STATISTICS (3) Review of hypothesis testing, goodness-of-fit tests, regression, correlation analysis, completely randomized designs,

- randomized complete block designs, Latin squares. Prerequisite: STAT 200, 220, 240, 250, 301, or 401.
- W F S 209 GN. WILDLIFE AND FISHERIES CONSERVATION (3) Survey of current and historical issues in wildlife and fisheries conservation; emphasis on vertebrate biodiversity, habitat management and protection, and populations. Prerequisite: BIOL 110 or BIOL 240W.
- W F S 300. THE VERTEBRATES (2) Overview of the evolution, systematics, ecology, and behavior of the subphylum vertebrata. Prerequisite: BIOL 110.
- W F S 301. VERTEBRATE LABORATORY (2) Overview of the anatomy, identification, collection, and preservation of the vertebrates. Prerequisite or concurrent: W F S 209, W F S 300.
- W F S 310. WILDLIFE AND FISHERIES MEASUREMENTS (3) Introduction to field and laboratory approaches for collecting, analyzing, and communicating data regarding wildlife and fish populations and their habitats. Prerequisite or concurrent: W F S 209, STAT 240.
- W F S 406. ORNITHOLOGY LAB (1) Laboratory and field identification of Pennsylvania birds, avian ecology, and behavior, field survey techniques. Prerequisite: W F S 209. Prerequisite or concurrent: W F S 407.
- W F S 407. ORNITHOLOGY (3) Introduction to the biology, ecology, adaptations, and conservation of birds. Prerequisite: BIOL 110 GN, W F S 209.
- W F S 408. MAMMALOLOGY (3) Identification, systematics, characteristics, adaptations, ecology, behavior, natural history and conservation, and socio-economic aspects of mammals. Prerequisite: BIOL 110.
- W F S 409. MAMMALOLOGY LABORATORY (1) Laboratory and field identification of mammals, ecology and behavior of mammals, field survey techniques. Prerequisites: W F S 209. Prerequisite or concurrent: W F S 408.
- W F S 410. GENERAL FISHERY SCIENCE (3) Introduction to the study, management, and uses of fish populations; methods of investigation, culture, and harvest of fishes. Prerequisite: W F S 209 or BIOL 220W.
- W F S 422. ECOLOGY OF FISHES (3) Role of fishes in aquatic communities and general ecosystems. Environmental factors influencing fish as individuals, populations, and communities. Prerequisite: BIOL 220W or W F S 209.
- W F S 424. AQUACULTURE (2) Scientific basis of aquaculture. Fundamental management skills for hatchery managers. Prerequisite: One course in biology.
- W F S/FOR 430. CONSERVATION BIOLOGY (3) The application of biological principles to issues in the conservation of biodiversity. Prerequisite: BIOL 220W or FOR 308.

- W F S/E R M 435. LIMNOLOGY (3) Biogeochemistry and natural history of freshwater ecosystems. Prerequisite: BIOL 110 , BIOL 220W , CHEM 110.
- W F S 440. NATURAL RESOURCES PUBLIC RELATIONS (3) This course prepares students to integrate public relations concepts with principles of natural resources management at the community level. Prerequisite: CAS 100, seventh-semester standing, and 6 credits of W F S, FOR, or RPTM.
- W F S 446. WILDLIFE AND FISHERIES POPULATION DYNAMICS (3) Concepts and estimation of mammalian, avian, and fish populations; processes of mortality, natality, growth, and regulation. Prerequisite: W F S 209.
- W F S 447W. WILDLIFE MANAGEMENT (3) Management of renewable wildlife resources by applying ecological concepts, habitat evaluation, and decision-making; writing and editing reports are emphasized. Prerequisite: W F S 209.
- W F S/E R M 450. WETLAND CONSERVATION (3) Wetland types, classification, functions and values; hydrology, soils, and plants; introduction to wetland identification and delineation; wetland regulations. Prerequisite: E R M 300 or W F S 209.
- W F S 452. ICHTHYOLOGY (2) Study of the structure, taxonomy, systematics, and natural history of freshwater and marine fishes. Prerequisites: BIOL 110, BIOL 240W.
- W F S 453. ICHTHYOLOGY LABORATORY (2) Identification of fishes, major fish families, use of keys. Prerequisites: BIOL 110, BIOL 240W. Prerequisite or concurrent: W F S 452.
- W F S 460 WILDLIFE BEHAVIOR ( 3) Scholarly discussion and critique of history, concepts, and application of wildlife behavioral concepts to conservation issues. Prerequisite: at least 6 credits in general wildlife or biology
- W F S 462 AMPHIBIANS AND REPTILES (3) Scholarly discussion and critique of evolution and conservation of amphibians and reptiles (collectively termed herps) from a worldwide perspective, with a focus on the natural history and ecology of amphibians and reptiles in the northeastern United States.
- W F S 463W. FISHERY MANAGEMENT (3) Management of sport and commercial fisheries, including biological, political, social, and economic factors; regulations and other management techniques. Prerequisites: W F S 209, W F S 300, W F S 301, W F S 310.
- W F S 495. WILDLIFE/FISHERIES INTERNSHIP (1-6) Supervised field experience related to the student's major. Prerequisite: approval of proposed assignment by instructor prior to registration.
- W F S 496. INDEPENDENT STUDIES (1-18)

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. It is the policy of the University to maintain an academic and work environment free of discrimination, including harassment. The Pennsylvania State University prohibits discrimination and harassment against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Discrimination or harassment against faculty, staff or students will not be tolerated at The Pennsylvania State University. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 328 Boucke Building, University Park, PA 16802-2801, Tel (814) 865-4700/V, (814) 863-1150/TTY.