Syllabus

GSE-GEOG-766-SO1 Advanced Remote Sensing Applications: Fire and Other Disturbances

Meeting Times: Mondays @ 5:00 – 7:50 PM
Meeting Location: Wecota 100
Instructors: Professor Mark A. Cochrane, 115H Wecota, 688-5353,
mark.cochrane@sdstate.edu

Professor David Roy, 115G Wecota, 688-5352
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Office Hours for Spring 2008: Cochrane -Tuesdays & Thursdays 2:00-3:30 PM; or by appointment. Roy – by appointment.

"Advanced Remote Sensing Applications: Fire and Other Disturbances", Cochrane, M. and Roy, D., (GSE/GEOG-766-S01). This course describes the state of the practice algorithms and sensors for remote sensing of drought stress, forest degradation and biomass burning, including the location and timing of these disturbances, the area affected, and the post-disturbance effects on the environment. The need for these information, in the context of ecological and climatological applications, is emphasized. Materials are presented in lectures and experienced in lab applications. Understanding of the fundamental principles of remote sensing, physics, ecology, and computer literacy is required.

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

1. Detailed information on the capabilities of multiple remote sensing sensors for detection and monitoring of ecosystem disturbance.
2. A comprehensive understanding of a variety of applied remote sensing methods for assessing the potential for wildfire, detecting the incidence of fire, and mapping of burned area extent and characteristics.
3. Experience applying several remote sensing methods for monitoring, detecting and quantifying forest disturbance.
4. Knowledge of remote sensing land cover products and their application for fire spread modeling simulation and experience using the FARSITE Fire Area Simulator.

Required Text: None.

Course Grade: Class participation (40%), Labs (60%).

This class will be team taught. Class periods will be roughly 1/3 lecture and 2/3 lab. Lectures and class discussions will be integral to the course and support the subsequent lab exercises. Required readings and moderated discussion will augment the lecture and lab components.

Students are expected to apply class materials in several lab exercises. Labs will be graded on successful completion of subcomponents discussion questions.

Supplemental Readings:

Adams, J.B. D.E. Sabol, V. Kapos, R.A. Filho, D.A. Roberts, M.O. Smith and A.R. Gillespie. 1995. Classification of Multispectral Images Based on Fractions of Endmembers: Application to Land-Cover Change in the Brazilian Amazon. *Remote Sensing of Environment* 52: 137-154.

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

Cochrane, M.A. and C.M. Souza Jr. 1998. Linear mixture model classification of burned forests in the eastern Amazon. *International Journal of Remote Sensing* 19: 3433-3440.

Chuvieco, E., D. Cocero, D. Riano, P. Martin, J. Martinez-Vega, J. de la Riva and F. Perez. 2004. Combining NDVI and surface temperature for the estimation of live fuel moisture content in forest fire danger rating, *Remote Sensing of Environment* **92**(3):322-331.

Friedl, M.A. and C.E. Brodley. 1997. Decision Tree Classification of Land Cover from Remotely Sensed Data. *Remote Sensing of Environment* 61: 399-409.

Giglio, L. J. Descloitres, C.O. Justice and Y. Kaufman. 2003. An enhanced contextual fire detection algorithm for MODIS. *Remote Sensing of Environment* 87: 273-282.

Giglio, L. 2007. Characterization of tropical diurnal fire cycle using VIRS and MODIS observations. *Remote Sensing of Environment* 108: 407-442.

Hansen, M.C., R.S. DeFries, J.R.G. Townshend, M. Carroll, C. Dimiceli and R.A. Sohlberg. 2003. Global Percent Tree Cover at a Spatial Resolution of 500 Meters: First Results of the MODIS Vegetation Continuous Fields Algorithm. *Earth Interactions* 7: Paper 10.

Keane, R.E., R. Burgan, and J.V. Wagtendonk. 2001. Mapping wildland fuels for fire management across multiple scales: Integrating remote sensing, GIS, and biophysical modeling. *International Journal of Wildland Fire*. 10: 301-319

Lentile, L.B., Z.A. Holden, A.M.S. Smith, M.J. Falkowski, A.T. Hudak, P. Morgan, S.A. Lewis, P.E. Gessler and N.C. Benson. 2006. Remote sensing techniques to assess active fire characteristics and post-fire effects. *International Journal of Wildland Fire* 15: 319-345.

