Master Syllabus

1. *Full course title:

Emissions, energy and ecosystems: foundations for carbon and greenhouse gas management

2. *Course Number and Level

ESS 524

3. *Credit hours for the course:

3 Credit Hours

4. *Recommended prerequisites or other special information:

Student should have a Bachelors Degree with prior coursework that supports understanding basic chemical transformations of carbon and other greenhouse gases, budgeting tools, and policy analysis. Solid communication and mathematical skills and the ability to think broadly and solve problems will also contribute to student success in this course.

5. *Short course description for the catalog:

Demonstrate understanding of the principles involved in energy use, carbon emissions, and terrestrial carbon cycling. Focus on past, present, and future human impacts on the carbon cycle and the design of policies and programs to control atmospheric carbon dioxide.

6. *Long course description:

This course examines carbon cycle science and greenhouse gas management, including carbon cycling in natural systems, anthropogenic greenhouse gas emissions by sector, measurement and monitoring, and mitigation opportunities. Students will explore all aspects of carbon cycle science in several types of organization: energy, manufacturing, service, natural resource management, transportation, land use, and waste sectors.

7. *Description of the major goals and objectives of the course, and specific student learning outcomes. (Goals should be broad, general statements about outcomes, and objectives should be specific, measurable outcomes representing specific competencies)

The goal of this course is to provide students with theoretical underpinnings and conceptual frameworks needed to understand the role of a variety of organizations in greenhouse gas emissions and emission reduction strategies, design, and opportunities.

Learning objectives:

- Understand fundamental concepts of greenhouse gases, emissions, and mitigation and the role of natural systems in cycling C and N.
- Learn about drivers of emissions and future emission scenarios.
- Understand issues related to measurement, monitoring, and verification of greenhouse gas emission reductions.
- Be able characterize greenhouse gas emissions from different sectors.

- Develop the ability to understand and assess emission reduction and mitigation opportunities.
- Be familiar with greenhouse emission control policies.
- Be able to characterize and assess costs and benefits of various emission reduction options.

8. *List of general course topics, recommended contact hours per topic and recommended sequencing.

List of General Course Topics:

- Carbon and greenhouse gases in natural ecosystems
- Carbon and greenhouse gases in our economy
- Emissions trends – past and present
- International emissions profiles
- Emission trajectories and drivers
- Food production systems and emissions
- Emission reduction / sequestration strategies

Expanded Course Topics and recommended sequencing:

1-Carbon dioxide and energy

- Production, decomposition, reduction-oxidation
- Land use, land use change
- Emission drivers/trends

2-Carbon and greenhouse gases in our economy

- Fuel use, greenhouse gas production by sector
- Linkages between products and energy use
- Energy and human well-being
- Energy intensity – past, present, future
- Direct, indirect, embodied emissions

3-CO2 Emission trends

- Recent and past trends in global emissions
- Trends in national emissions

4-International emission profiles

- Developed versus developing countries
- How emission profiles inform negotiating stance
- Emissions and efficiency

5-Emission trajectories and drivers

- Population
- Intensity
- Efficiency
- Carbon intensity

6-CH4 and N2O emissions

- Crop production
- Livestock production

- Industrial/waste emissions
- Fate of N2O/CH4
- Global warming potential

7-Emission reduction policies

- Kyoto protocol
- International activities
- US policies (national, state, voluntary)
- Evaluation of policies

8- Accounting

- Measurement, reporting, verification
- Leakage, additionality
- Project-level accounting, boundaries
- Life cycle assessment

9- Mitigation opportunities

- Land/ag sector, C sequestration
- geoengineering
- carbon capture/storage

9. Library requirements or other special resources recommended for inclusion in the course, such as web links, supplementary readings, or multimedia content:

Nature and Science magazines

- http://www.nature.com/nature/index.html
- http://www.sciencemag.org/magazine.dtl

11. Specific pedagogical techniques, or recommended course activities:

- Class exercises to facilitate student interaction/discussion
- Student project designed to review emerging greenhouse gas emission issues
- Student-led discussions on emerging issues
- Guest speakers with experience in carbon management implementation
- Student-led evaluation of emerging greenhouse gas management-related career options

12. Grading

- Class participation 10%
- Formative evaluation/quizzes 15%
- Assignments 25%
- Project 25%
- Final exam 25%