COURSE SYLLABUS - FALL 2017

Climate Change Adaptation: Perspectives at the Nexus of Science, Society, and Resource Management
RNR 440 – 540

COURSE DESCRIPTION: Much of modern society’s experience of managing resources and protecting people and infrastructure has occurred during a period of relatively stable climate. In the most recent decades in the Southwest, we have observed a cascade of impacts associated with temperature increases, including changes in snow hydrology, in phenology, and in the severity of drought impacts. Projected future climate changes and impacts may lie outside the range of climate variation that we have observed and may have more serious consequences for society and the environment. Anticipating changes will allow society to identify response options across a range of vulnerabilities and manage the risks associated with projected climate changes. In the best possible cases, these actions, or adaptations, may provide economic and other benefits to society.

In this 3 credit course, we will examine actions to reduce vulnerabilities or increase resilience to the potential impacts of climate change. Each of the class sessions is designed to include thought-provoking presentations by practitioners, land managers, and researchers – in order to ground state-of-the-art science and theory with on-the-ground realities. While the general focus will be on impacts and responses in the arid Southwest (water, fire, species, ecosystems), we will also investigate the tools, philosophies, and frameworks for advancing action and incorporating adaptation planning at the local, regional, national and international scale.

The course is open to graduate students and to seniors from relevant academic programs, with the permission of the instructors.

TIME: Thursdays, 2:00 to 4:50 PM
LOCATION: Environment and Natural Resources Building 2, Room S210

LEAD INSTRUCTORS:
Gregg Garfin (gmgarfin@email.arizona.edu) (Office: ENR2, N419; Office Hours: Thursdays, 11:00 AM-12:00 PM)
David Breshears (daveb@email.arizona.edu) (Office: ENR2, N227; Office Hours: by appointment)

Contributing Instructors
Kathy Jacobs (jacobsk@email.arizona.edu) (Office: ENR2, N462, Office Hours: by appointment)
Jim Buizer (buizer@email.arizona.edu) (Office: ENR2, N519; Office Hours: by appointment)
FORMAT: Lecture, discussion, group exercises. Frequent guest presentations by practitioners, natural resource managers, and researchers. Optional field trip to a site where adaptation measures are being implemented.

COURSE GOALS: We will explore perspectives on climate change adaptation through a series of topical presentations and discussions. The course will include exposure to key scientific literature, agency and organizational source material, analytical and planning methods, and numerous project and case studies. The overall goal of the course will be to provide students with a broad perspective of issues related to climate change adaptation, and to identify key themes, important concepts, tools and methods, best practices, and emerging lessons from this experience.

LEARNING OUTCOMES. By the end of this course, students will:

- Be familiar with key literature on adaptation to climate change, climate science, and impacts on natural resources and other sectors
- Develop an understanding of tools and methods used in assessing vulnerability to climate change, developing adaptation options, and planning for adaptation to current and future changes
- Develop critical thinking skills with respect to the science upon which climate change adaptation decisions, practices, and policies are based
- Develop skills in oral and written synthesis of course concepts

EXPECTATIONS: Registered students should be prepared to:

- Attend all presentations and discussion sessions
- Review all background materials prior to the class sessions
- Participate actively in discussion sessions
- Complete multiple written assignments for selected sessions during the course
- Complete an individual research paper, project report, or proposal, and make a short presentation of this assignment to the class

REQUIRED READINGS: Two to three core readings per week will be identified and made available electronically (via the course D2L site); optional readings for each topic will be offered for those students interested in further study. Some materials will be distributed as handouts during class sessions.
GRADING: Since the course seeks to cover a broad set of concepts by highlighting applications in a range of program settings, class attendance throughout the semester is mandatory.

For undergraduate students (seniors):

- Attendance and active participation in class sessions will account for 25% of the grade for the course for undergraduate students.

- Writing assignments. Students will select two sessions of particular interest during the semester, and prepare written assignments for those sessions. The writing assignments will consist of: an abstract summarizing one of the overview class sessions, and a short synthesis of literature from one of the four natural resource adaptation class sessions (see below for details). The written assignments will constitute 20% of the grade for the course (10% for each assignment).

