

FIRE (BIO 427)

T Th 9:15-10:30a

Instructor: Stephen Pyne

Office hours: M 11-12n, TTh 10:30-11:30a, and by appointment

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Course description

This course surveys fire – its natural history, its behavior and ecology, its alliance with humanity; in brief, why and how it exists on Earth. The course will explore this saga in five parts. Part 1 will examine fire as a natural phenomenon. Part 2 will scrutinize the ancient role of humans as fire creatures, manipulating fire through control over ignition and fuel. Part 3 will study the impact of industrialization, which for fire means the burning of fossil biomass. Part 4 will examine the fire history of America’s public lands. Part 5 will compare fire histories among three boreal countries, along with Australia.

Course satisfies General Studies requirement for *Historical Awareness*.

Assignments and Grades

§ **Exams.** There will be three exams. Two will be in-class midterms, the third a take-home final. Each will be worth 50 points, or collectively 150 points. Guidelines are included with the syllabus.

§ **Answers to S290**, “Principles of Fire Behavior.” Instructions included with syllabus.

Due on or before February 17. *Value:* 25 points

§ **Question sheet** for *Year of the Fires*. *Due:* April 7. *Value:* 20 points

§ **Book review** for Norman Maclean, *Young Men and Fire*. Guidelines included with syllabus. *Due:* April 21. *Value:* 25 points

§ **Extra credit.** A short research paper (2,000-2,500 words) or book review. Topics can include fire effects on a species, a habitat, or a country fire situation or historic event. See me for mutually agreeable topic, and for a list of prospective books. *Due* by last day of class.

Value: Up to 15 points for research paper, and 10 points for book review.

Total points possible: 220

Grade distribution: A=220-205 points; B=204-190 points; C=189-174 points; D=173-154 points.

Policies

- *Incompletes* are discouraged and will be given only for bona fide emergencies.
- *Makeups:* Assignments are due on date specified. If you cannot attend that day, notify me in advance and arrangements will be made for a makeup exam or tardy submission. Late assignments will be penalized 10 points for each day they are late.
- **NB:** No e-mail attachments accepted.
- Please turn off or silence cell phones.

- Reasonable accommodations are available for students with documented disabilities or who must miss class for a documented religious holiday. Please inform us early in the semester if you need accommodation.
- Academic dishonesty, including inappropriate collaboration, will not be tolerated. There are severe sanctions for cheating, plagiarizing and any other form of dishonesty For ASU *student academic integrity policy*, see:
http://www.asu.edu/studentaffairs/studentlife/judicial/academic_integrity.htm

Required Readings

Stephen Pyne, *Fire: A Brief History*
 Stephen Pyne, *Year of the Fires: The Story of the Great Fires of 1910*
 S-290, "Principles of Fire Behavior" (CD-ROM; handed out in class; no charge)
 Norman Maclean, *Young Men and Fire*

NB: All books available at ASU Bookstore, or for purchase on-line, or on reserve at Noble Library.

FIRE

Jan 20

Introduction

Course themes and assignments.

First Fire: Natural Fire

Jan 22

Fire Planet: Creating Combustion

Read: Pyne, *Fire*, pp. 3-23

Jan 27

Thinking about fire

Read (optional): Pyne, "Problems, Paradoxes, Paradigms" (Blackboard posting)

Jan 29

Fire and Life (1)

Feb 3

Fire and Life (2)

Feb 5

Fire Behavior (1)

Feb 10
Fire Behavior (2)

Feb 12
Strategies for Fire Control: South Canyon fire

Second Fire: Anthropogenic Fire

Feb 17
Frontiers of Fire (I): Colonization by Hominids
Read: Pyne, *Fire*, pp. 24-45
Assignment: S290 exam due

Feb 19
Aboriginal Fire
Read: Pyne, *Fire*, pp. 46-64

Feb 24
Agricultural Fire: Cycles of Cultivated Fire
Read: Pyne, *Fire*, pp. 65-86

Feb 26
First midterm

Mar 3
The Fire in the Garden: The European Exemplar

Mar 5
Frontiers of Fire (II): Agricultural Colonization
Read: Pyne, *Fire*, pp. 87-101

March 10 and 12
Spring break

Mar 17
Pyrotechnologies
Read: Pyne, *Fire*, pp. 119-138
Video: *Discover: Fire* [clips]

Mar 19
Urban Fire
Read: Pyne, *Fire*, pp. 102-118

Third Fire: *Industrial Fire*

Mar 24

Industrial Fire

Read: Pyne, *Fire*, pp. 139-172

Mar 26

Interlude: Flame and Fortune

Videos: *Forest Smokechaser*; *50 Years of Smokey Bear*

Mar 31

The Future of Fire: Global Change

Read: Pyne, *Fire*, pp. 172-189

American Fire: *A Historical Survey*

Apr 2

Flame and Fortune (1)

