

# General Syllabus, Forest Entomology (FES 412)

**Tue/Thurs 4:00-5:20pm**

## **Recurring Zoom Link:**

<https://oregonstate.zoom.us/j/94376585953?pwd=NTBKV1FIdE5xK1JvaFRhMWxBMVhCUT09>

Meeting ID: 943 7658 5953

Password: FORento

## **Instructor Contact Information & Office Hours:**

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Office hours are by online appointment only

## **Learning Objectives:**

1. Know and understand all aspects of what forest entomology is and why it is important to forests and forest management
2. Understand basic insect biology, life cycles, biodiversity, and ecological relevance
3. Learn what resources are available to help manage forest pests and beneficial insects
4. Learn the biology and management of major forest insect pests in the PNW
5. Understand the threat from invasive insects to PNW forests

## **Letter Grade Breakdown**

A = 89.5-100%

B = 79.5-89.5%

C = 69.5-79.5%

D = 59.5-69.5%

F = <59.5%

This course will be taught remotely via CANVAS and Zoom. Students should be familiar with these platforms and prepared to use them, as well as have access to reliable internet. All students must abide by Oregon State University rules and regulations, including policies following acceptable classroom behavior and avoiding plagiarism; and adhere to the [OSU Student Code of Conduct](#).

**Attendance & Assignment Policy:**

Students are **required** to attend and participate in class lectures, and submit all assignments on time (**no late submissions accepted**). In the case of extenuating circumstances, students are required to contact either instructor **at least 2 business days prior to the absence** with a valid excuse.

**Syllabus by lecture topic**

*20 lectures, 1 mid-term 'take-home' assignment, and 1 pre-final review day.*

**List of Graded Exams & Assignments**

Final Exam	100 pts
Mid-Term take home assignment	50 pts
Weekly Quizzes (9 total, 10pts each)	90pts
Attendance (4pts per class, 2pts for weekly contribution to discussion board on CANVAS)	100 pts
Out of class assignments (180 pts total)	
iNaturalist- get 10 insect observations over the course of the quarter	50 pts
1st assignment: ESA 3-minute videos	10 pts
2nd Assignment: Database Assignment	25 pts
3th Assignment: Insect Management Case Study Assignment	25 pts
4th Assignment: Favorite Forest Insect Assignment	25 pts
Total Possible Points	475
<b>pts</b>	

**Assignment due dates (tentative)**

Weekly quizzes will open on CANVAS after class (5:20pm) on thursdays and are due the following monday by 11:59pm. There is no quiz the week of the mid-term assignment.

The 'iNaturalist assignment' will be assigned the first week of class, and is due Monday, May 31st by 11:59pm.

The 'ESA 3-minute videos assignment' will be assigned on the first day of class, and is due the following Monday April 5 by 11:59pm.

The 'Database assignment' will be assigned on Tuesday, April 6, and is due Monday April 12 by 11:59pm.

The 'Insect Management Case Study assignment' will be assigned on Tuesday, April 20, and is due Monday, April 26, by 11:59pm.

The 'Mid-term assignment' will be assigned Thursday, May 6, and is due the following Monday by 11:59pm.

The 'Favorite Insect Assignment' will be assigned Thursday, May 13th, and is due Monday May 24th by 11:59pm.

### **Tentative course schedule**

#### **Part I. Introduction to Forest Entomology (4 lectures). Foundations for this class.**

1. **Tuesday, March 30:** *What is an insect? What is forest entomology and insect ecology? Insect physiology/morphology in relation to forest life.*

2. **Thursday, April 1:** *Chemical Ecology of Insects (pheromones)* **Guest lecture: Dr. Christine Buhl**

3. **Tuesday, April 6:** *Taxonomy, museums, and databases*

4. **Thursday, April 8:** *Orders of Insects: biodiversity of insects and relationship to forest ecology*

#### **Part II. Forest Pest Insect Groups: (8 lectures, including some management). What are the major groups of forest insect pests of relevance to foresters and disturbance ecologists? Sometimes these are taxonomic groups, sometimes groups with similar damage syndromes. Here we focus on reviewing these groups.**

6. **Tuesday, April 13:** *Bark beetles (Coleoptera/Curculionidae/Scolytinae).* Special focus on *Ips* & *Dendroctonus* (fir engraver, pine engraver, MPB, doug fir beetle)

7. **Thursday, April 15:** *Ecology of Bark Beetles* **Guest lecture: Dr. Chris Fettig**

