COURSE SYLLABUS
NRES 454 - FIRE BEHAVIOR AND FUELS
Spring 2023

Meeting Time and Location:
Section 1: **Lecture:** Monday and Wednesday: 11:00a – 11:50a - TNR 361
Lab: Wednesday: 12:00p-1:50p - TNR 359

Exam-1: February 27 11:00a-11:50a
Exam-2: April 10 11:00a-11:50a
Final Exam: May 17 12:30p-2:30p

Instructor:
Dr. Michael Tiller
Phone: 715-346-2153
E-mail address: mtiller@uwsp.edu

Course Purpose & Description: The purpose of this course is to provide you with an intermediate understanding of fire behavior and the fire environment. The course is divided into 3 units; fuels, weather, and fire behavior. Note that elements of weather relationships will be incorporated into the units on fuels and fire behavior as well. The unit on fuels will cover sampling for fuel characterization (ground and canopy), live and dead fuel moisture, determining weather relationships, and have some emphasis on fuel model determination and fuel modeling. The unit on weather will cover basic processes, atmospheric stability, wind systems and sources of weather data. The unit on fire behavior will explore the combustion process, properties of fire and how the fire environment affects spread and behavior. It will also cover estimation methods and basic calculations for characterizing and predicting fire behavior.

Course Objectives, Learning Outcomes and Dispositions:
Objectives:

To facilitate student learning and understanding about the fire environment – fuels, weather and topography and their respective contribution to varying fire behavior. To give students practical experience is measuring and characterizing fuels, weather conditions and resulting fire behavior. To equip students with an understanding of fuel models and their use in fire behavior modeling. To develop an understanding of factors that contributes to extreme fire behavior and how that impacts safety and tactical approaches to wildland firefighting.

Learning Outcomes:

Students will; 1) be able to identify and describe the characteristics of the fire environment; topography, fuels and weather and how these elements interact and influence wildland fire behavior,2) learn to assess fuel characteristics and describe how weather interacts to influence fuel availability, 3) be able to characterize, calculate and predict wildland fire behavior, 4) learn how fire behavior models work and how to , 5) develop skill in understanding the application of fire behavior models to wildland situations and the limitations of models, and 6) learn. the causes of extreme fire behavior in relation to the fire environment

Dispositions:

Students will appreciate the variability in the fire environment and thus the complexity of fire behavior and its prediction. Students will value data accuracy and the best methods to achieve accuracy for behavior prediction. Students will respect the situations that lead to propagation of extreme fire behavior.

Required Textbook(s):
A number of National Wildfire Coordinating Group publications will be required. PDFs of these publications and other required readings will be provided on Canvas.

Canvas: This course will use Canvas to provide assigned readings, turn in completed assignments (lab reports, projects), provide access to your grade, rubrics, and other course materials.

Assignments and Class Activities:
Weekly reading assignments are generally on the course schedule. You are expected to read assignments before class and come prepared to discuss the material or complete the lab assignment. The class schedule will denote if the lab will be in the field or not. At least two burns are planned. Weather will dictate when they occur (during the week or on Saturday). Attendance is required as data will be collected on these burns and used in later labs. These will likely occur in March or April. A major semester project is the prescribed burn field experience in measuring fuels, fuel moisture, fuel consumption and quantifying fire behavior using various methods**.** If a prescribed burn cannot be arranged, we will collect some pre-fire data and then conduct a simulated burn and you will be provided with post-fire output to analyze. You will be expected to write a scientific paper presenting the results of your findings.

Homework Assignments: will be assigned during class and turned in either with Canvas or in class the following week.

