

## SYLLABUS – FALL 2015

### GEOL2700 *EXPERIENCES IN SUSTAINABLE DEVELOPMENT: WATER*

#### Contact Information

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#### Course Overview

We will investigate the role of water in our lives and the environment by reflecting on cross-discipline experiences from the United States and around the world. Our focus will be on understanding how sustainability of this critical resource is impacted by scientific, engineering, social, economic, and political factors.

**Clemson Thinks<sup>2</sup>:** This course is part of the Clemson Thinks<sup>2</sup> (CT<sup>2</sup>) program that is aimed at improving student critical thinking skills. Memorizing facts and being able to repeat definitions or procedures is not a sufficient skill set to address the complex problems facing our world today. You need to develop the ability to *reason*, *evaluate*, and *decide* if you are to become successful in your career and an effective steward of our future.



Some key critical thinking skills that you should consciously make an effort to develop and demonstrate throughout your activities in this course include:

#### **Core Critical Thinking Skills**

1. Determine the relevance of information for evaluating an argument or conclusion.
2. Recognize the flaws and inconsistencies in an argument.
3. Propose and evaluate competing causal explanations.
4. Evaluate explanations for consistency with established facts.
5. Determine whether an interpretation is supported by evidence.
6. Recognize relevant features or themes in a published work (e.g., article, image, etc.).
7. Evaluate the appropriateness of procedures for investigating a question of causation.
8. Evaluate data for consistency with established facts, hypotheses, or methods.

Your ability to apply and demonstrate these skills will be an important part of the criteria used to establish your grade in this course based on the CT<sup>2</sup> student learning objectives outlined on the next page. More details on grading are given in the *How Will I Be Assessed* section of this syllabus.

The CT<sup>2</sup> program is being implemented as a campus wide research effort to improve the University's ability to teach students critical thinking skills. As a result, ***you will be required to complete two general critical thinking exams*** (one at the beginning of the term and one at the end) that will be used to study the effectiveness of different teaching methods. ***The results of these exams do not count toward your grade or degree progress at Clemson and only aggregate results will be used to evaluate the teaching strategies of this course versus other CT<sup>2</sup> courses. Failure to complete both exams, however, may lead to a grade of F in the course.***

**A Note on Artifacts:** There are a variety of assignments in this course that you can utilize as artifacts to demonstrate your refinement of general education and critical thinking skills over the term (e.g., position statements and projects). The final term project will be submitted as an artifact to demonstrate critical thinking skills for CT<sup>2</sup>, but may also be used to demonstrate proficiency for the Science and Technology in Society GenEd requirement.

*Clemson Thinks<sup>2</sup> Student Learning Objectives*

OBJECTIVE	WHAT DOES THIS MEAN IN OUR CLASS?
<p><b>1. Define</b> complex challenges.</p>	<p><b>Demonstration Element:</b> <i>Student has defined a clear and concise position.</i></p> <p><b>Description:</b> A specific position is clearly stated and relates directly to the question to be resolved. The statement recognizes the complexities of the issue being discussed without confusing the specific position of the student.</p> <p><b>Example:</b> <i>“Laws should inhibit the construction of new dams on major waterways.”</i></p>
<p><b>2. Analyze</b> multi-dimensional problems.</p>	<p><b>Demonstration Element:</b> <i>Different viewpoints are defined and evaluated.</i></p> <p><b>Description:</b> A systematic and methodological analysis of assumptions is given that explicitly takes into consideration the author’s viewpoint as well as the view point of others; viewpoints may, for example, take the form of specific policy frameworks, scientific concepts, value systems, personal perspectives, or combinations of these. The analysis considers how the context (e.g., social, cultural, political, and/or environmental details of a location) influences the assumptions and conclusions of the analysis.</p> <p><b>Example:</b> The discussion evaluates the position by explicitly identifying two problems with dams (e.g., socioeconomic and environmental impacts of population displacement and degradation of downstream environments), and two positive outcomes of dam building (e.g., economic impacts in energy, agricultural, domestic water sectors and flood management).</p>
<p><b>3. Extrapolate</b> from one conceptual context to others.</p>	<p><b>Demonstration Element:</b> <i>Identify relevant examples to support the discussion.</i></p> <p><b>Description:</b> Examples are provided that clearly support the analysis and conclusions. Enough interpretation/evaluation of specific details or observations from the examples is given to explain the relevance of the example. The student makes connections that draw on examples or experiences from physical or conceptual settings different from the specific one being discussed. A sufficient number of examples are given to support a comprehensive analysis to evaluate the stated position.</p> <p><b>Examples:</b> Specific examples and data are used from (1) Three Gorges Dam, China, (2) Hoover Dam, USA, and (3) small earth dams used in rural areas.</p>
<p><b>4. Synthesize</b> alternative solutions to multi-dimensional challenges.</p>	<p><b>Demonstration Element:</b> <i>Concepts and examples are integrated to form conclusions.</i></p> <p><b>Description:</b> Multiple viewpoints and examples are compared using a well-defined framework (e.g., an identified set of qualitative priorities or a quantitative metric such as a cost-benefit analysis). Opinions (both those of students and experts) are critiqued in the context of other data. Facts and interpretations are consistent with concepts presented in lectures, readings and videos or inconsistencies are clearly pointed out and citations are given to support the statements.</p> <p><b>Example:</b> Student identifies environmental preservation as the most important criteria influencing their position because they use course concepts and examples to illustrate how large dams are rarely economically and socially sustainable solutions to long-term development.</p>
<p><b>5. Communicate</b> complex ideas effectively.</p>	<p><b>Demonstration Element:</b> <i>Discussion is clearly developed and well written.</i></p> <p><b>Description:</b> Conclusions and related outcomes are logical and follow directly from the analysis and synthesis provided. The writing follows a clear and linear progression of ideas to demonstrate the student’s informed evaluation and ability to place evidence and perspectives discussed in priority order.</p> <p><b>Example:</b> The student used an outline to organize their thoughts into clearly structured paragraphs and made appropriate use of headings and figures to guide the reader. The conclusion summarizes how the arguments made throughout the discussion support their position statement.</p>