- Final paper, including preparation and oral presentations. Students will also identify a research topic, project or policy report, or a project or research proposal, to pursue in greater depth during the semester. Topics will be discussed with and approved by the instructors by Week 8 (October 12). The final paper, including precursor components, will account for 55% of the student’s grade, as follows:
  - Students will prepare a brief research proposal, including a title, a description of the overall topic, the importance of the topic, the climate adaptation elements of the topic, and at least one expected finding (based on literature about this topic). The proposal is due during Week 6 (September 28). Proposal length: 500 words. (10% of the course grade)
  - Students will give a 3.5 minute “lightning” presentation of their final paper topic, during the Week 8 class (October 12). The presentation should include a brief description of the overall topic, the importance of the topic, the climate adaptation elements of the topic, at least one expected finding, and at least one interesting or surprising finding or challenge. (5% of course grade)
  - Students will prepare a well-developed outline of their final paper, including at least 5 key references. The outline is due during Week 12 (November 9). (5% of course grade)
  - Students will give a 5 minute “lightning” presentation of their final paper during the Week 15 class (November 30). The presentation should include a brief description of the overall topic, the climate adaptation elements of the topic, your key findings, and the importance of your findings. Please see the description of our expectations for the final presentation, on the D2L website. (5% of course grade)
  - The final written assignment is due by **6 pm on December 6, 2017**—the final day of classes.
    - The final paper should be 3,000-4,000 words, not including references in the word count.
    - References should be formatted according to the guidelines in the citation tips on the D2L website.
    - The final paper will constitute 35% of course grading.
For graduate students: Graduate students are expected to fulfill all of the expectations for undergraduates outlined above. Graduate students are expected to produce a more in-depth final research paper project report, or proposal (5,000-6,000 words). Graduate students should aim to produce a final written assignment that is consistent with the quality of submissions for a professional journal article, and students are encouraged to use the format of a recognized journal in their field. Grading for graduate students will be determined as follows:

- Attendance and participation (20%)
  - Lead class discussion (5% - included as part of participation)
- Summary and Synthesis papers (20%)
- Final paper precursors, including initial presentation (20%)
- Final paper and final presentation (40%)

### Grading Summary

<table>
<thead>
<tr>
<th>Assignment</th>
<th>RNR 440</th>
<th>RNR 540</th>
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<tbody>
<tr>
<td>Attendance and participation</td>
<td>25%</td>
<td>20%</td>
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<tr>
<td>Overview session summary (an executive summary of key points from the lecture, readings, and discussion – 1 page; due 1 week after the class chosen by the student — due dates 9/7, 9/14, 9/21)</td>
<td>10%</td>
<td>10%</td>
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<tr>
<td>Synthesis of literature (an abstract of 300 words; due 1 week after the natural resource adaptation class chosen by the student — due dates 10/5, 10/12, 10/19, 10/26)</td>
<td>10%</td>
<td>10%</td>
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<tr>
<td>Research proposal (1-page summary — due 9/28)</td>
<td>5%</td>
<td>5%</td>
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<tr>
<td>Initial presentation of paper topic (10/12)</td>
<td>5%</td>
<td>5%</td>
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<tr>
<td>Research paper outline and references (due 11/9)</td>
<td>5%</td>
<td>5%</td>
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<td>Research paper presentation (11/30)</td>
<td>5%</td>
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<tr>
<td>Research paper written report (due 12/6)</td>
<td>35%</td>
<td>40%</td>
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<td><strong>TOTAL</strong></td>
<td><strong>100%</strong></td>
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*Extra credit: field trip (mid-to-late October)*

5% 5%

More detail on the written assignments and criteria for grading/evaluation is provided in the Addendum below.
## 2017 COURSE STRUCTURE AND TOPICS

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8/24</td>
<td>Organizational meeting, course overview; Instructors panel and discussion – Breshears (syllabus), Garfin (overview), Buizer</td>
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<tr>
<td>2</td>
<td>8/31</td>
<td>Overview 1: Climate variability and change – overview and general principles – Garfin (Guest: Weiss [UA College of Agriculture and Life Sciences])</td>
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<td>3</td>
<td>9/7</td>
<td>Overview 2: Adaptation: theory, practice, trends, and challenges – Garfin (Guest: Enquist [USGS SW Climate Science Center])</td>
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<tr>
<td>4</td>
<td>9/14</td>
<td>Overview 3: Politics, policy, and law – Fisher, (Guest: Ortiz y Pino [City of Tucson, Ward 6])</td>
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<td>5</td>
<td>9/21</td>
<td>Forest management in an era of climate change –Breshears (Guests: Falk [UA SNRE], Stetson [USDA-Forest Service TBA])</td>
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<tr>
<td>6</td>
<td>9/28</td>
<td>Wildlife management: Assisted migration –Garfin (Guests: Christianson [UA SNRE], Bogan [UA SNRE])</td>
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<tr>
<td>7</td>
<td>10/5</td>
<td>Water: Climate change and water management in the arid Southwest – Jacobs, Garfin (Guest: Seasholes [Central Arizona Project])</td>
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</table>
| 8    | 10/12  | Proposals approved  
Presentation of topics  
Abstract 10/5 due |
|      |        | Summary discussion and review; mid-course evaluation – Garfin  
Preliminary student presentations |
| 10   | 10/26  | Tools 1: Vulnerability assessment – Garfin, Jacobs, Breshears (Guest: Guido [UA Institute of the Environment], Knutson [UA Institute of the Environment, TBA]) |
| 11   | 11/2   | Tools 2: Scenario planning – Garfin, Enquist (Guests: Marra [Southwest Water Resources Consulting], Hornbach [Anthros Consulting]) |
| 12   | 11/9   | Tools 3: Adaptation planning – Jacobs, Garfin, (Guest: Meadow [UA Institute of the Environment]) |
| 13   | 11/16  | Overview 4: International issues and the emerging global architecture for climate change –Buizer, Garfin |
| 14   | 11/23  | THANKSGIVING |
| 15   | 11/30  | Final student presentations – Garfin, Breshears, Buizer, Jacobs |
|      | 12/6   | Final Papers due (no class this week) |
ADDENDUM: CRITERIA FOR EVALUATION/GRADING

1) Attendance and participation
   - Physical attendance at all class sessions.
   - Active engagement in class discussions, including thoughtful questions or comments that advance class discussion.
   - Advance readings and timely completion of all written assignments.
   - Grad students: co-lead discussion of readings during management classes (Weeks 5, 6, 7, 9, 13).
   - No texting or emailing during class sessions – this will result in reduction of 5% your grade for the course.

