

Session Instructors

School of Forest Resources & Environmental Science

- David Flaspohler, Ph.D. - ornithology, biodiversity, conservation biology
- Chris Webster, Ph.D. - quantitative landscape and forest ecology

Department of Mechanical Engineering

- Tim Jenkins, Ph.D. - tree biomass from forest to processing facility

Department of Chemical Engineering

- David Shonnard, Ph.D. - technology for processing tree biomass to energy
- Jill Jensen, Ph.D. Candidate

USDA Forest Service Northern Institute of Applied Carbon Science

- Maria Janowiak, M.S. - terrestrial carbon sequestration

Time Schedule

9:00-9:45 am *Biofuels in the Gas Tank?*

What Does It Take? (Overview of day)

10:00-11:15 *Ethanol Production in Lab:*

Cellulosic Biomass to Fuel

11:30-Noon LUNCH at Wadsworth Hall

12:15-1:15 pm *Getting Trees from Forest to*

Processing Plant

1:30-3:00 *Forest Resource Management:*

Impacts on Avian Biodiversity & Forest Productivity

3:00 Questions & Summary

3:15 pm Students depart

Dates Available (first-come)

- ◇ Wednesday, March 18
- ◇ Friday, March 20
- ◇ Wednesday, March 25
- ◇ Friday, March 27

Class Size—can accommodate up to 24 high school students.

Is It Really FREE?

Roundtrip mileage up to \$500, and a one-day teacher sub fee will be reimbursed to participating schools by Michigan Tech with a grant from the National Science Foundation. Students may enjoy lunch in a residence hall, compliments of the Michigan Tech Admissions Office.

Overnight Accommodations (optional)

For an additional cost, classes may stay overnight. Michigan Tech has two large dorm-style rooms with multiple beds (one room with 18 bunk beds sleeps 36; second room with 8 bunk beds sleeps 16 @ \$14/person/night). Each room has its own bathroom. To reserve a room, please contact: Lisa Pignotti <lpignot@mtu.edu>

To Make Reservations

Joan Chadde, Education Program Coordinator
Western U.P. Center for Science, Mathematics
& Environmental Education
105 Dillman Hall
Michigan Technological University
1400 Townsend Drive
Houghton, MI 49931

Tel: 906-487-3341 Fax: 906-487-1620
Email: jchadde@mtu.edu

Michigan Tech

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Future Fuels from Forests

FREE High School Field Trips

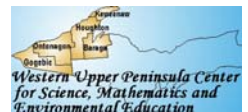
... available for high school classes to learn about forest biofuels from scientists engaged in cutting edge research.

An excellent opportunity for :

- Physics classes
- Chemistry classes
- Biology classes
- Career exploration



These field trips will provide a framework for high school students to examine the multiple issues associated with the development of liquid biofuels from forests in the Upper Peninsula.



Future Fuels from Forests— High School Field Trip Opportunity

Michigan Tech
Michigan Technological University

Why Will High School Students Benefit?

To encourage mentoring between high school students and research scientists, the program will provide an opportunity for high school students to visit scientists at work in their labs and in the field. This hands-on program will foster greater understanding of complex scientific and societal issues and engage students (and teachers) in scientific discovery and problem-solving in ways that are not possible in typical classroom instruction.

Students will participate in lecture, data analysis, laboratory experiences, and discussions with research scientists, gaining new knowledge and skills.



All Students will participate in these Five Sessions with MTU Scientists

(1) *Biofuels in the Gas Tank? What Does It Take to Develop a Forest-based Fuel?*

Cheap, plentiful gas? Find out what we need to do to transition to a biofuel-based economy. Compare several sources of biomass: corn, switchgrass, and trees to evaluate which source of biofuels may be more desirable.

(2) **Ethanol Production: From Cellulosic Biomass to Liquid Fuel**

The goal of this lab is to introduce students to the main processes for converting woody biomass to ethanol, a transportation biofuel. Students will have the opportunity to inspect different types of wood chips under the microscope and describe the surface features, as well as view fermenting microorganisms at work. Purified ethanol will be recovered from the fermentation broth using a small batch distillation column.

(3) **Forest Management: Evaluate Impacts of Biofuel Production on Avian Biodiversity**

To survive and reproduce successfully, wildlife species have various habitat requirements. Although these vary by species, there are a number of fundamental patterns that are important to consider for any plant community managed as a feedstock for ethanol production. This session will provide an overview of the key resources needed by birds, mammals, amphibians, reptiles, and arthropods and how those features can be retained or lost depending on the system used for growing plants for ethanol production.

(4) **Impacts on Forest Ecosystem Productivity**

A basic understanding of how trees grow is necessary to evaluate the potential for trees and other woody plants to provide a sustainable fuel source. Students will learn about the structure of woody plants, how they build woody tissue, how to measure and interpret tree rings, and some key requirements that need to be met in order to maintain tree and ecosystem productivity. We will conclude with a short tree ring exercise, where students will determine how much biomass a tree gains during the student's life time.

(5) **From Forest to Processing Plant**

A simulation model has been developed that allows the user to react to system changes and make decisions in order to satisfy operational requirements of an ethanol-producing facility. Students will use a computer simulation program, ServiceModel, to interactively coordinate the flows of materials and information between the various points of supply and demand along the chain with the objective of minimizing system-wide costs while satisfying service-level requirements. The model will be run several times under varying conditions in order to see visually and through simple analysis how system changes affect overall performance.

**Funded by the
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<http://forestbiofuels.org/>