Read: Pyne, *Year of the Fires*

Apr 7

Flame and Fortune (2)

Assignment: Turn in question sheet for *Year of the Fires*

April 9

Second midterm

Apr 14

Vestal Fires and Virgin Lands

Video: *Wildfire* [clips]

Apr 16

The Fire This Time

Video: *Fire in the Hills: the Oakland Story* [clips]

Apr 21

Rekindling: Fire and Restoration

Assignment: review essay on *Young Men and Fire*

Fire on Earth: *Comparisons*

Apr 23

Canada

Videos: *Into the Fire* [clips]; *Bush Angels* [clips]

Apr 28
Boreal Europe

Apr 30
Russia
Video: *The Fire Experiment* [clips]
Take-home exam handed out

May 5
Australia
Extra credit project due
Turn in take-home exam (optional)

May 7
Final exam due – turn in to Center for Biology & Society, LSC 284, by *12 noon*.

USEFUL WEBSITES on FIRE

Global Fire Monitoring Centre
www.fire.uni-freiburg.de

National Interagency Fire Center
www.nifc.gov

Southwest Fire Coordinating Center
gacc.nifc.gov/swcc

Public domain software
fire.org

Fire Effects Information System
<http://www.fs.fed.us/database/feis/>

NOAA fire and weather
www.noaa.gov/fireweather

Public domain photos
firepix.blm.gov

International Assoc. for Wildland Fire
www.iawfonline.org

Assoc. for Fire Ecology
www.fireecology.net

S-290 INTERMEDIATE WILDLAND FIRE BEHAVIOR

QUICK INSTALLATION

- Insert the S290 CD into your CD-ROM drive.
- Double click "My Computer" and the CD-ROM drive where "S290" is located.
- Double click the "Setup.exe" icon and follow the instructions on your screen.
- Click "Stand Alone" - then "Next" button.
- Click "Next" button to use default directory (C:\S290)
- Click "Next" to use default folder ("Intermediate Wildland Fire Behavior")
- Installation of necessary files will follow.
- Ensure that screen resolution is set to 640 x 480 pixels and 16 bit color or better (not 16 color) or program will run extremely slow. Consult Windows software manual if you are not sure how to do this.
- Click "Finish" button to restart your computer. Then move to "User Setup" procedure.

USER SETUP

- Click on "Intermediate Wildland Fire Behavior" icon to open login box.
- In lower-case letter, enter "admin" in the "NAME" space and "password" in the "PASSWORD" space. (Note: you can later change both name and password.)
- Click the "Login" button.
- Click the "Users" tab
- Click the "Add User" button
- Fill in the appropriate information in the "User Information" box. An entry into the "User I.D." field is not required. Click "OK" button.
- Click on the "Viewing" scroll bar under the "User tab."
- Click on "Courses assigned to User."
- Click on the User's name you entered previously.
- Click on the "Assignments" button.
- Click on "S290: in the "Assignment" box.
- Click on "OK."
- Click the "Logout" button to return to your Windows desktop (you do not have to restart your computer).

RUNNING THE COURSE

- Insert CD into CD-ROM.
- Click on desktop icon for program
- Enter name and password and click on Login.
- Click on "Overview" at the top of the menu. Then click on the "Start" button.
- If your computer is configured properly, you will hear music, see video, and the computer will automatically proceed through the next three screens.
- At third screen - follow prompts to proceed through the course. Click on the "Help" button if you have difficulties.
- To exit, click on "Manager" button. This will return to the menu. You can then proceed item by item.

TO PRINT FINAL TEST SCORE: Copy page to clipboard by “ALT”+”PRINT SCREEN”, then paste into Word document or Powerpoint slide.

PRE-TEST (S290)

NOTE: The actual order of questions will vary with CD (or different times you take the test).