## **Course Logistics**

Class Time: MW – 3:35-4:50 PM

Class Location: Rm.M202, Martin Hall

Attendance: Mandatory attendance for every class. If the instructor is not present, students should proceed to discuss their projects and case studies within their groups or add to the current events discussion board. If insufficient members of a discussion group are present, students should join another group for the day.

Laptop Policy: You should bring your laptop fully charged to *every* class unless otherwise directed to leave them at home by the instructor. Alternative devices, e.g., iPads, smartphones, etc., may provide an acceptable alternative in some cases, but this should be discussed with the instructor prior to bringing them to class.

Textbook: *WATER: Global Challenges & Policy of Freshwater Use (Required)*  
Publisher: Cengage, ISBN:978-1-133-60367-2, available in Clemson bookstore (\$29.35)

Online Resources: Given the breadth of topical areas and case studies we will discuss, this class will make extensive use of computer and internet resources described below.

- (1) **Canvas** – The primary online tool we will use for class this term is the website *Canvas*. Modules containing lessons and assessment activities will be posted to this site for you to complete throughout the term. You'll receive an email giving you instructions on how to create an account and login or check Blackboard for this information. There is no charge to use Canvas.  
**Course Login:** <http://canvas.infrastructure.com> (after registration)
- (2) **Naranpur Online** – This is an online watershed simulation game that you will utilize throughout the term. You will be expected to login approximately once per day to review and adjust your management strategies. Details to be given in class.  
**Course Login:** <http://www.clemson.edu/naranpur>
- (3) **Google Drive** – Throughout the course you will complete a variety of team-based assignments and projects. These will generally be completed using shared files created in Google Drive. All Clemson students have access to Google Drive by logging in with your Clemson ID at <http://g.clemson.edu>.
- (4) **Blackboard** – I do not expect to use Blackboard significantly in this course, but may at times post information at this site to help get you to our other web resources or complete specific assignments. You will be notified in class and in Canvas if there is material you need to access on Blackboard.
- (5) **Internet** – You are strongly encouraged to use the internet to find resources that will enhance your personal experience in this course and the experience of your peers. Share with us the news articles, videos, data, tools and other resources that you find throughout the course. Please post these on the “**Water in the News**” discussion forum on Canvas.
- (6) **Twitter** – Through the class I will continuously post relevant current event stories related to water on Twitter; you can follow me at [@drmoyses](https://twitter.com/drmoyses).

