UNIVERSITY OF FLORIDA DEPT. OF GEOGRAPHY

Course title	**Geographical Sciences and Sustainability**
Course number	**GEO 3930**
Course date	**Spring 2018**
Location	**TUR 3018**
Meeting day	**Monday, periods 7-9, 1:55 – 4:55 pm**

INSTRUCTOR INFORMATION

Name	Jane Southworth
Email	jsouthwo@ufl.edu
Office location	TUR 3141
Office hours	By appointment

COURSE DESCRIPTION

Objectives: The most critical issue facing the world today is the sustainability of both human and physical systems in the 21st century. The importance of geographical and sustainability sciences is rooted in the complexity of social and environmental problems. We live on a dynamic planet, one that is constantly changing in response to human and natural processes that are highly interconnected. Geographers study the interactions of people and their environment to better understand these intricately related processes. This course will address the human and natural systems and how interactions between these systems shape the world we live in. Cutting edge technologies, such as geographic information systems (GIS), satellite imagery, and Global Positioning System (GPS), are used to help inform decision making at geographic scales and to analyze and visualize geographic processes.

Learning outcomes

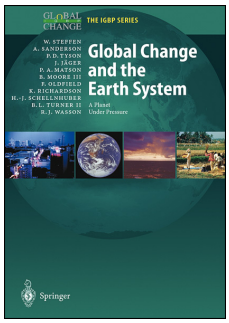
- Students will be able to identify how sustainability, both of societies and the environment, is one of the most significant issues in the world today.
- Students will be able to describe the sources experts use to explore the relationship between society and sustainability, including geographic methods, techniques and theories.
- Students will demonstrate an understanding of concepts and approaches of sustainability of societies on different scales, examining local, regional and worldwide issues.
- Students will demonstrate an understanding of the dimensions sustainability, including cultural, environmental, economic, and political systems
- Students will communicate major ideas and issues on society and sustainability through class activities, an individual project, and weekly discussions.

BRING LAPTOPS TO CLASS – CLASS ACTIVITIES WILL FREQUENTLY INVOLVE ACTION ON YOUR PART. ASSUME YOU NEED YOUR LAPTOP EVERY WEEK IN CLASS.

TEXTBOOK

Textbook required is listed below, along with a link to get a free copy. In addition, readings and other items will be posted in canvas as needed in advance of weekly activities and assignments.

TITLE: Global Change and the Earth System: A Planet under Pressure



Series: Global Change - The IGBP Series

AUTHORS: Steffen, W., Sanderson, R.A., Tyson, P.D., Jäger, J., Matson, P.A., Moore III, B., Oldfield, F., Richardson, K., Schellnhuber, H.-J., Turner, B.L., Wasson, R.J.

1st ed. 2004. 2nd printing, 2004, XII, 332 p. 258 illus., 145 in color. With CD-ROM.

Hardcover, ISBN 978-3-540-26594-8

Available free online:
http://www.igbp.net/publications/igbpbookseries/igbpbookseries/globalchangeandtheearthsystem2004.5.1b8ae20512db692f2a680007462.html

PREFACE: The relationship of humans with the Earth's environment has changed throughout the evolution of *Homo sapiens* and the development of societies. For virtually all of human existence on the planet, interaction with the environment has taken place at the local, or at most the regional, scale. The environment at the scale of the Earth as a whole - the passing of the seasons, the vagaries of weather and climate, the ebbing and flowing of river systems and glaciers, the rich diversity of life in all its forms - has been something within which people have had to operate, subject only to the great forces of nature and the occasional perturbations of extraterrestrial origin. Earth's environment has been a bountiful source of resources as well as a remarkably stable life support system that has allowed human civilisations to develop and flourish.

A profound transformation of Earth's environment is now apparent, owing not to the great forces of nature or to extraterrestrial sources but to the numbers and activities of people - the phenomenon of global change. Begun centuries ago, this transformation has undergone a profound acceleration during the second half of the economic activity increased nearly 10-fold between 1950 and 2000. The world's population is more tightly connected than ever before via globalisation of economies and information flows. Half of Earth's land surface has been domesticated for direct human use. Most of the world's fisheries are fully or over-exploited. The composition of the atmosphere - greenhouse gases, reactive gases, aero- sol particles - is now significantly different than it was a century ago. The Earth is now in the midst of its sixth great extinction event. The evidence that these changes are affecting the basic functioning of the Earth System, particularly the climate, grows stronger every year. The magnitude and rates of human-driven changes to the global environment are in many cases unprecedented for at least the last half-million years.