8. **Tuesday, April 20:** *Woodboring insects: Longhorned beetles/roundhead larvae (Coleoptera/Cerambycidae), Metallic jewel beetles/flathead larvae (Coleoptera/Buprestidae), Ambrosia beetles (Coleoptera/Curculionidae/Scolytinae), Horntail/Wood wasps (Hymenoptera/Siricidae), and various woodboring moths (Lepidoptera) Weevils (Coleoptera)*

9. **Thursday, April 22:** Bark beetle symbioses + *Ambrosia Beetles* (**Potential Guest Lecture**)

10. **Tuesday, April 27:** *Defoliators: Lepidoptera, Hymenoptera; Hard-wood defoliators* **Guest lecture: Dr. Dave Shaw**

11. **Thursday, April 29:** *Spruce Budworm + Pine Butterfly + Pandora Moth + Tussock Moth* **Guest lecture: Dr. Christine Buhl**

12. **Tuesday, May 4:** *Sap-sucking insects Hemiptera: Aphids, Adelgids, Scales + Root & Gall Insects*

13. **Thursday, May 6:** *Cone and Seed Insects + Terminal stem and branch insects* **Guest lecture: Dr. Christine Buhl**

**May 7th - 10th: Mid-term Assignment (no quiz this week)**

### **Part III. Specialized Systems with Forest Entomology Issues (2 lectures).**

14. **Tuesday, May 11:** *Young plantation management* **Guest lecture: Dr. Dave Shaw**

15. **Thursday, May 13:** *Xmas tree management* **Guest Lecturer**

### **Part IV. Beneficial Insects (2 lectures)**

16. **Tuesday, May 18:** *Parasitoid Wasps: the story of larch casebearer control* **Guest lecture: Dr. Dave Shaw + Pollinators Guest lecture: Dr. Christine Buhl**

17. **Thursday, May 20:** *Social Insects: Termites, Wasps, and Ants*

### **Part V. Special lectures**

18. **Tuesday, May 25:** *Invasive Insects in Oregon* **Guest Lecturer**

19. **Thursday, May 27:** *Unique control methods: Fungi and acoustics* **Guest lecture: Dr. Richard Hofstetter**

20. **Tuesday, Jun 1:** *Other aspects of Forest Entomology: Climate change, Fire, and International Forest Entomology*

### **Part VI. FINALS!**

**Thursday, June 3:** Final Review Day (Q&A Session & Jeopardy!)

**June 7, 2pm:** Final Exam

## Tentative assignment and reading schedule

Lecture #	Day	Date	Topic	Assignments (date assigned)	Readings (weblinks also provided at end of syllabus)
1	Tues	30-Mar	Introduction	ESA <a href="#">3-min videos</a> - <i>due April 5</i>	<a href="#">Insect morphology</a>
2	Thurs	1-Apr	Chemical Ecology of Insects	<a href="#">iNaturalist</a> - <i>due May 31</i>	<a href="#">Insect communication</a>
3	Tues	6-Apr	Taxonomy	Database- <i>due April 12</i>	<a href="#">Importance of museums for documenting diversity &amp; Species concepts</a>
4	Thurs	8-Apr	Forest Insect Orders		<a href="#">Why taxonomy is important for forestry</a>
5	Tues	13-Apr	Bark Beetles		Bark Beetles: <a href="#">1st</a> & <a href="#">2nd</a> readings
6	Thurs	15-Apr	Ecology of Bark Beetles		
7	Tues	20-Apr	Wood Boring Beetles	Case Management- <i>due April 26</i>	<a href="#">Wood Boring Beetles</a> & <a href="#">Wood Wasps/Hornails</a>
8	Thurs	22-Apr	Symbioses & Ambrosia Beetles		Ambrosia Beetles: <a href="#">1st</a> & <a href="#">2nd</a> readings
9	Tues	27-Apr	Defoliators		<a href="#">Defoliators</a>
10	Thurs	29-Apr	Spruce Budworm		<a href="#">Spruce budworm</a>
11	Tues	4-May	Sap-sucking Insects, Root & Gall Insects		<a href="#">Introduction to Sap-Sucking Insects, Gall Formers, and Mites</a>
12	Thurs	6-May	Cone, Seed, Stem & Branch Insects	Mid-term- <i>due May 10</i>	<a href="#">Cone &amp; Seed Insects</a>
13	Tues	11-May	Young Plantation Management		
14	Thurs	13-May	Xmas Tree Lecture	Fav Insect- <i>due May 13</i>	<a href="#">Xmas Tree Management</a>
15	Tues	18-May	Parasitoid Wasps & Pollinators		<a href="#">Native Pollinators</a>
16	Thurs	20-May	Social Insects		<a href="#">Ant social structure</a>
17	Tues	25-May	Invasive Insects in OR		<a href="#">Invasive Species</a>
18	Thurs	27-May	Unique Control Methods		<a href="#">How do you kill an invasive species?</a>
19	Tues	1-Jun	Other Aspects of Entomology		<a href="#">Insect decline in the Anthropocene</a>
20	Thurs	3-Jun	Review Day		
Final	Mon	7-Jun	Final		