McHugh, C.W. 2006. Considerations in the Use of Models Available for Fuel Treatment Analysis. In: Andrews, Patricia L., B.W. Butler,,comps. 2006. *Fuels Management-How to Measure Success: Conference Proceedings*. 28-30 March 2006; Portland, OR. Proceedings RMRS-P-41. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 24 p.

Miller, J.D. and A.E. Thode. 2007. Quantifying burn severity in a heterogeneous landscape with a relative version of the delta Normalized Burn Ratio (dNBR). *Remote Sensing of Environment* 109: 66-80.

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.

Radeloff, V. C., R. B. Hammer, S. I Stewart, J. S. Fried, S. S. Holcomb, and J. F. McKeefry. 2005. The Wildland Urban Interface in the United States. *Ecological Applications* 15: 799-805.

Roy, D.P., L. Boschetti and S.N. Trigg. 2006. Remote Sensing of Fire Severity: Assessing the Performance of the Normalized Burn Ratio. *IEEE Geoscience and Remote Sensing Letters* 3: 112-116.

Roy D.P. and T. Landmann. 2005. Characterizing the surface heterogeneity of fire effects using multi-temporal reflective wavelength data. *International Journal of Remote Sensing* 26: 4197-4218.

Roy, D.P., Y. Jin, P.E. Lewis and C.O. Justice. 2005. Prototyping a global algorithm for systematic fire-affected area mapping using MODIS time series data. *Remote Sensing of Environment* 97: 137-162.

Sandholt, I., K. Rasmussen and J. Andersen. 2002. A simple interpretation of the surface temperature/vegetation index space for assessment of surface moisture status, *Remote Sensing of Environment* **79**(2-3):213-224.

Souza, C.M., Roberts, D.A. and M.A. Cochrane. 2005. Combining Spectral and Spatial Information to Map Canopy Damages from Selective Logging and Forest Fires. *Remote Sensing of Environment* 98: 329-343.

Stewart, S. I., V. C. Radeloff, R. B. Hammer, and T.J. Hawbaker. 2007. Defining the Wildland Urban Interface. *Journal of Forestry* 105: 201-207.

Stratton, R.D. 2006. Guidance on Spatial Wildland Fire Analysis: Models, Tools, and Techniques. Gen. Tech. Rep. RMRS-GTR-183. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 15 p.

Verbesselt, J., S. Fleck and P. Coppin. 2002. Estimation of fuel moisture content towards Fire Risk Assessment: A review, in: *Forest Fire Research & Wildland Fire Safety* Viegas (ed.), Millpress, Rotterdam.

Week	Date	Lecture Topic	Lab Topic	Supplemental Reading
1	1/28/08	Course Introduction, – Remote Sensing of Environment - Principles of Change Detection - Fire Basics	Lab Introduction	Agee 1993; Pyne et al. 1996
2	2/4/08	Fire Vulnerability I	Fire Vulnerability 1: Moisture Stress	Verbesselt et al. 2002
3	2/11/08	Fire Vulnerability II	Fire Vulnerability 2: Fire Danger	Sandholt et al. 2002; Chuvieco et al. 2004
	2/18/08	Presidents Day		
4	2/25/08	Active Fire Detection	Satellite data ordering	Giglio et al 2003; Giglio 2007
5	3/3/08	Active Fire Detection II	Active Fire Detection Lab	
6	3/10/08	Fire Risk	Fire Risk	Radeloff et al. 2005; Stewart et al. 2007
**	3/17/08	*No Class – Spring Break*	**********	**********
7	3/24/08	Spectral Mixture Analysis I	Forest Degradation 1	Adams et al. 1995; Cochrane and Souza 1998
8	3/31/08	Spectral Mixture Analysis II/Decision Trees	Forest Degradation 2	Friedl and Brodley 1997; Hansen et al. 2003; Souza et al. 2005
9	4/7/08	MODIS Burned Area	No lab	Roy and Landmann 2005; Roy et al. 2005 IALE Conference (FYI – I'm traveling)
10	4/14/08	Landsat Burned Area	Burn Area mapping Lab	Roy et al. 2006; Lentile et al. 2006
11	4/21/08	Landsat Burn severity characterization	Burn Severity characterization	Miller and Thode 2007
12	4/28/08	Fire Spread Modeling I	Introduction to FARSITE & LANDFIRE	Keane et al. 2001; McHugh 2006 NASA Meeting (FYI – I'm traveling)
13	5/5/08	Fire Spread Modeling II	Fire spread modeling and calibration	Stratton 2006

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.*