Biology 414
Global Change Biology
Spring 2006
Dr. Daniel (Max) Taub
MWF 8:00-8:50 FJSH 151, Lab TH 2:30-5:30 FJSH 251

Instructor: Dr. Daniel (Max) Taub, Dept. of Biology

Office: Fondren-Jones 140 (the new part)

Office hours: M 12:00-1:00, Tu 9:30-10:30, or by appointment. You can also drop by anytime to see if I'm available. The best way to be sure that I can meet with you is to schedule an appointment- during office hours you might find that there are others already meeting with me, or that I've had to step out of the office for a moment.

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Course content: This course will survey the biological implications of anthropogenic changes to the geosphere/biosphere, with a particular emphasis on the responses of plants and ecosystems. Global change factors considered will include rising atmospheric CO_2, depletion of stratospheric ozone, alterations to the global nitrogen cycle, and global climate change.

Course format: This course will meet three times a week for one fifty-minute hour. Many class sessions will be spent in discussions of these readings rather than in a lecture format. Labs will meet for three hours on Thursday afternoons. Labs will consist of a mix of computer modeling and empirical experiments, as well as one trip to a USDA global change research facility.

Readings The readings for this course will largely be provided though the SU library e-reserve system. The course password is "ozone" (don't include the quotation marks). These readings are taken from a wide variety of sources, including professional scientific literature as well as textbooks. Consequently, the readings may be more challenging than in a class that closely follows a textbook. They will also hopefully be more up-to-date; most readings for this class will be from sources published in the past three or four years.

Course Policies:

Grading:

You will receive a base grade that may or may not (see below) be modified to obtain your final grade

Base Grade

There will be a number of different items that will be graded to determine your base grade:

4 Examlets- short exams, typically of 1 or 2 questions	
10% each for your three best, 5% for the one you do the least well on	35%
Final Exam	20%
Computer modeling assignments (3 @ 8% each)	24%
Experimental research planning documents and final report	15%
Research Presentation	6%

Examlets: These will be short exams that will typically present you with data taken from a published study, and ask you to interpret it in light of what we have been covering in class.

Final exam; This will be a comprehensive exam that will cover all aspects of the course.

Computer modeling assignments: There will be several assignments in which you will produce models of global-change-related phenomena, and/or evaluate existing models.

Research Report : Students will work in groups to design and conduct an independent experiment. Each student will write documents during the planning process, and also a paper describing the rationale for and design and results of an experiment that they will perform as a group.

Research Presentation: Each research group will present their experimental results to the entire class in an oral presentation during the last week of classes.

Modifications to the basic grade

Your base grade may be modified to determine your final grade. This will be done to reflect noteworthy contributions that you make, and/or shirking of your responsibilities.

Contributions to class discussions: Many of the class periods will be spent in discussion of the papers that we have read. Your active participation is highly valued, and will be rewarded. Your grade for participation will be based on my perception of the quality and quantity of your active involvement in class discussions. Additions to the base grade will be:

Discussion Grade	Addition to base grade
A+	3 points (i.e. 3%)
A	2 points
A-	1 point
B+	0.5 points

Because you will not be able to participate in the discussion if you do not attend, subtractions will be made to the base grade for unexcused absences on days that we discuss papers. For the second and each subsequent such absence, there will be a 1 point reduction in your final grade. Also, because it is nearly impossible to discuss a paper that you do not have in front of you, bringing a copy of the readings to class is also required, and failing to do so will lead to a deduction of 0.5 points from your final grade for the second and each subsequent day that you do not bring the reading that we are discussing.

Asking questions

Asking pertinent questions in class is valued. In general, this will count toward the class discussion grade. Particularly valued is the asking of pertinent questions that I am unable to answer, but feel that I ought to be able to answer. When you ask such a question, I will ask you to submit it to me in writing. Based on the number of such questions that you have submitted during the semester, you may receive an addition to your base grade of up to 2 points.