## **How Will I Be Assessed? (Assignments and Grades)**

Our focus on critical thinking in this course means that you will take an active part in developing and shaping the course content through a strong emphasis placed on in-class activities and discussion throughout the term. To aid you in this exploration, some of the material useful to guide your discussions will be presented as (in-class or online) lectures, readings, or videos. We will also utilize case studies and role playing as tools to aid our ability to assess evidence and make decisions. You are required to complete material as described in the learning guide that will be provided to you at the beginning of each of the modules we will complete throughout the term (see the *Course Schedule* below). ***A brief description of the course components that you will encounter in this course is given below with graded activities highlighted:***

**Lectures:** Instructor presentations of material. No advanced preparation is generally required for online lectures, but in-class ***participation*** is expected for live lectures; participation will be assessed in a variety of ways including engagement in informal discussions, web-based polls, and quizzes. Online lectures will be provided through Canvas and will have associated ***online assessments*** (e.g., self-graded questions) that must be completed in order to gain credit for the lecture. Build on concepts presented in the lectures in your other work throughout the term.

**Readings and Videos:** Throughout the term you will complete a variety of readings and videos expanding on or providing examples of topics discussed in the classroom. For each of these readings or videos, you will be required to complete an associated ***online assessment*** in Canvas. You should use examples from these materials to help support the arguments you make in your assignments throughout the term.

**Case Studies:** A focused in-class exploration of issues in a specific place/context. Students should prepare outside of class by completing readings and performing web searches to provide general environmental, social, and economic context and issues for the region being studied that can be shared with the class. Extra material brought to the class (and posted in Canvas) to enrich case study discussions will contribute to your ***participation*** grade.

**Group Discussions:** Student led exploration of content through focused discussion of material. Students must prepare ***outside of class*** by completing readings, performing supporting independent research, and preparing a ***Position Statement*** (must be posted before class on the appropriate Canvas discussion board).

**Group Project:** A group term ***project*** will be completed throughout the term, which will progress through assignments and discussions to culminate in a final presentation.

**Village Meeting:** Similar to GDs, but focused on problems faced in the village of Naranpur. Requires analysis of data generated throughout the term to support your ***Position Statements***. Position Statements for the village meeting should outline a definitive policy action that can be voted on for adoption.

**Role Play:** A formal role playing exercise where students will complete a simulation to resolve a specific issue. We will complete two role-playing activities throughout the term (Klamath Watershed, and the Naranpur simulation) which will be assessed using graded ***Projects*** and ***Position Statements***.

Grading: The general grading scheme for the course is given below. A rubric providing details on how Position Statements and Projects will be assessed is given on the last page of this syllabus. Criteria for grading each online assessment will be provided with the activity. Participation grades will be determined based on the quantity and quality of material posted to Canvas and shared in class discussions.

<u>Course Component</u>	<u>Fraction</u>	<u>Final Course Grade:</u>
Module Assessments	15%	>90% = A
Assignments & Statements	40%	75-90% = B
Projects*	30%	60-75% = C
Class Participation	15%	50-60% = D
<b>Total</b>	<b>100%</b>	<50% = F

\*Projects are expected to include:  
 Klamath Role Play Group Presentation – 10%,  
 Term Project Presentations and Reports – 20%

Late Assignments: ***No late assignments will be accepted*** as timely completion of your work is a requirement for effectively completing position statements and participating in discussions throughout the term. You will, however, have access to assignments for each course module in advance of the deadlines stated on Canvas. You will therefore have the opportunity to complete these activities at your own pace and working within your own schedule as long as each activity is completed before the deadline.

Bonus Points: Up to 10% course credit can be received as bonus points for exceptional peer reviews or extracurricular material submitted to the course that the instructor considers to go above and beyond expectations (e.g., the acquisition and analysis of an unusual dataset, a particularly insightful discussion of a current news article identified by the student, consistent contribution of relevant Tweets). Each contribution deemed worthy of bonus points may receive 1-10% extra credit and multiple contributions can be awarded bonus points up to a total of 10%.

COURSE SCHEDULE – Fall 2015\* (*Tentative*)

