

# **Adaptation to Climate Change: Perspectives at the Nexus of Science, Society, and Resource Management**

# **ASSIGNMENTS & GUIDANCE**

RNR 440/540  
Fall 2018

## **Writing**

We value writing, (a) as a means of experimenting with thought, testing ideas, (b) as a skill that is valued in many professions sought by college-educated individuals, and (c) as a craft for the clear expression of disruptive concepts, integrative frameworks, engaging stories, and carefully argued positions.

In this class, writing assignments are aimed at helping you develop skills for (a) clearly expressing, documenting, and justifying your points of view, (b) synthesizing information to generate novel perspectives, and (c) improving the substance of your arguments and insights. Most writing assignments in RNR 440/540 are “low-stakes” steps toward writing your “high stakes” final research paper. Hence, we aim to offer critique on your low-stakes writing, to encourage you to revise and hone your ideas, and the organization of writing in your final research paper.

### ***Elements leading toward the final research paper:***

1. Prospectus
2. Annotated Bibliography
3. Outline, with Preliminary Figure or Table
4. Oral Presentation
5. Final Research Paper

### ***Other Graded Writing***

1. Class synthesis paper

### ***Ungraded Writing***

1. Introduction
2. In-class informal writing

**Research Prospectus (5%).** (Due September 20, 2018). Prepare a 1-2 page (350-700 words) research prospectus, to describe your proposed term paper research topic. The prospectus should include at least the following:

- Your name
- Proposed title
- Background – What is the problem or issue that you are researching? What is the geographic scope? How is the subject or location of your research exposed to climate change? Who or what is vulnerable to changes in climate?
- Relevance – How does your topic relate to climate change adaptation? What makes this topic interesting, important?
- Overview of the study
  - Method (e.g., literature synthesis, literature synthesis accompanied by key informant interviews, case study, compare and contrast multiple cases or locations, analysis of original data)
  - Expected sources of information (e.g., peer-reviewed literature, government documents, news accounts, interviews, data [include the likely source of the data])
  - Key outputs (e.g., set of recommendations to decision-makers or researchers, critical evaluation of theories or frameworks, evaluation of methods, assessment of common elements and unique elements among case studies, identification of research gaps)

***To think about:***

- Make sure that your topic focuses on climate adaptation, not climate mitigation.
- If you use your own original data, then you must clearly demonstrate a strong connection with adaptation, and describe how your paper will augment any existing work that you have done on a thesis or dissertation.
- Write the prospectus in clear sentences and paragraphs. If it helps to illustrate your overview, then include a table or diagram (this will not be included in the word count).

<b>Criteria</b>	<b>Actual</b>	<b>Possible</b>
Adaptation: demonstration of connection with adaptation		30
Content: evidence that you have put thought into: the relevance and scope of the topic, how you might conduct the research, that you have started (even in a cursory way) consulting sources of information		40
Writing: sentences, wording, flow, voice, spelling		30
<b>TOTAL</b>		<b>100</b>

**Annotated Bibliography (5%).** (Due October 11, 2018). Prepare an annotated bibliography of five (5) sources of information that you will use in your term paper. For each source of information, include the following:

- Bibliographic information about the source (e.g., authors, year, title, volume, pages). Use American Psychological Association format. See:
  - <http://www.bibme.org/citation-guide/apa/>
  - <http://www.bibme.org/apa/journal-citation>
  - <http://www.bibme.org/apa/journal-citation/new>
    - This last one will generate a citation for you!
- Concise summary (around 150 words), that summarizes the central theme of the article, book or other information source. Include one or more sentences that (a) explain how this work sheds light on your topic, and (b) how this work contrasts with another source of information.

***To think about:***

- Do not simply cut and paste text from the information source, such as an excerpt from the source, or the abstract of a peer-reviewed paper.
- What is the central theme? How does this source of information illuminate your research topic and your understanding of the topic? How does this information relate to other sources of information? What does it add? Does it provide a new perspective? Does it confirm what you learned from another source?
- Consult: “How to Prepare an Annotated Bibliography,” Cornell University Libraries. <http://guides.library.cornell.edu>

<b>Criteria</b>	<b>Actual</b>	<b>Possible</b>
Articulation of key points		40
Connection to your research / critical thinking of how it connects to developing a body of ideas for your paper		40
Writing: sentences, wording, flow, voice, citations, spelling		20
<b>TOTAL</b>		<b>100</b>