Grading and Assessment

Discussions — 50 - 100 points

Discussions are of 2 types –

1. The first type is for students to respond to questions posted by me in advance of us starting a topic in class. These discussion posts will relate directly to the reading materials assigned for that topic. [50 points]

   Reading discussion questions posted in Canvas a week prior to class, discussion questions must be answered by Sunday night – prior to Monday class to receive credit

2. Following the initial discussions posted by me, the following week on a topic (all topics last 2 weeks except Topic 1 and topic 3 where this will not occur) students will post individual questions [minimum 5 each], and find additional readings [2 minimum per student] and suggested activities [1 minimum per student] on a selected topic of the students choice from those covered in the class. Students will sign up for topics in week 1 and then be assigned in Canvas. Each topic will have 2-4 students assigned to it. Students can choose to work individually or as a group on the topic. If a group must cover student minimums (e.g. 3 people would need 15 questions, 6 additional readings and 3 activities]. Students only do this once per semester. In addition, student group will also be responsible for compiling information on responses to posted questions for presentation in class. Powerpoint style presentation is recommended. 15 minutes max. [100 points]

Class activities — 25 - 100 points

Every class, activities will occur in the class period. Depending on content the points awarded will vary but there will be at least 1 activity per class and may be more than 1 per class period. If the activity cannot be completed during the class period then it will become HW and handed in the following class period. Most activities will be completed and handed in during the class period.

Project — 300 points

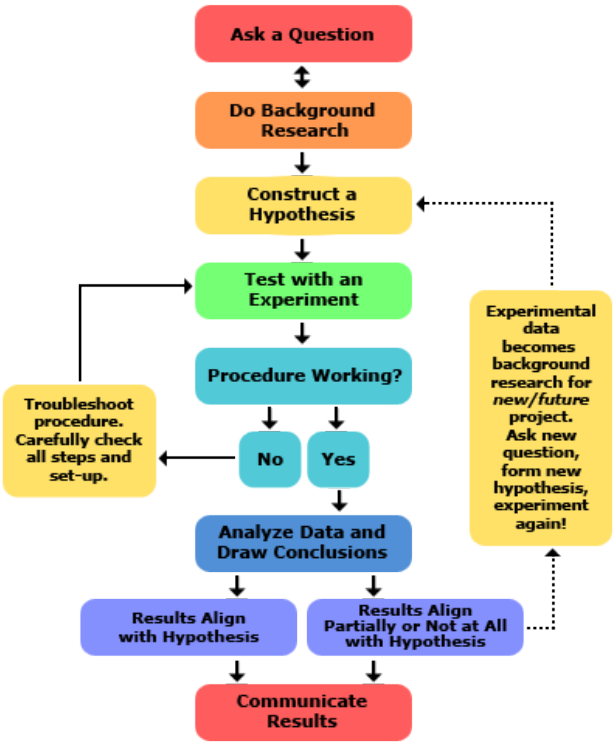
A final class project will be due the final week of classes. Final projects will be due Monday April 3th by 5pm. Details on class projects will be given during the class and posted online. This will be an activity using Google Earth Pro, where students address some issue of sustainability for a region of the world and topic of particular interest to them. In addition to the technology component there will also be a write up of the findings. Projects will be discussed in detail in class and topics approved prior to starting assignment.

Grading Scheme:

Based on final points total:

93-100% = A, 90-92.9% = A-, 87-89.9% = B+, 83-86.9% = B, 80-82.9% = B-, 77-79.9% = C+, 73-76.9% = C, 70-72.9% = C-, 67-69.9% = D+, 63-66.9% =D, 60-62.9% = D-, Less than 60 = E (Fail)

TOPIC 1: week 1, Jan 8th
INTRODUCTION: Introduction to this course, approaches and methods in science and the Scientific Method



The scientific method is a process for experimentation that is used to explore observations and answer questions. Does this mean all scientists follow *exactly* this process? No. Some areas of science can be more easily tested than others. For example, scientists studying how stars change as they age or how dinosaurs digested their food cannot fast-forward a star's life by a million years or run medical exams on feeding dinosaurs to test their hypotheses. When direct experimentation is not possible, scientists modify the scientific method. In fact, there are probably as many versions of the scientific method as there are scientists! But even when modified, the goal remains the same: to discover cause and effect relationships by asking questions, carefully gathering and examining the evidence, and seeing if all the available information can be combined in to a logical answer.

Even though we show the scientific method as a series of steps, keep in mind that new information or thinking might cause a scientist to back up and repeat steps at any point during the process. A process like the scientific method that involves such backing up and repeating is called an iterative process. Whether you are doing a science fair project, a classroom science activity, independent research, or any other hands-on science inquiry understanding the steps of the scientific method will help you focus your scientific question and work through your observations and data to answer the question as well as possible.