Participation in experiment : For the empirical experiments that we perform to be successful, each student must do their fair share of the work. If I perceive that you are not doing so, or are

performing this work in a careless or inappropriate fashion I will deduct up to ten points from your final grade. Unexcused absences on days that we are performing or discussing the experiments will definitely be counted in this regard.

Grades will be based on the calculated percentage for all components of the course, including the base grade and all modifications, according to the table below:

Percent	Grade
97-100	A+
93-96.99	A
90-92.99	A-
87-89.99	B+
83-86.99	B
80-82.99	B-
77-79.99	C+
73-76.99	C
70-72.99	C-
67-69.99	D+
63-66.99	D
60-62.99	D-
<60	F

Accommodations for disabilities:

Appropriate accommodations will be made for students with disabilities in accordance with University policy. All students requesting such accommodations must consult with the Office of Academic Services. For special accommodations for exams, students must make arrangements with Academic Services at least three weeks prior to the exam.

Honor system

All work is covered under the honor code. All suspected violations will be taken seriously and dealt with under the approved procedures as found in the Student Handbook. Lying or misrepresentation of the reasons for missing class will be considered a violation of honor, and will be treated as such.

Readings

Aguado, E. and Burt, J.E. (2004). *Understanding Weather and Climate,* 3rd edition. Pearson Education, Upper Saddle River, New Jersey, pp. 68-83, 475-499.

Oliver, J.E. and Hidore, J.J. (2002). *Climatology: An Atmospheric Science*, 2nd edition. Prentice Hall, Upper Saddle River, New Jersey, pp. 260-279.

Turco, Richard P. (2002) *Earth Under Siege: From Air Pollution to Global Change, 2nd edition*. Oxford Univ: Oxford, pp 293-298, 307-316.

Ashenden, T.W. (2002). Effects of wet deposited acidity. In Bell, J.N.B. and Treshow, M. eds. *Air Pollution and Plant Life*, 2nd edition. Wiley: West Sussex, pp. 237-249.

IPCC (2001a). *Technical Summary of the Working Group I Report*. Intergovermental Panel on Climate Change, pp 21-46.

Grace, J. (2004). Understanding and managing the global carbon cycle. *Journal of Ecology* 92: 189-202.

IPCC (2001a). *Technical Summary of the Working Group I Report*. Intergovermental Panel on Climate Change, pp 46-55,62-77.

Raven, P.H., Evert, R.F. and Eichhorn, S.E. (2005). *Biology of Plants*, 7th edition. W.H. Freeman, New York, pp. 115-139, 516-518.

Guo, L.B. and Gifford, R.M. (2002) Soil carbon stocks and land use change: a meta analysis. *Global Change Biology* 8: 345-360

Raven, P.H., Evert, R.F. and Eichhorn, S.E. (2005). *Biology of Plants*, 7th edition. W.H. Freeman, New York, pp. 667-679.

Medlyn, B.E. and McMurtrie, R.E. (2005). Effects of CO_2 on Plants at Different Timescales. In *A History of Atmospheric CO2 and its Effects on Plants, Animals and Ecosystems*. Ehleringer, J., Cerling, T and Dearing, M.D. eds. Springer-Verlag, New York, pp. 441-451.

Poorter, H. and Navas, M.-L. (2003) Plant growth and competition at elevated CO2: on winners, losers and functional groups. *New Phytologist* 157: 175-198

Wullschleger,S.D., Tschaplinski,T.J. and Norby, R.J. (2002) Plant water relations at elevated CO_2- implications for water-limited environments. *Plant, Cell and Environment* 25: 319-331

Davis, M.B. and Shaw, R.G. (2001) Range shifts and adaptive responses to quaternary climate change. *Science* 292: 673-679

Berteaux, D., Reale, D., McAdam, G. and Boutin, S. (2004). Keeping pace with fast climate change: Can arctic life count on evolution? *Integrative and Comparative Biology*, 44: 140-151.

Turco, Richard P. (2002) *Earth Under Siege: From Air Pollution to Global Change, 2nd edition*. Oxford Univ: Oxford, pp 301-305.