**Paper Outline and Preliminary Figure or Table (10%).** (Due November 1, 2018).

Prepare a 1-2 page preliminary outline of your research paper. In addition, on a 3<sup>rd</sup> page, prepare a preliminary figure or table that synthesizes information that you have gathered. The figure or table should show a new insight, such as a contrast of results from two or more papers that you have read, the flow of an adaptation process that you are examining, common and unique insights from multiple sources, a typology of key factors related to your topic and its relation to climate adaptation. The outline should include the following:

- Your name
- Title
- Introduction and background
  - What is (your topic or geographic area or resource management sector)?
  - What is the geographic location, or ecosystem, or societal system?
  - Why is (your topic) important? What is the key climate-related challenge?
  - How does it relate to **adaptation**?
  - State your hypothesis (only if you have one).
- What is the current state of knowledge?
  - Who? What? Where? When? Why?
  - Current status
  - What is vulnerable?
- Climate Change
  - How does climate change affect (your topic)?
- Adaptation evidence and discussion
  - Adaptation strategies or frameworks for thinking about (your topic)
  - Case studies
  - Prospects
  - Recommendations
- Conclusions
  - Implications for (your topic or geographic area or resource management sector)
  - What needs to be done? (new research, new collaboration, implementation of specific strategies, new way of thinking about the problem)
  - Your **informed thoughts** on (your topic or geographic area or resource management sector)
- References

Example:

*Ignore Climate Change and Save the Mount Graham Red Squirrel: Is it Possible?* Research Paper Outline and Bibliography

**I INTRODUCTION**

- Life history
- Role in ecosystems
- Background on its enlistment
- Current status
- Introduce vulnerabilities
- Introduce issue: MGRS recovery plan is lacking climate change adaptation strategies.
- Focus: Managers need to consider climate change in their adaptive management plans because it is a serious threat to the MGRS' viability

**II VULNERABILITIES/THREATS**

- Spatially isolated (habitat specific) → constrained to high elevations
- Intraspecific competition between Abert's squirrel
- Low genetic variation
- #1 threat: habitat degradation
  - Development
  - Wildfires
  - Insect and disease outbreak
- Transition: Threats to habitat are exacerbated by CC

**III CLIMATE CHANGE**

- Why should we care about it
- Mention vulnerability assessment of the SW
  - How CC will alter the environment
    - Plants, sources of food...
- Role of CC on small mammals
  - 1-2 Case studies on how small mammals are impacted by climate change at high elevations
    - CC → habitat degradation → smaller pop sizes → Extinctions??
    - Bramble cay meloms
    - Species that have naturally adapted vs those that haven't
      - Have not adapted: Pika, flying squirrel
      - Have adapted:

**IV CC ADAPTATION RECOMMENDATIONS**

- What is CC adaptation?
- Goals
- Base recommendations on recommendations for other mammal species confined in high elevations
- what worked vs what didn't work
  - Assisted migration (controversial) (-2 studies why it does and doesn't)
  - Decrease habitat degradation (1 case study)
  - Captive breeding (1 case study)

**V CONCLUSIONS**

- Importance of CC adaptation strategies
- Implications if CC adaptation strategies are not included
- What needs to be done/changed
- Final thoughts

Works Cited

Beckrich, Amanda. "When Climate Change Causes Extinction." *The Science Teacher* 83.6 (2016): 14. Web. 8 Nov. 2016.

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Edelman, Andrew J., John L. Koprowski, and Sadie R. Bertelsen. "Potential for Nest Site Competition Between Native and Exotic Tree Squirrels." *Journal of Mammalogy* 90.1 (2009): 167-74. Web. 8 Nov. 2016.

Fitak, Robert R., John L. Koprowski, and Melanie Culver. "Severe Reduction in Genetic Variation in a Montane Isolate: The Endangered Mount Graham Red Squirrel (*Tamiasciurus Hudsonicus Grahamensis*)." *Conservation Genetics* 14.6 (2013): 1233-241. Web. 8 Nov. 2016.

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Leonard, Katherine M., and John L. Koprowski. "A Comparison of Habitat Use and Demography of Red Squirrels at the Southern Edge of Their Range." *The American Midland Naturalist* 162.1 (2009): 125-38. Web. 8 Nov. 2016.