Assignments:

1. Class activities – assigned in class, completed as HW if necessary

TOPIC 2: weeks 3 & 4, Jan 22nd & Jan 29th
What is special about Geography & the tools used in Geographical Sciences, as they relate to Sustainability [READINGS ASSIGNED]

Just like a contractor uses a nail gun and level to build a set of cabinets, geographers use a set of specialized tools to understand and explain the structure of the Earth. Some of these tools are ancient, while others are new to the Space and Information ages. This section provides a brief discussion of contributions made by geographers to the development of techniques for

observation, display, and analysis of geographic data. With respect to the collection and display and analysis of data, we will examine cartography, remote sensing, fieldwork, visualization, geographic information systems (GISs), and spatial analysis. The techniques that geographers use in their work are not developed in a vacuum. They are developed to address specific problems and, thus, reflect the focus of the discipline at particular times. These techniques reflect the conscious decisions of geographers about the kinds of information that are important to collect; the spatial scales at which information should be collected, compiled, analyzed, and displayed; data sampling strategies and experimental designs; data representation; and methods for data analysis. As theoretical paradigms change, so do the techniques for empirical research. Thus, advancement of the discipline goes hand in hand with the development of new and improved techniques for collecting, analyzing, and interpreting information. Cutting edge technologies, such as geographic information systems (GIS), satellite imagery, and Global Positioning System (GPS), are used to help inform decision making at geographic scales and to analyze and visualize geographic processes.

Assignments:

2. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
3. Discussion sections led by student groups for Jan 29th class – selected in Week 1
4. Class activities – assigned in class, completed as HW if necessary

TOPIC 3: week 5, Feb 5th
CHAPTER 1: An Integrated Earth System [pages 1-9]

The interactions between environmental change and human societies have a long and complex history spanning many millennia. They vary greatly through time and from place to place. Despite this spatial and temporal variability, a global perspective has begun to emerge in recent years and to form the framework for a growing body of research within the environmental sciences. Crucial to the emergence of this perspective has been the dawning awareness of two aspects of Earth System functioning. First, that the Earth itself is a single system within which the biosphere is an active, essential component. Secondly, that human activities are now so pervasive and profound in their consequences that they affect the Earth at a global scale in complex, inter- active and apparently accelerating ways; humans now have the capacity to alter the Earth System in ways that threaten the very processes and components, both biotic and abiotic, upon which the human species depends. This book describes what is known about the Earth System and the nature of the human-driven changes impacting it. It also considers the responses of the System, the consequences of these responses for the stability of the System and for human well-being, and some of the ways forward towards an Earth System science that can contribute to the goal of global sustainability.

Assignments:

5. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
6. Class activities – assigned in class, completed as HW if necessary

TOPIC 4: weeks 6 & 7, Feb 12th & Feb 19th
CHAPTER 2: Planetary Machinery: The Dynamics of the Earth System Prior to Significant Human Influence [pages 11-73]

The properties and processes of the non-human dominated Earth System vary across a wide range of space and time scales. Nevertheless, the Earth System has functioned within domains characterised by well-defined limits and periodic patterns. Interconnections among physical, chemical and biological processes and between land, ocean and atmosphere, across both space and time, are ubiquitous and critical for the functioning of the System. Forcings and feedbacks are difficult to distinguish as one becomes the other in the cyclical dynamics of the System. Rapid, abrupt changes can occur as the Earth System reorganises into a new state.

Assignments:

1. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
2. Discussion sections led by student groups for Feb 19th class – selected in Week 1
3. Class activities – assigned in class, completed as HW if necessary

TOPIC 5: weeks 8 and 10, Feb 26th & March 12th
CHAPTER 3: The Anthropocene Era: How Humans are Changing the Earth System [pages 81- 135]

The planet is now dominated by human activities. Human changes to the Earth System are multiple, complex, interacting, often exponential in rate and globally significant in magnitude. They affect every Earth System component – land, coastal zone, atmosphere and oceans. The human driving forces for these changes – both proximate and ultimate – are equally complex, interactive and frequently teleconnected across the globe. The magnitude, spatial scale, and pace of human-induced change are unprecedented. Today, humankind has begun to match and even exceed some of the great forces of nature in changing the biosphere and impacting other facets of Earth System functioning. In terms of fundamental element cycles and some climatic parameters, human-driven changes are pushing the Earth System well outside of its normal operating range. In addition, the structures of the terrestrial and marine biospheres have been significantly altered directly by human activities. There is no evidence that the Earth System has previously experienced these types, scales, and rates of change; the Earth System is now in a no-analogue situation, best referred to as a new era in the geological history of Earth, the Anthropocene.

