

Syllabus

GSE-GEOG-WL-BIOL 767 Fire and Ecosystems

Meeting Times: Wednesdays @ 2:00 – 4:50 PM

Meeting Location: Wecota 100

Instructor: Professor Mark A. Cochrane, 115H Wecota, 688-5353,
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Office Hours for Spring 2011: Tuesdays & Thursdays 2:00-3:30 PM; or by appointment

Course Objectives: The specific objectives of the course are to provide the student with:

1. A comprehensive understanding of how fuel, topography and weather influence fire behavior.
2. Detailed information on the tenets of fire ecology and how they relate to plant and animal individuals and populations.
3. Integrated treatment of fire behavior and ecosystems response so that community composition and ecosystem properties can be understood or predicted.
4. A synthetic view of how human land use, fire history and biophysical conditions lead to ecosystem development and change over time for regions of interest to the student.

Required Texts: **The Ecology of Fire** by Robert J. Whelan. 2002. Cambridge University Press. Fire Weather by Schroeder and Buck. 1970. (I will provide this in pdf form as it is out of print).

Optional Texts: (a) **Fire Ecology of Pacific Northwest Forests** by James K. Agee. 1993. Island Press. *This is an excellent overview of plant related fire ecology especially for those interested coniferous forests.* (b) **Fire Vegetation and Dynamics** by Edward A. Johnson. 1992. Cambridge University Press. *This is an excellent short book on plant related fire ecology with particular emphasis on boreal forests.* (c) **Introduction to Wildland Fire** by Stephen J. Pyne, P.L. Andrews and R.D. Laven. 1996. John Wiley & Sons, Inc. *This book is a great overview of fire behavior, fire management and fire ecology principles, but it will cost you an arm and a leg, so acquire this only if you are planning on having a professional fire-related library!*

Course Grade: Participation in class discussions (40%), Quizzes (30%), Course paper/project (30%).

Class discussions will be integral to the course. While there will be lecture materials, students are expected to interact with the instructor and each other in moderated discussion of each day's materials. Students are expected to contribute at least one question for class discussion each week.

Quizzes will be given for the different sections of the course to verify understanding of important concepts and definitions. Since the course is designed to provide a synthetic understanding of how fire behavior and ecosystems interact, it is critical that concepts of each section are understood.

Course paper/project: The paper or project is a flexible assignment that must be approved by the instructor. The purpose is to provide the student with vehicle for applying the course materials to their own research or to an ecosystem or region of interest. A literature review can be used for this but the student is expected to explore the concepts from the course and synthesize materials. The project may also be related to data analysis or similar work if pertinent to the course.

Supplemental Readings:

Agee, J.K. *Fire ecology of Pacific Northwest forests*. (Island Press, Washington, D.C., 1993) (pages 42-52).

Agee, J.K. 1997. The severe weather wildfire—too hot to handle? *Northwest Science* 71: 153-156.

Bailey W.O. *Report on the Michigan forest fires of 1881* (U.S. War Department, Washington D.C., 1882).

Baird, B.N. 2006. Comments on “Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk”. *Science* 313: 615b.

Bessie, W.C. and E.A. Johnson. 1995. The Relative importance of fuels and weather on fire behavior in subalpine forests. *Ecology* 76: 747-762.

Bond, W.J., Woodward F.I. and G.F. Midgley. 2005. The global distribution of ecosystems in a world without fire. *New Phytologist* 165: 525-537.

Bond, W.J. and A.C. Scott. 2010. Fire and the spread of flowering plants in the Cretaceous. *New Phytologist* 188: 1137-1150.

Bowman, D.M.J.S. 1998. Tansley Review No. 101, The impact of Aboriginal landscape burning on the Australian biota. *New Phytologist* 140: 385-410.

Bowman, D.M.J.S., J.K. Balch, P. Artaxo, W.J. Bond, J.M. Carlson, M.A. Cochrane, C.M. D’Antonio, R.S. DeFries, J.C. Doyle, S.P. Harrison, F.H. Johnston, J.E. Keeley, M.A. Krawchuck, C.A. Kull, J.B. Marston, M.A. Moritz, I.C. Prentice, C.I. Roos, A.C. Scott, T.W. Swetnam, G.R. van der Werf and S.J. Pyne. 2009. Fire in the Earth System. *Science* 324: 481-484.

Brooks, M.L., C.M. D’ Antonio, D.M. Richardson, J.B. Grace, J.E. Keeley, J.M. DiTomaso, R.J. Hobbs, M. Pellant and D. Pyke. 2004. Effects of invasive alien plants on fire regimes. *BioScience* 54: 677-688.

