Interdisciplinary, Research-based Bioenergy Minor at Oregon State University

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Our program outcome is to produce:

Broadly-trained graduates capable of cross-disciplinary problem solving and innovation to meet current and future needs of biofuels, bioproducts, renewable energy and related industries.
Bioenergy Minor Overview

- Interdisciplinary
  - Open to students from any major
- 2 New Courses + existing courses

Why a minor?
- Speed and ease of implementation
- Can be added to any major: breadth (minor) and depth (major + research project)
Bioenergy Minor Requirements  
(29 credits)

• **1st-year core:**
  - Introduction to Regional Bioenergy (BRR 350; Fall, 2 credits)
  - Interdisciplinary Research: Bioenergy Focus (BRR 450; Winter, 2 credits)
  - Bioenergy and Environmental Impacts (WSE 473; Spring, 3 credits)

• **Electives** from 3 categories (2-4 credits each):
  - Technical
  - Environmental
  - Social/Economic/Policy

• **Research** (10 credits) with a mentor

• **Data Presentation** (1 credit)

• **Thesis** (3 credits)

• **Public Seminar** (1 credit)
Bioenergy Minor students will be able to:

1. Demonstrate an understanding of the core concepts of bioenergy, present and discuss important contemporary issues and challenges related to bioenergy, and suggest multidisciplinary approaches to solving bioenergy problems. **BRR 350**

2. Explain the research process, including quantitative and qualitative research methods and the use of evidence. **BRR 450**

3. Design a bioenergy research project, collect and analyze data, and interpret results. **RESEARCH**

4. Competently convey the meaning of research results in written and oral format, and demonstrate the ability to communicate with professionals, policymakers, and the general public. **THESIS, POSTER, SEMINAR**
BRR 350 – Introduction to Regional Bioenergy

Learning Outcomes:

- Demonstrate an understanding of the core concepts of bioenergy, including feedstocks, conversion, policy, and life cycle impacts – Expert Lecturers/Discussion
- Discuss important contemporary issues relating to bioenergy – Current Events
- Effectively communicate bioenergy concepts – Company Profile Presentations
- Explore and evaluate the role of bioenergy in regional research and industry – Field Trips
Learning Outcomes:

- Evaluate research talks, papers and studies, explain the issues addressed, discuss ethical considerations, and assess the conclusions – *OSU Researcher Presentations, Lab Tours, Journal Articles*

- Explain the research process, including quantitative and qualitative research methods and the use of evidence – *Assignments*

- Describe key components of a research proposal – *Write a Proposal*

- Effectively use the library and writing resources on campus – *Librarian: Databases, Endnote/Zotero*

- Suggest multidisciplinary approaches to solving bioenergy problems – *Team Projects*
Research Component

“An inquiry or investigation conducted by an undergraduate that makes an original intellectual or creative contribution to the discipline”

(Hu et al., 2008, p.6)

**Involves:**
- Reading appropriate literature
- Asking a researchable question
- Designing some part of the project
- Using reproducible research techniques
- Communicating significant findings orally and/or in writing

**Student Gains:**
- Increased self-efficacy
- Ability to work both independently and as part of a team
- Critical thinking and problem solving
- Professional skills: project management, organization, communication, networking, and using technology
- Clarification of and enhanced preparation for career and/or graduate school goals
Examples of Undergraduate Research Projects

**Shanti Johnson**, Chemical Engineering

**Research:** Investigating ways to lower the cloud point of biodiesel so it can be used at lower temperatures without gelling

**Crystal Oldfield**, BioResource Research

**Research:** Extracting tannins & lignin from pecan shells

**EXAMPLE SKILLS GAINED:**
- MATLAB algorithm development
- Electron Microscope training
Incentives

Students:
• Scholarships ($1000-4000/year)
• Internship funding (up to $4000 total)

Research Mentors:
• $1000 per student per year to help offset the cost of research
Students

• 2012-2013 cohort: 10 (2 graduated)
• 2013-2014 cohort: 10
• 2014-2015 cohort: 10

MAJORS:
• Biochemistry and Biophysics
• Bioengineering
• Chemical Engineering
• Ecological Engineering
• Renewable Materials
• Microbiology

• Applied Economics
• Political Science
• BioResource Research
• Horticulture
• Botany
• Sociology
• Management
Assessment

• Ongoing, formative – enables us to modify/improve program

• Pre/Post surveys
  ▪ Based on specific learning objectives
  ▪ Self-report slider scales and open-ended prompts

Learning Outcome 3: Design a bioenergy research project, collect and analyze data, and interpret results.
Please rate your competency with each of the following components of one of our program objectives. Please rate your current level of competency.

If you have had no experience or knowledge with the component, please mark "0" with the slider (this is not automatic, if you do not click the slider at 0 you will not have a response recorded for the question).

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<thead>
<tr>
<th>Component</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
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<tr>
<td>Ability to design a bioenergy research project</td>
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<td>Ability to collect data</td>
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Findings

• Ratings: Sample size too small
• Open-ended: Example - Describe three strengths of the Bioenergy minor program

Common Themes:

- Interdisciplinary nature
- Research experience
- Flexible; students can tailor the program to suit their interests
Challenges

• **Recruitment** – New minor, Bioenergy is relatively unknown
  ▪ New Adviser - Advertising through other advisers

• **Scheduling classes** – Time conflicts with multiple majors
  ▪ New courses taught from 6-7:50 PM once a week

• **Research** – Time-consuming, student perceptions/fear, matching students with mentors
  ▪ Highlight benefits: networking, soft skills, grad school
  ▪ Existing BioResource Research program as model
Ongoing Work and Future Plans

• Convert current classes to **Ecampus** (BRR 350 complete)
• **Delphi study**: Survey experts on essential concepts for Bioenergy education; compare input from industry and academia and strengthen program based on employer needs
• **Assessment**: Continue surveys, data analysis, feedback
• **Articulation**: Meetings with community colleges
• **Continuation of program**: Identifying options after grant funding ends
Thank you!

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Regional Coordinated Agricultural Project (CAP)

- http://agsci.oregonstate.edu/bioenergy/bioenergy-minor
- Director: kate.field@oregonstate.edu