Week	Date	In-Class Activity	Readings Due	Assignment Deadlines	Module Deadlines
1	Aug.19 (Weds)	Build a syllabus Course Introduction & Logistics		<i>Start Water Diaries</i>	
<p><b>MODULE 1: AN INTRODUCTION TO WATER RESOURCES</b>            What you should learn in this module:            - <b>Water on Earth:</b> How water is distributed on earth and what it means for human development.            - <b>Hydrologic Cycle and Climate:</b> The main components of the hydrologic cycle, how these act as drivers of water supply, and controls on climate.            - <b>Supply and Demand:</b> The sources and demands for our water and how the balance between these relates to the sustainability of water supplies.            - <b>Water Balances &amp; Watersheds:</b> Accounting for water in the environment.</p>					
2	24	<b>Lecture:</b> Section Overview <b>GD:</b> What are drivers of water resource issues?	Fresh Water (Ch.1-Water)	Position Statement #1 – Water Resources Drivers	CT2 Quiz
	26	<b>Lecture:</b> Supply and Demand			M1: Water on Earth
3	31	<b>Activity:</b> Water Diary <b>Lecture:</b> Watersheds	USGS (online)	Ass#1- Water Diary	M2: Hydrologic cycle & climate
	2	<b>Lecture:</b> Overview of SW/GW <b>Work Period:</b> Estimating Fluxes			<b>Video:</b> Water for the Fields (online)
4	7	<b>Lecture:</b> Intro to <i>Naranpur Online</i>		Ass#2 – Watershed	
	9	Discussion of Reading	Drying of the West (Ch.7 - Water)	Ass#3 – Discussion Board	M3: Runoff and Surface Water
5	14	<b>Case Study:</b> Tucson ( <i>class example</i> )	How a River Goes Dry (online)		
	16	<b>Work Period:</b> Analysis of watershed mass balance.  <b>GD:</b> Is life in Naranpur sustainable?		Ass#4 – Mass Balance	M4: Groundwater Geology
6	21	<b>Village Meeting</b>		Position Statement #2	M5: Groundwater Processes
	23	<b>TBD</b>		Ass#5 – Presentation	<b>Video:</b> Water for the Cities

**MODULE 2: WATER QUALITY, WATER SYSTEMS, AND THE ENVIRONMENT**

What you should learn in this module:

- **Water Quality:** Physical, chemical, and biological factors affecting human health; sources of contaminants in the environment; how contaminants affect the environment.
- **Water Supply Systems:** Collection of water from the env. and treatment for human use.
- **Water and Ecology:** Ecological impacts of water resource development.
- **Water and Climate Change:** Likely impacts of climate change on supply and demand and how this impact on water resources might affect our lives.

7	28 TBD	<b>Lecture: Section Overview, Contaminants Intro &amp; Reading Discussion</b>	Bitter Waters (Ch.4–Water)		M6: Environmental Contaminants
	30	<b>Lecture: Water Quality</b> <b>Case Study: Walkerton</b>			
8	Oct.5	<b>Case Study: Mono Lake (Part II)</b> <b>Case Study: Aral Sea</b>	Aral Sea (online pdf)	Ass#6 - Mono Lake Worksheet + Discussion Board	M7: Water Supply Systems
	7	<i>Village Meeting</i>		Position Statement #3	
9	Oct.12	<b>Fall Break (Monday)</b>			
	14	<b>Lecture: Future of Water</b>	Outlook Extreme & Australia’s Dry Run (Ch. 2+3 – Water)	Ass#7 – Project Report	

**MODULE 3: WATER, PEOPLE, AND MANAGEMENT**

What you should learn in this module:

- **Water Rights and Management:** Understand different systems of water rights, explain how these affect availability of water, and discuss how different systems of management can be used to facilitate development of resources and participation.
- **Stakeholders:** Identify and explain how different groups of people are affected by water resources.
- **Economics of Water:** Explain how water is treated as an economic good, how basic economic concepts are typically applied to water, and be able to discuss motivations for and consequences of privatization of water resources.
- **Water and Conflict:** Conflict in the Mideast and other parts of the world; mediation strategies.

10	19	<b>Lecture: Stakeholders</b>			
	21	<b>Case Study + Role Play: Klamath watershed</b>	Reuniting a River (Ch.6)		
11	26	<b>Role Play: Klamath watershed</b>		Ass#8: BATNA	
	28	<b>Role Play: Klamath watershed</b>		Position Statement #4	
12	Nov.2	<b>Presentations: Klamath watershed</b>		Ass#9: Presentation	

Week	Date	In-Class Activity	Readings Due	Assignments Deadline	Recommended Online Lecture
	4	<b>TBD</b>			
13	9	<b>Lecture:</b> Water Management	TBA		
	11	<b>Lecture:</b> Water Rights and Economics		Ass#10: Discussion Board	M8: Water Privatization
14	16	<b>TBD</b>	Parting the Waters (Ch.5 – Water)		
	18	<b><i>Village Meeting</i></b>		Position Statement #5	
15	23 25	Thanksgiving (No class)			
16	30	<b><i>Term Project Presentations</i></b>	<i>Presentations</i>	Project Due Online 8AM	
	2 (Last Class)	<b><i>Term Project Presentations</i></b>	<i>Presentations</i>		
<b>Final Exam Period (TBD)</b>					

\*NOTE: The course topics and schedule are tentative and *likely* to shift based on our progress!