Brown, J.K. 1974. *Handbook for inventorying downed woody material*. United States Department of Agriculture Forest Service General Technical Report INT-6. Intermountain Research Station, Ogden, Utah, USA.

Brown, P.M., C.L. Wienk and A.J. Symstad. Fire and forest history at Mount Rushmore. *Ecological Applications* 18: 1984-1999.

Cochrane, M.A. *et al.* 1999. Positive feedbacks in the fire dynamic of closed canopy tropical forests. *Science* 284: 1832-1835.

Cochrane, M.A. 2003. Fire Science for Rainforests. *Nature* 421: 913-919.

Cochrane, M.A. and K.C. Ryan. 2009. Fire and fire ecology: Concepts and principles. Pp. 25-62 in M.A. Cochrane, ed. *Tropical Fire Ecology: Climate Change, Land Use and Ecosystem Dynamics*. Springer-Praxis, Heidelberg, Germany.

Donato, D.C., J.B. Fontaine, J.L. Campbell, W.D. Robinson, J.B. Kauffman and B.E. Law. 2006. Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk. *Science* 311: 352. Including Supporting Online Material.

Donato, D.C., J.B. Fontaine, J.L. Campbell, W.D. Robinson, J.B. Kauffman and B.E. Law. 2006. Response to Comments on “Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk”. *Science* 313: 615c. Including Supporting Online Material.

Donovan, G.H. and T.C. Brown. 2007. Be careful what you wish for: the legacy of Smokey Bear. *Frontiers in Ecology* 5: 73-79.

Flannigan, M.D., B.J. Stocks and B.M. Wotton. 2000. Climate change and forest fires. *The Science of the Total Environment* 262: 221-229.

Jackson, W.D. 1968. Fire, air, water and earth – An elemental ecology of Tasmania. *Proc. Ecol. Soc. Aust.*, 3, 9-16.

Keeley, J.E., C.J. Fotheringham and M. Morais. 1999. Reexamining fire suppression impacts on brushland fire regimes. *Science* 284: 1829-1832.

Kulakowski, D. and T.T. Veblen. 2007. Effect of Prior Disturbances on the Extent and Severity of a 2002 Wildfire in Colorado Subalpine Forests. *Ecology* 88: 759-769.

McCullough, D.G., R.A. Werner and D. Neumann. 1998. Fire and insects in northern and boreal forest ecosystems on North America. *Annual Review of Entomology* 43: 107-27.

McKenzie, D. Z. Gedalof, D.L. Peterson and P. Mote. 2003. Climatic change, wildfire, and conservation. *Conservation Biology* 18: 890-902.

Minnich, R.A. 1983. Fire mosaics in Southern-California and Northern Baja California. *Science* 219: 1287-1294.

Mutch, R.W. 1970. Wildland fires and ecosystems—a hypothesis. *Ecology* 51: 1046-1051.

Newton, M., S. Fitzgerald, R.R. Rose, P.W. Adams, S.D. Tesch, J. Sessions, T. Atzet, R.F. Powers and C. Skinner. 2006. Comments on "Post-Wildfire Logging Hinders Regeneration and Increases Fire Risk". *Science* 313: 615a.

Pyne, S.J., P.L. Andrews and R.D. Laven. 1996. *Introduction to wildland fire*. 769p. (John Wiley and Sons, New York) Pages 3-24.

Running, S.W. 2006. Is Global Warming Causing More, Larger Wildfires? *Science* 313: 927-928.

Ryan, K. C., E. Rigolot, and H. Botelho. 1994. Comparative analysis of fire resistance and survival of Mediterranean and Western North American Conifers. In: Proceedings of the 12th Conference on Fire and Forest Meteorology. Society of American Foresters, Bethesda, MD. pp. 701-708.

Ryan, K.C. 2002. Dynamic interactions between forest structure and fire behavior in boreal ecosystems. *Silva Fennica* 36: 13-39.

Schwilk, D.W. and D.D. Ackerly. 2001. Flammability and serotiny as strategies: correlated evolution in pines. *Oikos* 94: 326-336.

Turner, M.G., W.H. Romme, R.H. Gardner and W.W. Hargrove. 1997. Effects of fire size and pattern on early succession in Yellowstone National Park. *Ecological Monographs* 67: 411-433.

Turner, M.G. and W.H. Romme. 1994. Landscape dynamics in crown fire ecosystems. *Landscape Ecology* 9: 59-77.

Wellington, A.B. and I.R. Noble. 1985. Post-fire recruitment and mortality in a population of the Mallee *Eucalyptus Incrassata* in semi-arid, south-eastern Australia. *Journal of Ecology* 73: 645-656.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan and T.W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. *Science* 313: 940-943. Including Supporting Online Material.