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Moritz, Craig, James L. Patton, Chris J. Conroy, Juan L. Parra, Gary C. White, and Steven R. Beissinger. "Impact of a Century of Climate Change on Small-Mammal Communities in Yosemite National Park, USA." *Science* 322.5899 (2008): 261-64. Web. 8 Nov. 2016.

Rushton, S. P., D. J. A. Wood, P. W. W. Lurz, and J. L. Koprowski. "Modelling the Population Dynamics of the Mt. Graham Red Squirrel: Can We Predict Its Future in a Changing

**To think about:**

- Do not simply put together a rote list of sections, such as "introduction, methods, results, conclusions." What section headings will help the reader understand where your insights and arguments are headed? What section headings will help the reader understand the evidence that you are consulting and how it points toward your insights and possible conclusions?
- Use the table or figure to bring together information from multiple sources. How can you use it to help clarify your thoughts? How can a figure or table help make the information more clear to the reader?

Criteria	Actual	Possible
Direction: evidence of progress in articulation of important information, concepts, and possible findings for the paper		40
Adaptation: demonstration of connection with adaptation		10
Organization: clear structure, flow of evidence		30
Literature: evidence of progress with literature, beyond annotated bibliography assignment		20
<b>Overall</b>		<b>100</b>

**Research Presentation (10%).** (Due November 29, 2018). Prepare an approximately 5-minute “lightning” presentation of your final paper, during the Week 15 of the class (November 29). 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.

Suggested Outline:

- Background:
  - Introduction/overview of the topic
  - Why is it important? Why should we care?
- Context
  - Geographic, environmental, social setting, sources of information
- Findings/results:
  - What was interesting, new, important?
  - How does this relate to key themes of the class?
- Concluding thoughts
  - Additional research questions or recommendations for decision-makers or researchers

**To think about:**

- How can you use graphics: photos, figures, tables to illustrate your points?
- You won't be able to say everything about your topic. What are the most important points for you to convey?
- Don't assume that your audience knows anything about your topic. How can you tell the story of your research, in a way that informs a non-expert, a decision-maker, your grandmother?
- Consult the description of our advice and expectations for the final presentation, on the D2L website.

<b>Criteria</b>	<b>Actual</b>	<b>Possible</b>
Content and relevance to climate adaptation		40
Articulation of hypothesis, demonstration of critical thinking, evidence of synthesis		40
Clarity of visual and spoken presentation		20
<b>TOTAL</b>		<b>100</b>

**Final Research Paper (40%).** (Due December 5, 2018). 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. ***The final research 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.

Previously mentioned assignments (prospectus, annotated bibliography, outline with figure/table) are designed to assist you in making progress toward the final term paper. You will develop the topic, based on your individual interests. You are strongly encouraged to meet with instructors, to identify topics.

Aspects of the paper:

- Demonstrate that you have synthesized information and developed an original analysis of information on your topic of interest. Original tables and figures will help demonstrate original synthesis.
- Papers should be single-spaced, 12 point Times New Roman.
- Recommended Length: *undergraduates* 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 expected to consult at least 10 sources.
  - 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. Figures, tables, maps, and other visuals, and associated figure titles or captions are not included in the word count. Undergraduate students must submit at least 2 of these synthesis aids.
  - Follow the bibliographic citation and reference formats for the American Psychological Association. See guidelines for the in the Annotated Bibliography exercise for further information.
- Graduate students are expected to demonstrate substantial synthesis of information. Graduate writing quality and format should be on par with submission to a peer-reviewed journal.
- Final papers are due no later than 6 PM on the last day of classes, December 5, 2018.
- Examples of well-written past papers from this class will be provided in the D2L site for the class

***To think about:***

- How can you best use graphics: photos, figures, tables to illustrate your points?
- What organizational structure will best help you to articulate your research and key findings?