Attendance: Your participation in lab periods is a significant part of your grade. No make-up sessions will be held. If you must miss an exam, lab, or a field trip for illness or other emergency you must email me before that exam, lab, or field trip occurs and provide appropriate documentation afterward. *Make-up exams for **excused absences only** will be given the last day of finals week during the last two-hour exam period.*

Grading Policies / Procedures / Scale:
Three exams will be given. Each exam will only cover material since the previous exam. The last exam will be given during finals week, **Wednesday, May 17**. The exams over each of the units will compose 60% of the final grade. Exams will be a combination of multiple choice, short answer and at least one or more short essay question. Homework assignments and quizzes will constitute 20% of your grade and the burn report will be 15%. The remaining 5% will be from discussion participation.

GRADING	WEIGHT
Exam-1	20%
Exam-2	20%
Final Exam	20%
Homework & Quizzes	20%
Burn Report	15%
Discussion	5%
	100%

Grade Scale

Mean Score	Letter Grade	Mean Score	Letter Grade
100-93	A	77-73	C
92-90	A-	72-70	C-
89-88	B+	69-68	D+
87-83	B	67-60	D
82-80	B-	<60	F
79-78	C+		

Student Responsibilities:
To keep up with the readings, to get ALL notes if you miss a lecture and to turn in your assignments on time. If you have an emergency or are ill, extensions will be provided, but it is your responsibility to inform me, **in writing or by e-mail,** why you missed class. Also, if any material is not clear, YOU must let me know; I will be happy to sit down with you one-on-one and discuss it as much as you need.

Academic integrity is central to the mission of higher education in general and UWSP in particular. Academic dishonesty (cheating, plagiarism, etc.) is taken very seriously. **Don't do it!** The minimum penalty for a violation of academic integrity is a failure (zero) for the assignment. For more information, see the UWSP "Student Academic Standards and Disciplinary Procedures" section of the *Rights and Responsibilities* document, Chapter 14, which can be accessed here: UWSP Chapter 14 – Academic Misconduct

Students With Disabilities:
The university has a legal responsibility to provide accommodations and program access as mandated by Section 504 and the Americans with Disabilities Act (ADA). The university's philosophy is to not only provide what is mandated, but also convey its genuine concern for one's total well-being. If accommodations are needed, please contact the instructor as well as the Disability Resources Center, 609 Albertson Hall (ALB)/the Library room 108 in Collins Classroom Center (CCC): phone (715) 346-3365 or email: drc@uwsp.edu.

Professionalism

Students in the College of Natural Resources are pursuing courses of study that prepare them for careers as natural resources professionals. Thus, CNR students and faculty/staff are expected to exhibit conduct and attitudes appropriate to professionals. Conduct and attitudes appropriate for professionals include, but are not restricted to,

1. The UWSP Student Rights and Responsibilities are available via: www.uwsp.edu/centers/rights

2. Attitudes appropriate for resource professionals of the 21st Century:

   a. Respect for others and for their ideas;

   b. Appreciation for ethnic and gender diversity in the workplace;

   c. Sensitivity to environmental quality;

   d. Adherence to professional ethics, e.g. the Society of American Foresters or Wildlife Society Code of Ethics.

- SAF Code of Ethics: https://www.eforester.org/CodeofEthics.aspx
- Wildlife Society Code of Ethics: https://wildlife.org › 20190304-Code-of-Ethics

Academic Integrity

Academic integrity is central to the mission of higher education in general and UWSP in particular. Academic dishonesty (cheating, plagiarism, etc.) is taken very seriously. Don't do it! The minimum penalty for a violation of academic integrity is a failure (zero) for the assignment. For more information, see the "Student Academic Standards and Disciplinary Procedures" section of the Community Rights and Responsibilities document, UWSP Chapter 14. This can be accessed by viewing page 11 of the document at: UWSP Chapter 14 – Academic Misconduct

Incomplete Policy

Under emergency/special circumstances, students may petition for an incomplete grade. An incomplete will only be assigned under extenuating circumstances. All incomplete course assignments must be completed within deadline given by the instructor.

