

## **Science of Carbon: Fall, Winter, and Spring 2024-25**

### **Faculty and Contact Information:**

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**Prerequisites:** One year each of college level General Biology with Laboratory and General Chemistry with Laboratory.

**Program Information:** Carbon plays a critical role in both serving as the backbone of organismal chemistry and the center element in considerations of global climate change. Forests store more carbon than any other terrestrial biome on the planet, and play a critical role in regulation of planetary carbon balance. In this upper division science program we will explore the interdisciplinary intersection of chemistry, carbon science, and forest ecology in a year-long sequence. Accordingly, the program will examine the subject matter through the central idea that structure defines property and function, working at the scale of molecules in chemistry labs to the global scale in GIS and modeling exercises. Students will learn: quantitative approaches and tools in forest measurements and inventorying carbon in forests; major concepts in biogeochemistry and human interactions with forests through management and alteration of global carbon cycles; structure, reactivities, and mechanisms of organic reactions; and the relationship between organic chemistry and biochemistry in the context of ecosystem science. Weekly class activities will include lectures, collaborative problem-solving workshops, instrumentation workshops, laboratories and field work. We will also read primary literature in the areas of environmental biology and chemistry. Throughout the year, students will acquire experience with various sampling techniques that are used to measure carbon in forested ecosystems, and lab exercises in forest biogeochemistry focusing on carbon flux. Chemistry laboratory activities will introduce fundamental and modern methods of organic chemistry, including synthesis methods and the use of chemical instrumentation to characterize organic compounds. Students will write formal laboratory reports and maintain laboratory notebooks.

Along the way, we will also cover broader forest ecology concepts, environmental history of Pacific Northwest forests, and global issues in forest management and conservation. We will have multi-day field trips each quarter to forested **long-term research sites on both the east and west sides** of the Cascade Mountains. During each trip, students will gain hands-on experience measuring forest attributes in a variety of different ecosystems, and visit sites that are playing important roles in understanding carbon science and carbon fluxes from the microsecond to century timescales. This program will also include weekly day trips where we will use local forests and The Evergreen State College Ecological Observation Network (EEON) to refine skills in measuring forests and detecting change using long-term data in forest ecosystems. Students will develop a scientific research proposal throughout fall quarter, a research methods review in winter, and then implement research projects in spring quarter. Fieldwork skills, mastery of instrumentation, scientific writing, quantitative skills, work with common computer software (GIS and statistics packages), and presentation/communication skills will all be emphasized.

Assessment of learning will occur through many methods such as in-class quizzes and exams, homework assignments, written reports, and project work.

This is an intensive program, the subjects are complex, and the sophisticated understanding we expect to develop will require devoted time and attention each week. By the end of the year, students will have gained essential skills for continued studies in chemistry and forest ecology.

### Tentative Weekly Schedule

| Tuesday  | Wednesday                                     | Thursday                                       | Thursday  |
|--|---|--|---|
| 9:00-12:30<br>Lecture/Workshop<br>Purce Hall 4 | 9:00-1:00<br>Ecology Field/Lab<br>Lab II 3221 | 9:00-12:30<br>Lecture/Workshop<br>Purce Hall 4 | 9:00-5:00<br>Laboratory<br>Lab II 3221<br>OR<br>Lab II 3216<br>OR<br>Exam<br>Purce Hall 4 |
| 1:00-3:30<br>Lecture/Workshop<br>Purce Hall 4  |   | 1:00-6:00<br>Ecology Field/Lab<br>Lab II 3221  |   |

**\*\*NOTE: To succeed in this program, you will need to form study groups outside of scheduled program sessions.**

#### **Total Credit Equivalencies: Fall quarter**

##### **16 credits:**

- 4 – Forest Measurements
- 4 – Forest Biogeochemistry and Ecology
- 6 – Organic Chemistry I with Laboratory
- 2 – Biochemistry

**Textbooks:** (these books will be required on day one of fall quarter and used in all three quarters)

1. Forest Ecosystems 2<sup>nd</sup> Edition by Perry et al. (2008)  
<https://www.press.jhu.edu/books/title/8425/forest-ecosystems>
2. P. Y. Bruice, 'Organic Chemistry', 8<sup>th</sup> ed., Pearson.
3. Nelson; M. M. Cox, 'Lehninger Principles of Biochemistry', 8<sup>th</sup> ed., W. H. Freeman.

#### Field Trips

We will have a major remote field trip on **October 14<sup>th</sup>-16<sup>th</sup>**. The trip will focus on forests of the Cascades and long-term research sites. We will be staying in apartments on the 14<sup>th</sup>-16<sup>th</sup>. Contact your faculty to arrange for a separate assignment if either of these trips presents an issue for you.