<b>Criteria</b>	<b>Actual</b>	<b>Potential</b>
<b>Content and relevance:</b> Is there a clear link to climate change adaptation? Is the content interesting and compelling? Is there sufficient background for the reader to understand the topic? Does the paper include a discussion of key ideas, key points?		30
<b>Critical thinking, analysis, and new insights:</b> Does the paper offer critical insights or original reflections? Does the paper offer lessons or recommendations? If appropriate, is there comparative analysis? Does the paper demonstrate a synthesis of ideas?		30
<b>Application of key concepts and literature:</b> Is the content well supported by literature? Does the paper show application of key concepts from the literature, the class, the class readings?		20
<b>Presentation: writing quality, figures, tables:</b> Does the paper demonstrate proper spelling, good grammar and sentence structure? Is the paper well organized? Are the arguments connected with good transitions that lead the reader logically from one point to the next? Is there a good flow between sentences? Good flow between paragraphs? Have you used figures and/or tables to illustrate key points, or to synthesize information? If so, do they convey the message in a crystal-clear manner?		20
<b>Total</b>		<b>100</b>

**Participation (20%)** Attendance at all class sessions is required. Each unexcused absence will result in a reduction of one quarter of the participation grade. Make sure to give plenty of advanced notice for any anticipated absences.

- Each class will present multiple opportunities for interactions. These include opportunities to present questions to guest speakers. Be sure to prepare questions, in advance, for each class.
- Class interactions will include providing review and feedback of classmates' ideas related to class exercises, and term papers.
- An ungraded initial writing assignment will also count toward the participation grade.
- You will be evaluated according to both the amount and the quality of your participation.

<b>Criteria</b>	<b>Actual</b>	<b>Possible</b>
Attendance		70
Participation in class discussions; participation in question & answer sessions with speakers; interaction with fellow students		20
Ungraded writing assignments		10
<b>TOTAL</b>		<b>100</b>

## Other Graded Writing

**Class synthesis paper (10%).** (Due October 25, 2018). Prepare a 1000-word synthesis of one of three topical classes (forest management [September 20], wildlife and assisted migration [September 27], water resources [October 18]). The synthesis should include insights from (a) the readings for that class, (b) the class lecture(s) (including question-and-answer session), and (c) class discussion.

- Grading will be based on your ability to synthesize information, articulate key points, derive your own insights.
- With this, and all writing assignments, we expect excellent English-language grammar, and demonstration of critical thinking.
- Regardless of which session you choose, the assignment is due no later than October 25 (Week 10).

### ***To think about:***

- Do not simply cut and paste text from the information source, such as an excerpt from the source, or the abstract of a peer-reviewed paper.
- What is the central theme? How does this source of information illuminate your research topic and your understanding of the topic? How does this information relate to other sources of information? What does it add? Does it provide a new perspective? Does it confirm what you learned from another source?
- Can you use graphics: original figures or tables to illustrate your points?

<b>Criteria</b>	<b>Actual</b>	<b>Possible</b>
Articulation of key points		40
Inclusion of literature as well as class presentation and discussion		20
Development at least one original finding based on a synthesis of knowledge / Demonstration of critical thinking		20
Overall flow of ideas and use of grammar		20
<b>TOTAL</b>		<b>100</b>

### **Ungraded Writing**

- We will occasionally require less formal writing assignments, in order to give you practice in writing, to share ideas and understandings with classmates and instructors, to process and explore concepts from class sessions and readings, and to hone ideas. While the writing for these assignments will not be graded, the ungraded assignments will count toward your class participation grade.

## EXAMPLES OF ORIGINAL TABLES AND ADAPTED FIGURES FROM RESEARCH FINAL PAPERS

**Table 2: Exposure-Outcome Pathways for southern Arizona**

Weather Event	Disease Vector	Pathway	Exposure Outcome
increased nighttime temperatures	kissing bug (Chagas disease)	increase feeding activity; shorter life cycles	higher population densities of infected insect vectors
higher temperatures	kissing bug (Chagas disease)	faster development of <i>T. cruzi</i>	
increased winter minimum temperatures	mosquitoes (Dengue virus)	northward range shifts	increased exposure to disease
increased winter minimum temperatures	mosquitoes (chikungunya)	northward range shifts	
higher temperatures	mosquitoes (all arboviruses)	increasing mosquito populations, viral replication rates, lower incubation times	infectiousness increases
higher temperatures	mosquitoes	shorter reproduction cycles	higher feeding rates and greater chance of transmission to humans
higher temperatures	mosquitoes	higher feeding rate	higher chance of human-human transmission during a single blood meal
extreme temperature events	mosquitoes	larvae are killed	infectiousness decreases
more precipitation events	mosquitoes	more standing water	vector populations increase
more precipitation events	mosquitoes	more flushing of drainage channels	vector populations decrease
more intense precipitation events	valley fever	increased fungal growth	fungus spreads
drought	mosquitoes	concentrated water sources	vector populations increase; increased exposure to birds for WNV
drought	valley fever	dry soils and dust storms	aerosolizing and spread of spores increase infectiousness

