

## Forest Bioresources

ESRM 325- Autumn Quarter 2009  
(CFR521 for graduate students)

3 credits

Tu Th 10:30-12:00



This course covers three main areas: biofuels, phytoremediation, and carbon sequestration.

For further information, contact Professor Doty: [sldoty@u.washington.edu](mailto:sldoty@u.washington.edu) or check out the course website: <http://courses.washington.edu/esrm490h/index.shtml>

### Topics Covered:

Phytoremediation of organic and inorganic pollutants, enhancing phytoremediation through metabolic engineering or microorganisms.  
Biofuels including bioethanol, biomethanol, biodiesel, biochemicals.  
Methods for improving the efficiency of biofuel production.  
Carbon sequestration by trees



## Course Grading

- Two exams (100 points each)
- Final exam (175 points)
- Participation in discussions (25 points)
- Exam questions will be essay-style and open-note. Powerpoints are not provided

## Exams

- Open note
- Lectures: Stop me as much as you want
- Typical questions:
  - Compare and contrast conventional remediation with phytoremediation
  - Describe examples of enhancing phytoremediation with endophytes

## See the course website

- <http://courses.washington.edu/esrm490h/index.shtml>
- Syllabus with links to readings
  - Not on exams, but helpful information
- Final exam-Mon. Dec 14

## Syllabus Overview

- 2 lectures on phytoremediation (organic and inorganic chemicals)
- 1 lecture on genetic engineering
- 3 lectures on improving phytoremediation
- Exam 1

## Syllabus Overview-2

- Bioenergy overview
- 4 lectures on bioenergy: bioethanol, biomethanol, biodiesel, biochemicals
- 2 lectures on improving bioenergy production
- Exam 2

	<b>Syllabus Overview- Part 3</b>
	<ul style="list-style-type: none"> <li>■ Global climate change</li> <li>■ Photosynthesis is carbon sequestration by plants</li> <li>■ Plant responses to climate change</li> <li>■ 1 lecture to review and link all the lectures</li> <li>■ Final exam</li> </ul>


	<b>"Environmental Uses of Trees"</b>
	<ul style="list-style-type: none"> <li>■ Classic use: lumber</li> <li>■ Newer: <ul style="list-style-type: none"> <li>– Environmental restoration</li> <li>– Phytoremediation: removing environmental pollutants</li> <li>– Bioenergy: bioethanol, biomethanol, biodiesel</li> <li>– Biochemicals</li> <li>– Carbon sequestration; "carbon credits"</li> </ul> </li> </ul>


	<b>Environmental uses of trees:</b>
	<ul style="list-style-type: none"> <li>■ Water erosion, wind erosion, wind breaks, living walls</li> <li>■ Maintain a secure upland slope by depleting soil moisture</li> <li>■ Stabilize sand dunes</li> </ul>


	<b>Environmental uses of trees: Land Restoration</b>
	<ul style="list-style-type: none"> <li>■ Willow can establish on badly degraded soils with scarce topsoil</li> <li>■ Helps anchor pioneer community</li> </ul>

	<b>Environmental Uses of Trees: Reforestation/Afforestation</b>
	<ul style="list-style-type: none"> <li>■ Reforestation- replacing a forest</li> <li>■ Afforestation- planting a forest where it wasn't before</li> </ul>

	<b>Examples of Restoration/Afforestation</b>
	<ul style="list-style-type: none"> <li>■ Planting trees to stop desertification</li> <li>■ Planting trees (willow or a variety of deciduous trees) to control invasive species (reed canary grass and Himalayan black berry) and increase diversity</li> <li>■ Planting trees to control swamps</li> </ul>

	<p><b>Environmental Uses of Trees: Increasing available nitrogen</b></p>
<p>Trees that improve soil nitrogen</p>	

	<p><b>Biological Nitrogen Fixation</b></p>
<ul style="list-style-type: none"> <li>■ Atmosphere: 80% nitrogen gas</li> <li>■ Some microorganisms can "fix" N<sub>2</sub> gas into usable forms</li> </ul>	 <p><i>Root nodule on alfalfa root contains <i>Sinorhizobium meliloti</i></i></p>

	<p><b>Tropical leguminous trees</b></p>
<ul style="list-style-type: none"> <li>■ <i>Acacia koa</i></li> <li>■ Grows in Hawaii</li> <li>■ Associates with rhizobium that fixes nitrogen within root nodules</li> <li>■ Also canopy nodulation by Bradyrhizobium</li> </ul>	

	<p><b>Summary: Environmental Uses of Trees</b></p>
<ul style="list-style-type: none"> <li>■ 1 Phytoremediation</li> <li>■ 2 Bioenergy</li> <li>■ 3 Carbon Sequestration</li> <li>■ 4 Geoengineering-bank stabilization</li> <li>■ 5 Land Restoration/Afforestation</li> <li>■ 6 Insect Control- shading</li> <li>■ 7 Nitrogen- from nitrogen-fixing microbes</li> </ul>	