NRES 454 Fire Behavior and Fuels TENTATIVE Lecture Schedule

Week	Lec/Lab Date	Lecture/Lab Topic	Reading Assignment
1	23-Jan	Course Introduction & Fire Environment	
	25-Jan	Fire Environment	Pyne et al. 1996 Chap 2: 48-67
	25-Jan	LAB: Fire Chemistry & Physics-Lab	
2	30-Jan	Topographic Influences	S-290 Workbook- Unit 2:2.1-2.16
	1-Feb	Basic Weather Processes	Fire Weather p. 19-32
	1-Feb	LAB: Combustion Efficiency & Heat Yield	
3	6-Feb	Basic Weather Processes	Fire Weather p. 19-32
	8-Feb	Basic Weather Processes-Temp & RH	Fire Weather p. 33-48
	8-Feb	LAB: KBDI	
4	13-Feb	Fuel characteristics - Ground and Surface	Anderson 1982
	15-Feb	Fuel characteristics - Ladder and Aerial	Pyne et al. Chap 3:90-108
	15-Feb	LAB: BEHAVE-1	
5	20-Feb	Fuel Moisture-Water Relations	Pyne et al. Chap 3:109-127
	22-Feb	Dead Fuel Moisture	Fire Weather p. 180-196
	22-Feb	LAB: BEHAVE-2	
6	27-Feb	**Exam-1**	
	1-Mar	Live Fuel Moisture-Flammability	Jolly et al 2010
	1-Mar	LAB: FOFEM	Reid et al. 2012

7	6-Mar	Live Fuel Moisture (cont)- Predicting the Spring Dip	Jolly et al. 2016
	8-Mar	Fuel Models - A Look Under the Hood	Anderson 1982; Scott & Burgan 2005
	8-Mar	LAB**:** Temperature -RH (Field)	
8	13-Mar	Fuel Models - New 40	Scott & Burgan 2005
	15-Mar	Fire Characteristics - Temperature	Anderson 1982; Scott & Burgan 2005
	15-Mar	LAB**:** Spotting and Probability of Ignition	
9	20-Mar		
	22-Mar	**Spring Break**	
	22-Mar		
10	27-Mar	Attributes of Fire Behavior	Cruz et al 2003
	29-Mar	Fireline Intensity - Byram & Rothermel Equations	Alexander & Cruz 2012a
	29-Mar	LAB: Fuel Inventory (Field)	Brown 1974
11	3-Apr	Fireline Intensity - Byram & Rothermel Equations	Alexander and Cruz 2013
	5-Apr	Predicting Fire Behavior - Modeling approaches	Sparks et al. 2007; Masters and Engle 1994
	5-Apr	LAB: Fire Behavior Observation - RX Burn (Field)	
12	10-Apr	**Exam-2**	
	12-Apr	Atmospheric stability-1	Fire Weather Chap 4
	12-Apr	No Lab	
13	17-Apr	Atmospheric stability-2	Fire Weather Chap 4
	19-Apr	Weather Systems	Werth et al 2011; Fire Weather Chap 5
	19-Apr	LAB: Fuel Moisture Content (Field)	
14	24-Apr	Wind Systems	Fire Weather Chap 6&7
	26-Apr	Wind Systems	Fire Mgt Today 73(4)
	26-Apr	LAB: Canopy Bulk Density (Field)	
15	1-May	Fire Behavior-Scorch & Crown Fire Descriptions	Werth et al 2011; Chap 7
	3-May	Crown Fire Dynamics / Wind & Fire Behavior-Mack Lake	Werth et al 2011; Chap 8
	3-May	LAB: TBD	
16	8-May	Extreme Fire Behavior	McRae et al 2011
	10-May	Lessons learned	
17	17-May	**Final Exam: May 17 12:30p-2:30p - TNR 361**	

Computer Lab Schedule

1-Feb	TNR-356 12:00p-2:00p
15-Feb	TNR-356 12:00p-2:00p
22-Feb	TNR-356 12:00p-2:00p
1-Mar	NFAC-126 12:00-2:00p
15-Mar	TNR-356 12:00p-2:00p