1. Wildland fires burn hotter and with more intensity when air is unstable. TRUE
2. Light fuels take on and lose moisture faster than heavier fuels. TRUE
3. Wind direction is the direction the wind is blowing from. TRUE
4. VALLEY WINDS: Winds that are the result of temperature differences between air in the valley and air at the same elevation over the adjacent plain.
LAND BREEZE: A light nighttime breeze which originates over the relatively cool land surface and flows out over the warmer coastal waters.
SEA BREEZE: A daytime breeze in which cooler, higher pressure air from over coastal waters moves on shore to replace heated air rising off the warmer land mass.
SLOPE WINDS: Small-scale convective winds that occur due to local heating and cooling of a natural incline of the ground.
5. Surface winds from a thunderstorm will be the strongest in the direction the thunderstorm is moving. TRUE
6. The most variable component of the fire environment in time and space is: WEATHER
7. A large amount of rain fall in a short time will raise the fuel moisture more than a smaller amount of rainfall over a longer time. FALSE
8. Generally, upslope winds occur at night and downslope winds during the day: FALSE
9. Topography and vegetation do not influence the amount of solar heating the earth's surface: FALSE
10. Which slope aspect will likely have sparsest lighter fuels, higher temperatures, lower humidity, and lower fuel moisture? SOUTH
11. Topography and fuel can change rapidly over space: TRUE
12. Which fuel characteristic affects fire behavior? ALL OF THE ABOVE
13. Five factors of topography which can influence fire ignition and spread include: ASPECT, SLOPE, SHAPE OF THE COUNTRY, ELEVATION, BARRIERS
14. The methods of heat transfer are: RADIATION, CONVECTION, CONDUCTION
15. Foehn winds are generally found on the LEE side of mountain ranges.
16. Visual indicators of a thunderstorm include: TALL BUILDING CUMULUS CLOUD, CAULIFLOWER APPEARANCE, DARK FLAT BASE, VIRGA OR RAIN FROM BOTTOM, ICE CRYSTAL TOP ANVIL SHAPE
17. The sides of the fire triangle are: HEAT, FUEL, OXYGEN
18. Prediction of fire behavior for safe and effective control and use requires: ALL OF THE ABOVE
19. What is the most dangerous condition that can develop when a fire is burning in a box canyon? CHIMNEY EFFECT
20. INVERSION: A layer in the atmosphere where the temperature increases with altitude.
THERMAL BELT: An area of a mountainous slope that experiences the least variation in diurnal temperatures, has the highest temperatures, and the lowest average relative humidity.
DUST DEVIL: Occurs on hot day over dry ground when skies are clear and the winds are light
SUBSIDENCE: An extensive downward or sinking motion of air in the atmosphere
21. The four main weather factors which affect the start and spread of wildland fire are: RELATIVE HUMIDITY, PRECIPITATION, TEMPERATURE, WIND
22. The three principal environmental elements affecting fire behavior are: WEATHER, TOPOGRAPHY, FUEL
23. The relative humidity of a foehn wind is high: FALSE
24. Which fuel characteristic changes most rapidly? MOISTURE CONTENT
25. Relative humidity is usually at its highest in the early morning hours: TRUE

GUIDELINES

Book Review of Norman Maclean, *Young Men and Fire*

The review is not a book report but a personal essay that examines *what is said, how it is said,* and *whether it was worth saying.*

The essay, that is, must identify the important themes, arguments, and data of the book; it must consider how the author organizes and conveys that material; and it must extend some judgment about the success of the book on the reader, the book's probable audiences, and its overall character. The order of presentation and the degree of emphasis given to each aspect is up to the student, but the choice should bear some relationship to the character of the book in question. The choice of voice, first person or third, is up to you. Insight, thoughtfulness, care of expression – all are important criteria in evaluating the essay.

Remember, speak to the book, not just its themes. Don't simply retell the saga or tragedy, or elaborate on why a protagonist (or author) is a hero or a jerk. Go beyond those reactions to explain why.

Finally, this book is a work of non-fiction: it speaks to real events, although the author may use some of the literary or rhetorical devices more common to fiction. It is emphatically not a novel.

Some particulars:

- Review should run between 1000-1500 words.
- No email attachments accepted
- Review due by end of class on day posted in syllabus (April 21)

Question Sheet

Year of the Fires

Answer the following questions, as indicated:

1. What was the light-burning controversy? What did each argue with regard to fire? (<300 words)
2. List three factors that promoted a policy of aggressive fire suppression? (<300 words)
3. How did the events of 1934-35 challenge and confirm those of 1910? (<300)
4. Pick three people from the book who influenced the course of fire protection, and explain in 2-3 sentences who they were and what they did.