Galloway, J.N.et al. (2003) The Nitrogen Cascade. *Bioscience* 53: 341- 356

Vingarazan, R. (2004). A review of surface ozone background levels and trends. *Atmospheric Environment* 38: 3431- 3442.

Long, S.P. and Naidu, S.L. (2002). Effects of oxidants at the biochemical, cell and physiological levels, with particular reference to ozone. In Bell, J.N.B. and Treshow, M. eds. *Air Pollution and Plant Life*, 2nd edition. Wiley: West Sussex, pp. 69-88.

Ashmore, M.R. (2002). Effects of oxidants at the whole plant and community level. In Bell, J.N.B. and Treshow, M. eds. *Air Pollution and Plant Life*, 2nd edition. Wiley: West Sussex, pp. 89-118.

Legge, A.H. and Krupa, S.V. (2002). Effects of sulphur dioxide. In Bell, J.N.B. and Treshow, M. eds. *Air Pollution and Plant Life*, 2nd edition. Wiley: West Sussex, pp. 135-162.

Turco, Richard P. (2002) *Earth Under Siege: From Air Pollution to Global Change, 2nd edition*. Oxford Univ: Oxford, pp 407-416, 422-440.

IPCC (2005). Safeguarding the ozone layer and the global climate system : Issues relating to hydroflurocarbons and perflurocarbons. Technical Summary. Intergovernmental Panel on Climate Change, pp 16-47.

Searles, P.S., Flint, S.D. and Caldwell, M.M. (2001). A meta-analysis of plant field studies simulating stratospheric ozone depletion. *Oecologia* 127:1-10.

De Gruijl, F.R., Longstreth, J., Norval, M., Cullen, A.P., Slaper, H., Kripke, M.L., Takizawa, Y. and van der Leun, J.C. (2003). Health effects from stratospheric ozone depletion and interactions with climate change. *Photochemical and Photobiological Sciences* 2: 16-28.

Scavia, D. et al. (2002). Climate change impacts on U.S. coastal and marine ecosystems. *Estuaries* 25: 149-164

Brown, B. E. (2002). Coral bleaching (1997-1998). In Mooney, H.A. and Canadell, J.G., eds. *Encyclopedia of Global Environmental Change*, Vol. 2. Wiley: West Sussex, pp 231-232.

Gattuso, J.-P. and Buddemeier, R.W. (2002). Coral reefs: an ecosystem subject to multiple environmental threats. In Mooney, H.A. and Canadell, J.G., eds. *Encyclopedia of Global Environmental Change*, Vol. 2. Wiley: West Sussex, pp 232-241.

Lanoo, Michael, editor (2005). *Amphibian Declines: The Conservation Status of United States Species*. University of California Press: Berkely. Chapters 1, 11, 14, 15, 18 and 20. (These chapters are short- 35 pages total).

Ruddimann, W.F. (2003) The anthropogenic greenhouse era began thousands of years ago. *Climatic Change* 61: 261-293.

Conacher, A.. (2002). Salinity and Agriculture. In Douglas, I., ed. *Encyclopedia of Global Environmental Change*, Vol. 3. Wiley: West Sussex, pp 559-564.

Reilly, J., Tubiello, F., McCarl, B. and Melillo, J. (2001). Climate Change and Agriculture in the United States. In: *Climate Change Impacts on the United States - Foundation Report: The Potential Consequences of Climate Variability and Change*. Edited by National Assessment Synthesis Team. Pp 380-389.

Larcher, W. (2003) *Physiological Plant Ecology,* 4th edition. Springer-Verlag, Berlin. Pp 416-428.

IPCC (2001b). Human Health. In *Climate Change 2001: Impacts and Vulnerability*. Intergovernmental Panel on Climate Change, 451-485.