2) Field trips
   - There will be one field trip during the course, to the Las Cienegas National Conservation Area. Participation, while strongly encouraged, is optional.
   - The field trip will be held on a weekend (likely on Saturday), approximately 6 – 8 hours in duration, and scheduled with students during the initial class session.
   - Extra credit (5% of total grade) will be awarded to students participating in the field visit.

3) Overview session summary – Executive Summary
   - Students will summarize readings from one of the three overview sessions (Weeks 2, 3, 4) in a crisp, one side of a page (single spaced) executive summary.
     - Grading will be based on your ability to articulate key points, and develop at least one original finding, based on a synthesis of knowledge from the readings, lecture, and discussion. With this, and all writing assignments, we expect excellent English-language grammar, and demonstration of critical thinking.

4) Synthesis of literature – Scientific Abstract
   - Students will summarize one of the four natural resources content sessions (Weeks 5, 6, 7, 9) in a crisp, 300 word abstract.
     - Grading will be based on your ability to articulate key points, based on a synthesis of knowledge from the readings and class lectures. With this, and all writing assignments, we expect excellent English-language grammar, and demonstration of critical thinking.

5) Final research paper, project or policy report, research or project proposal (individual assignment)
   - This assignment is intended to provide students with an opportunity to explore a research topic or relevant program or policy issue in greater analytical depth. Students may also choose to use the final assignment as an opportunity to develop a full research or project proposal. However, the term paper must be a distinct and original piece of writing which addresses a topic relevant to course material.
The final paper should provide an in-depth examination of a topic related to climate change adaptation, and framed in terms of critical question(s) or an assessment of a contemporary policy issue or project initiative.

The topic will be identified by students, based on their individual interests.

Students are strongly encouraged to meet with instructors to identify topics, and to review proposed topics and outlines.

Students will submit a proposed topic, by Week 6 (28 September), including:

- Title
- Statement of relevance to climate adaptation
- Geographic scope
- How is the subject of interest exposed to climate change?
- What is vulnerable? (e.g., populations, infrastructure, species, habitats)
- Expected findings
- Expected sources of information

Proposals will be reviewed and approved by instructors by Week 8 (12 October).

Papers should be single-spaced, 12 point Times New Roman.

Recommended Length: undergrads at least 3,000 words, maximum 4,000 words; graduate students at least 5,000 words, maximum 6,000 words

- References are not included in the word count
- Students are strongly encouraged to include figures, maps, tables and other visuals that help summarize, synthesize, and clarify the articulation of important findings presented in your papers.
  - See “Criteria for Reviews” (except for the word limits). Make sure to read the parts on “Writing Style,” and “References Section: Examples.”

Final papers are due no later than 6 PM on the last day of classes, December 6, 2016

Examples of well-written past papers from this class will be provided in the D2L site for the class.

6) Review Criteria for All Writing Assignments:

- Content and relevance (30%)
- Critical thinking and analysis (30%)
- Application of key concepts and literature (20%)
- Writing skills (20%)
- Writing should be succinct and consistent with the highest standards of scientific writing.
- Students are expected to provide appropriate citations and bibliographic references (See the class D2L website for guidelines) (See *Frontiers in Ecology and the Environment* – above).
CLASSROOM BEHAVIOR:

- All cell phones and beepers must be turned off prior to entering the classroom. These sounds and conversations distract both students and instructors alike. The sole exception will be for those individuals involved in emergency services.
- While in class, students are expected to conduct themselves in a manner conducive to learning and in a way that does not distract the other students from learning. Respect and common courtesy to fellow students and the instructor is expected.
- We will not tolerate texting or emailing during class sessions – this will result in reduction of your overall grade.
- The Arizona Board of Regents’ Student Code of Conduct, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one’s self. See: http://azregents.asu.edu/rrc/Policy%20Manual/5-308-Student%20Code%20of%20Conduct.pdf.

SPECIAL NEEDS AND ACCOMMODATIONS: Students who need special accommodation or services should contact the Disability Resources Center (DRC), 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: uadrc@email.arizona.edu, http://drc.arizona.edu/. You must register and request that the DRC send the course instructor official notification of your accommodations needs as soon as possible. Please plan to meet with the instructor by appointment to discuss accommodations and how the course requirements and activities may impact your ability to fully participate. The need for accommodations must be documented for the DRC.

STUDENT CODE OF ACADEMIC INTEGRITY: Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/codeofacademicintegrity


SUBJECT TO CHANGE STATEMENT: Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.