### **Recommended (not required) texts**

Vega, F.E. and Hofstetter, R.W. eds., 2014. *Bark beetles: biology and ecology of native and invasive species*. Academic Press.

Ciesla, W., 2011. *Forest entomology: a global perspective*. John Wiley & Sons.

Oester, P.T., D.C. Shaw, and G.M. Filip. 2019. *Managing Insects and Diseases of Oregon Conifers*. EM 8980. Oregon State University Extension Service Press. (available as pdf: <https://catalog.extension.oregonstate.edu/em8980>)

Goheen, E.M., and E.A. Willhite. 2006. *Field Guide to the Common Diseases and Insect Pests of Oregon and Washington Conifers*. USDA Forest Service, Pacific Northwest Region. R6-NR-FID-PR-01-06. Portland, Oregon. 327 p.

Furniss, R.L., and V.M. Carolin. 1977. *Western Forest Insects*. USDA, Forest Service, Misc. Publication No. 1339. US Gov. Printing Office, Washington D.C.

Peterson, Merrill A. 2018. *Pacific Northwest Insects*. Seattle Audubon, Washington, USA.

Ciesla, W. 2011. *Forest entomology: a global perspective*. John Wiley & Sons.

Johnson, N.F., and Triplehorn, C.A. 2005. *Borror and DeLong's Introduction to the Study of Insects*. Belmont, CA: Thompson Brooks/Cole.

### **Useful Resources**

*These two Rocky Mt. Region USFS Website ID and Management Guides are awesome:*

[https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5262952.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5262952.pdf)

<http://dnrc.mt.gov/divisions/forestry/docs/assistance/pests/management-guide/complete-mgt-guide/mgtguide-full.pdf>

*Oregon Department of Forestry. Forest Health:*

<https://www.oregon.gov/odf/ForestBenefits/Pages/ForestHealth.aspx>

*US Forest Service, R6, Forest Health Protection:*

<https://www.fs.usda.gov/main/r6/forest-grasslandhealth>

*Insects and Diseases:*

<https://www.fs.usda.gov/main/r6/forest-grasslandhealth/insects-diseases>

*Aerial Detection Survey:*

<https://www.fs.usda.gov/detail/r6/forest-grasslandhealth/insects-diseases/?cid=stelprdb5286951>

*Awesome interactive map:*

<https://usfs.maps.arcgis.com/apps/webappviewer/index.html?id=87d6cf9c2e1a45408ef01a357b84c811>

*Arthropod Databases:*

Bugguide.net

[inaturalist.org/observations](http://inaturalist.org/observations)

<https://www.idigbio.org/portal/search>

<https://scan-bugs.org/portal/>

*Trainings:*

Tree School (Insects): <https://tinyurl.com/TreeSchool-insectpests>

Tree School (Bees): <https://tinyurl.com/TreeSchool-bees>

Tree School (Diseases): <https://tinyurl.com/TreeSchool-diseases>

*Bark beetles:*

<https://youtu.be/HQUO4RAKULw>

<https://youtu.be/xSmi9gm0CKo>

<https://youtu.be/sLG7O499UGo>

Key to genera: <http://idtools.org/id/wbb/bbgus/index.php>

*Misc:*

Monthly drought status email: <https://tinyurl.com/drought-report>

Post-fire tree mortality: <https://www.oregon.gov/odf/Documents/forestbenefits/post-fire-tree-mortality.pdf>

Quick and dirty major pest guide:

<https://www.oregon.gov/odf/Documents/forestbenefits/InsectPestDiagnosis.pdf>

*Professional groups-*

Entomological Society of America (<https://www.entsoc.org/>)