Assignments:

1. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
2. Discussion sections led by student groups for March 12th class – selected in Week 1
3. Class activities – assigned in class, completed as HW if necessary

TOPIC 6: weeks 11 & 12, March 19th & March 26th
CHAPTER 4: Reverberations of Change: The Responses of the Earth System to Human Activities [pages 143-196]

Although human activities are, in the context of the Earth System, now equal in magnitude to some of the great forces of nature, it is often difficult to determine the extent to which an observed change in Earth System functioning is due to the anthropogenic forcing or is part of the Earth System's natural variability. Human impacts on the Earth System do not operate in separate, simple cause-effect responses. A single type of human-driven change, for example deforestation or fossil fuel combustion, triggers a large number of responses in the Earth System, which themselves reverberate or cascade through the System, often merging with patterns of natural variability. The responses seldom follow linear chains, but more usually interact with each other, sometimes damping the effects of the original human forcing and at other times amplifying them. Responses become feedbacks, which in turn can lead to further forcings in the System. The sequence of forcings-responses-feedbacks-forcings thus forms loops that can alter overall patterns of behaviour of the Earth System.

Assignments:

1. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
2. Discussion sections led by student groups for March 26th class – selected in Week 1
3. Class activities – assigned in class, completed as HW if necessary

TOPIC 7: weeks 13 & 14, April 2nd & April 9th
CHAPTER 5: Living with Global Change: Consequences of Changes in the Earth System for Human Well-Being [pages 203-249]

The changes that are occurring in the functioning of the Earth System, owing at least in part to human activities, have implications for human well-being. Ba- sic goods and services supplied by the planetary life support system, such as sufficiency and quality of food, water resources, air quality, and an environment conducive to human health, are all being affected by global change. These impacts, however, are not the same around the world, but strongly interact with the particular biophysical and socio-economic processes typical of a given region. The concept of vulnerability pro- vides a useful framework within which to study the con- sequences of global change for human societies. At an- other level, global change poses potentially serious con- sequences for the stability of the Earth System itself. The palaeo-record shows that abrupt changes and surprises are common, and that environmental extremes outside the range recorded by instruments in the mod- ern era occur frequently. The stratospheric ozone episode demonstrates that catastrophic failures of the Earth System are not only possible, but that humankind has already narrowly escaped one. Other possible catastrophic failures, such as the slow-down or collapse of the thermohaline circulation in the North Atlantic Ocean, are possible as the Earth System responds to an increasing suite of interacting human forcings.

Assignments:

1. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.

2. Discussion sections led by student groups for April 9th class – selected in Week 1
3. Class activities – assigned in class, completed as HW if necessary

TOPIC 8: weeks 15 & 16, April 16th & April 23rd
CHAPTER 6: Towards Earth System Science and Global Sustainability [pages 255-299]

Based on the latest scientific understanding from IGBP and related research, an attempt has been made in this book to show how the Earth System functions, how human activities have now become a global-scale force in their own right, and what the implications of global change are for human well-being and for the Earth's life support system. This last chapter looks forward by asking a series of questions that science must help to answer over the coming decades if global sustainability is to be achieved. Two over-arching questions, however, still dominate: first, what the nature of changes in the Earth System will be over the next decades and secondly, what the implications of these changes for humankind will be. Other critical questions follow. What type and scale of management responses – from prevention and adaptation to more proactive geo-engineering approaches – are consistent with the scientific knowledge base? How must science itself change to tackle the challenges that lie ahead; how can an innovative and integrative Earth System science be built? Global change is a reality. Human-induced changes over the last two centuries have transformed the Earth in both systemic and cumulative ways, and have pushed it beyond its natural operating domain. The continuing transformation of the Earth System may lead to extremes and rates of change that are much more significant than smooth alterations in global means. The inter- actions between the likely accelerating changes to the Earth System over the coming decades and the growing needs of a rapidly expanding human population give a sense of urgency to realising the goals of Earth System science and global sustainability.

Assignments:
1. Discussion Questions posted from readings – complete in canvas prior to first class on this topic.
2. Discussion sections led by student groups for April 23rd class – selected in Week 1
3. Class activities – assigned in class, completed as HW if necessary

ACADEMIC HONESTY
You are all bound by the student academic honor code.

"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."

"On my honor, I have neither given nor received unauthorized aid in doing this assignment."

Any material obtained from other sources must be cited correctly. Do not plagiarize material.

AMERICANS WITH DISABILITIES ACT
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Student Services.