Table 2: Sensitivity of the northern diamondback terrapins and wild horses to the impacts of climate change. Rating scores in (parentheses)

<b>Sensitivity Elements</b>	<b>Northern Diamondback Terrapins</b>	<b>Wild Horses</b>
<i>Elements from the “Climate Change Vulnerability Assessment for Species” (World Wildlife Fund, 2014):</i>		
IUCN Red List Status	Near Threatened (1.5)	Least Concern (1)
Geographic Range	Medium (2)	Small (3)
Population Size	Small (3)	Small (3)
Temperature Tolerance	Low (3)	High (1)
Does the species rely on environmental cues for reproduction?	Yes (3)	Yes (3)
Does the species rely on environmental cues for migration?	No (1)	No (1)
Does the species rely on environmental cues for hibernation?	Yes (3)	No (1)
Does the species have any strong or symbiotic relationships with other species?	Possible (2)	No (1)
Diet	Generalist-Specialist (2)	Specialist (3)
Abundance of Food Source	Medium (2)	Medium (2)
Freshwater Requirements	Low (1)	Medium (2)
Habitat Specialization	Specialist (3)	Specialist (3)
Susceptibility to Disease	Medium (2)	Medium (2)
<i>Elements from the “Scanning the Conservation Horizon” (Glick, Stein, &amp; Edelson, 2011):</i>		
Hydrology Changes	High (3)	Medium (2)
Wind Changes	High (3)	Low (1)
Interaction with Non-Climatic Stressors (i.e. Habitat Degradation and Road Mortality)	High (3)	Low (1)
<b>Total Score:</b>	37.5	30
<b>Average Score/Sensitivity Level:</b>	<b>Medium-High Sensitivity (2.34)</b>	<b>Medium Sensitivity (1.875)</b>

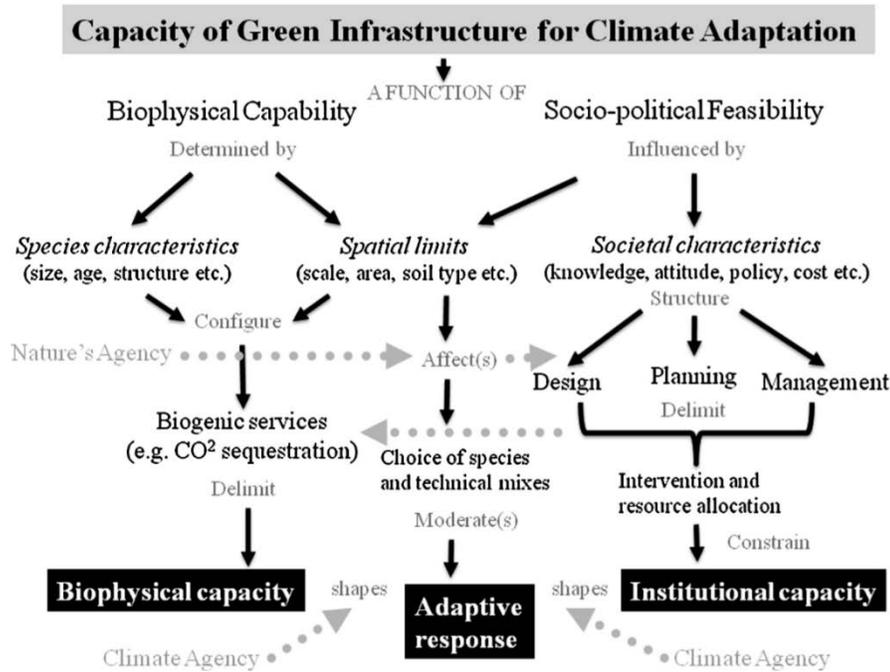


Fig. 1. Capacity of green infrastructure for climate adaptation.

**Figure 1. Conceptual model of Green Infrastructure as an adaptive element (Matthews et al., 2015)**

Professors' note: The student used this conceptual model as a structure for examining the climate adaptation potential of a particular urban area. The student also critiqued the model.