North American Forest Insect Work Conference (<https://ccaps.umn.edu/2021-north-american-forest-insect-work-conference>)

*Facebook Groups/pages-*

Frass & Noodles; Dr. Art Evans, entomologist; Pacific Northwest Bugs; Relax. I'm an entomologist; Friends of Coleoptera at the Natural History Museum (Entomology department); Hymenopterists Forum; Myrmecologists

## **List of Supplemental Readings Weblinks**

### *Insect morphology-*

[http://centralpt.com/upload/407/GalleryPrograms/10335\\_InsectMorphology.pdf](http://centralpt.com/upload/407/GalleryPrograms/10335_InsectMorphology.pdf)

### *Insect Communication-*

<https://allyouneedisbiology.wordpress.com/2015/11/22/insect-communication/>

### *Importance of Museums for documenting diversity-*

[https://nma.gov.au/research/understanding-museums/DHoesse\\_2011.html](https://nma.gov.au/research/understanding-museums/DHoesse_2011.html)

### *Species concepts-*

[https://bio.libretexts.org/Courses/University\\_of\\_California\\_Davis/BIS\\_2B%3A\\_Introduction\\_to\\_Biology\\_-\\_Ecology\\_and\\_Evolution/2%3A\\_Biodiversity/2.1\\_Species\\_Concepts](https://bio.libretexts.org/Courses/University_of_California_Davis/BIS_2B%3A_Introduction_to_Biology_-_Ecology_and_Evolution/2%3A_Biodiversity/2.1_Species_Concepts)

### *Why taxonomy is important for forestry-*

<https://pubs.cif-ifc.org/doi/pdf/10.5558/tfc71581-5>

### *Bark beetles (2 readings)-*

<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7421.html>

[https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5186641.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5186641.pdf)

### *Woodboring beetles-*

<https://www.oregon.gov/odf/Documents/forestbenefits/Woodboringbeetles.pdf>

### *Wood wasps and horntails-*

<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7407.html>

### *Ambrosia beetles (2 readings)-*

<http://www.ambrosiasymbiosis.org/ambrosia-beetles/ecology/>

[https://www.oregon.gov/odf/Documents/forestbenefits/Ambrosia\\_beetle\\_2017.pdf](https://www.oregon.gov/odf/Documents/forestbenefits/Ambrosia_beetle_2017.pdf)

### *Defoliators-*



<https://forestpests.community.uaf.edu/module-4/>

*Spruce budworm-*

[https://csfs.colostate.edu/media/sites/22/2014/02/Western\\_Spruce\\_Budworm\\_QG\\_10May2016.pdf](https://csfs.colostate.edu/media/sites/22/2014/02/Western_Spruce_Budworm_QG_10May2016.pdf)

*Introduction to Sap-Sucking Insects, Gall Formers, and Mites-*

[https://www.fs.usda.gov/Internet/FSE\\_DOCUMENTS/stelprdb5350724.pdf](https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5350724.pdf)

*Cone & Seed Insects-*

[https://rngr.net/publications/forest-nursery-pests/conifer-and-hardwood-insects/seed-and-cone-insects/at\\_download/file](https://rngr.net/publications/forest-nursery-pests/conifer-and-hardwood-insects/seed-and-cone-insects/at_download/file)

*Christmas Tree Management-*

[https://www.canr.msu.edu/resources/christmas\\_tree\\_pest\\_manual\\_e2676](https://www.canr.msu.edu/resources/christmas_tree_pest_manual_e2676)

*Native Pollinators-*

[https://www.biologicaldiversity.org/campaigns/native\\_pollinators/index.html#:~:text=They%20provide%20stability%20for%20every.and%20other%20animals%20to%20reproduce.](https://www.biologicaldiversity.org/campaigns/native_pollinators/index.html#:~:text=They%20provide%20stability%20for%20every.and%20other%20animals%20to%20reproduce.)

*Ant social structure-*

<https://www.quantamagazine.org/ants-build-complex-structures-with-a-few-simple-rules-20140409/>

*Invasive Species-*

<https://www.annualreviews.org/doi/full/10.1146/annurev-environ-033009-095548>

*How do you kill an invasive species?-*

<https://thewalrus.ca/how-do-you-kill-an-invasive-species-bring-in-a-bigger-meaner-species-to-eat-it/>

*Insect decline in the Anthropocene-*

<https://www.pnas.org/content/118/2/e2023989118>