GUIDE TO EXAMS

Midterm 1

General concepts

- what is the fire triangle? What are the sources for its components, and their general history?
- what is the fire behavior triangle?
- describe the three methods of heat transfer
- describe the four phases of combustion
- explain the two meanings of fire growth
- what is meant by “fire rhythms”? Name four examples.
- how does the geography of lightning relate to the geography of fire?
- how do the following affect fire behavior?
 - slope
 - aspect
 - atmospheric stability (and inversions)
 - thunderstorms
 - frontal passage
 - local winds (mountainous terrain)
 - foehn winds (SMDW)
 - fuel moisture (live and dead)
- in what ways is fire a biological phenomenon?
- what is the difference between "protective" and "promotive" adaptations to fire? Cite examples
- are there any adaptations that seem specific to fire?
- in what sense is fire a conservative process?
- how does fire affect fauna?
- what are the components of a fire regime? In what sense is a fire regime a statistical composite?
- in what ways can people shape fire regimes? Direct ways? Indirect ways?
- describe the special capacities of the three paradigms for understanding fire – physical, biological, cultural. Which might best describe the recent outbreaks of “megafires” in the American West?
- describe basic fire ecology for the following North American biomes:
 - prairie – chaparral - sequoia groves - boreal forest (including lodgepole pine)

Identifications

heading fire	controlled fire	contained fire
backing fire	fireline	backfire
flanking fire	spot fire	ground fire
burning out	surface fire	direct attack
crown fire	indirect attack	available fuel
blackline	plume-driven fire	wind-driven fire
blowup fire	fireline intensity	fire-characteristics chart
rate of spread	patch	pulse
lines of fire	fields of fire	serotiny
fire frequency	lignotubers	fire timing
fire intensity	epicormic sprouting	chamise
megafire	ecological control of fire	cultural control of fire
biological construction of fire		

Midterm 2

General concepts

- in what ways can people shape fire regimes? Direct ways? Indirect ways?
- how is aboriginal fire both powerful and limited?
- how does agriculture change fire regimes? What are the powers and limitations of agricultural fire?
- what were the effects of megafaunal extinctions on fire regimes?
- what might be the relationship(s) between fire and domestication?
- how do Europe's fire ceremonies relate to fire ecology?
- how did agricultural settlement affect fire in different regions of the U.S. ?
- in what ways is fire a "technology"?
- how can we speak of "cooking the woods" or "cooking stone"?
- what two ecologies combine to make modern urban fire?
- how do urban and wildland firefighting cultures differ?
- what is the basic unit of urban fire dynamics?
- what are the three fire landscapes of industrial cities?
- what are the major causes of conflagrations in modern cities?
- what, for fire history, is the definition of industrialization?
- how does industrial fire interact with other forms of combustion? how does it substitute? how does it suppress?
- in what sense is the Earth dividing into two grand combustion regimes?
- give examples of contemporary places with too much fire and too little
- what were the circumstances under which the national forests were established?
- how did the national parks (especially Yellowstone) contribute to fire protection?
- what was the light-burning controversy?
- how did fire protection on public lands differ from that on private lands?
- describe the impact of World War II on fire prevention programs
- what is meant by the expression "Cold War on fire"?
- what were the objections to aggressive fire control during the 1930s?
- what were the reasons for reintroducing fire in the 1960s?

Identifications

fire-fallow farming
fallow
swidden
fossil fallow
prime mover
urban fire gap
tame fire
hearth
smokechaser
pulaski (tool)
prescribed fire
defensible space
prescribed fire
intermix fire
Flagstaff model

transhumance
landnam
field rotation
pyric transition
Big Burn
industrial fire
captured fire
10 AM policy
Transfer Act (1905)
light burning
William Greeley
prescribed natural fire
Leopold Report (1963)
wildland/urban interface (WUI)
wildland fire use

firestick farming
fire-forage herding
need fire
fire appliances
Big Dump
tool fire
1871 fires (Chicago and Peshtigo)
light burning
Smokey Bear
prescribed natural fire
Gifford Pinchot
let burn
Wilderness Act (1964)
Cerro Grande fire (2000)
Civilian Conservation Corps (CCC)

Midterm 3 (Final – take-home)

General concepts – national comparisons

- What are the fire regimes of the Eurasian forest?
- How did Swedish (and Finnish) agriculture evolve? How was Russian agriculture similar and different?
- Explain this statement: “Canada’s fundamental fire problem is reconciling the rhythms of the northern environment with the dynamics of political confederation.”
- How does Sweden’s “social model” shape fire management?
- How does Canada’s political structure affect fire management? How does this differ from the U.S.?
- How does the economics of fire management differ between the U.S. and Canada?
- How does the Canadian Forest Service differ from the U.S. Forest Service?
- How does the fire policy of Parks Canada differ from that of the U.S. National Park Service?
- What was the strategy (and what were the methods) of fire protection in the Soviet Union?
- How did the debate about controlled burning differ in Australia from elsewhere? What are the issues today? What might the U.S. learn from Australia’s controversies involving prescribed fire?

General concepts – American fire scene

- What are the major problem fires in America today?
- What are the management strategies for each? And what are the strengths and liabilities of each strategy?
- Why is wilderness fire difficult to manage? Is it a national problem?
- Why do houses keep burning, and is this even a national problem?
- What are the practical options for restoring fire to landscapes?