Week	Date	Lecture Topic	Text Reading	Supplemental Reading
1	1/19/11	Course Introduction, Film – Fire Wars	Whelan; Chapter 1	
2	1/26/11	Combustion and Heat Transfer	Whelan; Chapter 2	Bowman et al. 2009 Handout – Pyne et al. 1996 – Pages 3-24
3	2/2/11	The Fire Environment; Topographic Influences; Basic Weather; Video	Schroeder and Buck; Chapter 1	http://meted.ucar.edu/fire/fwx/ Flannigan et al. 2000; McKenzie et al. 2003; Running 2006; Westerling et al. 2006
4	2/9/11	Temperature/Humidity, Atmospheric Stability	Schroeder and Buck; Chapters 2, 3, & 4	http://meted.ucar.edu/fire/fwx/ Bessie and Johnson 1995
5	2/16/11	Winds	Schroeder and Buck; Chapters 5-10	http://meted.ucar.edu/fire/fwx/ Agee 1997
6	2/23/11	Fuels; Fuel Moisture	Schroeder and Buck; Chapter 11	Brown 1974; Agee 1993 pages 42-52; Kulakowski and Veblen 2007
7	3/2/11	Fire Behavior/ First and Second Order Fire Effects	Cochrane and Ryan 2009	Bailey 1882; Cochrane et al. 1999; Ryan 2002
*****	3/9/11	Spring Break	*****	*****
8	3/16/11	Plant Tolerance to Fires	Whelan; Chapter 3 (pages 58-103)	Ryan et al. 1993; Bond et al. 2005
9	3/23/11	Fire and Evolution in Plants	Whelan; Chapter 3 (pages 116-134)	Mutch 1970; Schwilk and Ackerly 2001; Bond and Scott 2010
10	3/30/11	Fire and Animals	Whelan; Chapter 3 (pages 104-116); Chapter 6)	McCullough et al. 1998
11	4/6/11	Plant Populations and Fire	Whelan; Chapter 5	Turner et al. 1997; Wellington and Noble 1985; Donato et al. 2006 – and resulting controversy
12	4/13/11	Human Land Use and Fire Regime Changes		Bowman 1998; Cochrane 2003; Donovan and Brown 2007
13	4/20/11	Plant Communities and Fire	Whelan; Chapter 7	Jackson 1968; Brooks et al. 2004 Brown et al. 2008
14	4/27/11	Landscape Ecology and Fire		Minnich 1983; Keeley 1999; Turner and Romme 1994

Standard Disclaimers

ADA STATEMENT:

South Dakota State University is committed to providing equal access to University programs and services for all students. Under University policy and federal and state laws, students with documented disabilities are entitled to reasonable accommodations to ensure the student has an equal opportunity to perform in class. If any member of the class has such a disability and needs special academic accommodations, please notify me and make the appropriate arrangements with the Office of Disabilities Services. The ODS is located in Room 145 of Binnewies Hall. To schedule an appointment call (605) 688-4504 and request to speak with Nancy Hartenhoff-Crooks, the Coordinator of Disability Services. Reasonable accommodations may be arranged after the Office of Disabilities Services has verified your situation. Do not hesitate to contact me if any assistance is needed in this process.

ACADEMIC FREEDOM AND RESPONSIBILITY STATEMENT:

Freedom in learning. Students are responsible for learning the content of any course of study in which they are enrolled. Under Board of Regents and University policy, student academic performance shall be evaluated solely on an academic basis and students should be free to take reasoned exception to the data or views offered in any course of study. Students who believe that an academic evaluation is unrelated to academic standards but is related instead to judgment of their personal opinion or conduct should first contact the instructor of the course. If the student remains unsatisfied, the student may contact the department head and/or dean of the college which offers the class to initiate a review of the evaluation.

CHEATING AND DISHONESTY POLICY:

The consequences of academic cheating and dishonesty range from any and all plagiarized or compromised assignments, tests, and other forms of evaluations being given zero credit as per offense to a student being given a failing grade for the class in which the offense took place. There is also the possibility that any student who has committed a cheating offense may face disciplinary probation or expulsion from the University. The full policies are found in Chapter 1 of the Student Code (01: 10:23:01-1: 10:23:04) of the SDSU Student Policies Manual.

Freedom in learning. *Under Board of Regents and University policy student academic performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled. Student who believe that an academic evaluation reflects prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards should first contact the instructor of the course to initiate a review of the evaluation. If the student remains unsatisfied, the student may contact the department head and/ or dean of the college which offers the class to initiate a review of the evaluation.*