Date	Topic	Reading	Availability
1/16	MLK day- no class		
1/18	Introduction		
1/19	Introduction to Modeling		
1/20	Global Climate System and Climate Change	Aguado and Burt (2004) 68-83, 475-499	e-reserve
1/23	Paleoclimates	Oliver and Hidore (2002) 260-279	e-reserve
1/25	Biogeochemistry and the carbon cycle	Turco (2002) 293-298, 307-316	e-reserve
1/26	**Carbon models**		
1/27	Introduction to experimental planning	Ashenden (2002)	e-reserve
1/30	Anthropogenic forcings	IPCC (2001)a. 21- 46	e-reserve
2/1	**Discuss Grace**	Grace (2004)	e-reserve
2/2	General Circulation Models	IPCC (2001a). pp 46-55,62-77.	e-reserve
2/3	Photosynthesis I	Raven et al. (2005) 115-128	e-reserve
2/6	Photosynthesis II	Raven et al. (2005) 128-139	e-reserve
2/8	**Experimental planning**		
2/9	No class- Brown Symposium		
2/10	No class- Brown Symposium		
2/13	**Discuss Guo and Gifford**	Guo, L.B. and Gifford, R.M. (2002)	e-reserve
2/15	Plant Water Relations	Raven et al. (2005) 516-518, 667-679	e-reserve
2/16	**General Circulation Models**		
2/17	Plants and CO_2	Medlyn, B.E. and McMurtrie, R.E. (2005) 441-451	e-reserve
2/20	**Discuss Poorter and Navas**	Poorter and Navas (2003)	e-reserve
2/22	Elevated CO_2 and Plant water relations	Wullschleger et al. (2002)	e-reserve
2/23	Experimental planning		
2/24	**Examlet # 1**		
2/27	Plants and Climate change	Davis and Shaw (2001)	e-reserve
3/1	**Discuss Berteaux et al**	Berteaux et al (2004)	e-reserve
3/2	No class-Texas Academy of Science		
3/3	No class-Texas Academy of Science		
3/6	Trophic interactions	TBA	
38	Trophic interactions and Global Change	TBA	
3/9	Experimental planning		
3/10	**Examlet # 2**		
3/13	Spring break		

3/15	Spring break		
3/16	Spring break		
3/17	Spring break		
3/20	Nitrogen cycle	Turco (2002). 301-305	e-reserve
3/22	**Discuss Galloway et al**	Galloway et al. (2003)	e-reserve
3/23	**Plant functional models**		
3/24	Effects of excess nitrogen	TBA	
3/27	Surface ozone trends and ozone effects on plants and people	Vingarzan (2004), Long and Naidu (2002)	Course packet, e-reserve
3/29	**Discuss Ashmore (2002)**	Ashmore (2002)	e-reserve
3/30	Experiment		
3/31	**Examlet # 3**		
4/3	Sulfate pollution and effects	Legge and Krupa (2002)	e-reserve
4/5	Stratospheric ozone and UV	Turco (2002) 407-416, 422-440	e-reserve
4/6	Visit to Temple USDA CO_2 research facility		
4/7	Ozone depletion & mitigation	IPCC (2005) 16-47	e-reserve
4/10	**Discussion of Searles et al**	Searles et al (2001)	Course packet
4/12	No class- Passover		
4/13	No class- western Easter		
4/14	No class-western Easter		
4/17	UV effects on human health	de Gruijl et al (2003) + TBA	Course packet
4/19	**Examlet # 4**		
4/20	Experiment		
4/21	Global change and marine systems	Scavia et al (2002)	Course packet
4/24	Coral declines	Brown (2002), Gattuso, J.-P. and Buddemeier, R.W. (2002)	e-reserve
4/26	Ampibian declines, anomalies	Lannoo (2005), editor- Chapters 1,11,14, 15,18 and 20 (35 easy pages in all)	e-reserve
4/27	Experiment		
4/28	**Discuss Rudimann**	Ruddiman (2003)	Course packet
5/01	Agriculture and salinization and global change	Reilly et al. (2001), 380-389, Conacher (2002), Larcher (2003) 416-428	e-reserve
5/03	Global change and Human health	IPCC (2001)b	e-reserve
5/04	**Research Presentations**		
5/05	Global Change and human nutrition	TBA	

Final Exam: May 9, 1:30-4:30

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This syllabus is provisional and subject to change as circumstances require.