ENVR 788 Managing Environmental Financial Risk

Instructor:
Greg Characklis
Office: Rosenau 139
Email: charack@email.unc.edu
Website: www.unc.edu/~charack
Phone: (919) 843-5545

Class Location and Time: Mondays and Wednesdays, 10:10a-11:25a, McGavran-Greenberg room 1303
Office Hours*:* Whenever, just not right before class
Prerequisites: Intermediate mathematical and computational skills.
Text: No text, instead there are selected readings from a number of sources

Course Motivation: As society's exposure to environmental risks grows, it has become increasingly important to find innovative tools for mitigating these risks. While there is a long history of environmentally-related insurance and hedging instruments based on direct correlations between time series data (e.g., temperature and electricity demand), the ability to reliably model more complex environmental systems offers a range of opportunities for expanding risk management. The financial risks of drought, for example, are often poorly correlated with straightforward metrics such as rainfall. Many hydrologic factors and human interventions (e.g., reservoirs) mean that simple indices are typically inadequate proxies for financial risk, but a more advanced understanding of these linked environmental-financial systems can be used to develop more sophisticated indices that can serve as the basis for effective insurance and hedging instruments. Hydropower represents another example in which hydrologic modeling can be used to link water scarcity and financial risk. In this case, financial impacts on hydropower producers are a function of both water scarcity and the costs of replacement power (often derived from natural gas), so some form of composite metric is required if it is to serve as an effective foundation for an index-based instrument. Many opportunities exist to develop advanced risk mitigation tools and strategies for other sectors (e.g., thermal energy generators, inland navigation, any water intensive manufacturer) by combining models from both natural and human/economic/financial systems. This is a unique course developed to meet the growing, and often unmet, demand for more sophisticated approaches to mitigating the increasingly complex array of environmental risks that threaten the financial stability of many societal activities.

Course Objectives: This course is designed to introduce students to the fundamentals of risk management within an environmental context, with an emphasis on developing coupled environmental-financial systems models. Students are introduced to methods of assessing financial risk and its impact of such issues as cost of capital and firm valuation. Students then begin with a series of stylized examples that involve the development of straightforward weather derivative contracts, and their use in mitigating various levels of financial risk. Several forms of contracts (e.g., swaps, collars) are introduced within a power and natural gas setting, with subsequent expansion into an environmental context. Students are expected to be able to engage in a basic analysis of the reliability of environmental indices as a foundation of hedging risk, including assessments of basis risk, actuarial analyses and contract pricing. At the end of the

course, students are expected to be able to (i) evaluate the utility of instruments currently available to mitigate environmental risks; (ii) develop a strategy for mitigating a desired level of financial risk, and; (iii) identify the potential for more innovative instruments and strategies mitigating environmental risks.

Course Format:

The multi-faceted nature of the analytical techniques developed in this course do not lend themselves well to examinations, therefore grades will be determined on the basis of student performance on several (4-5) assignments. These will be lengthy and require a substantial amount of forethought regarding problem formulation and solutions, so please do not wait until the last minute to begin work on them. In addition, there will be group projects that stretch over the entire semester in which students will have an opportunity to develop a financial risk management strategy for an environmental scenario. Students will then present their analysis and strategy in both written and oral form (in lieu of a final exam). Grades will be based on performance in the assignments (40%), group project (50%), and participation in class discussions and activities (10%).

ENVR 788 Managing Environmental Financial Risk			
Spring 2018			
Date	**Lecture #**	**Rough Schedule of Topics**	**Remarks**
10-Jan	1	Introduction to Environmental Risk	
17-Jan	2	Introduction to Environmental Risk	
22-Jan	3	Characterizing and Managing Risk	
24-Jan	4	Characterizing and Managing Risk	
29-Jan	5	Time-series analysis	
31-Jan	6	Time-series analysis	
5-Feb	7	Coupling Environmental and Financial Models	
7-Feb	8	Coupling Environmental and Financial Models	Assignment #1
12-Feb	9	Introduction to Hedging Tools	
14-Feb	10	Introduction to Hedging Tools	
19-Feb	11	Energy Risk and Existing Strategies	
21-Feb	12	Energy Risk and Existing Strategies	Assignment #2
26-Feb	13	Risk Pooling	
28-Feb	14	Risk Pooling	
5-Mar	15	Guest Lecture	
7-Mar	16	Preliminary Presentations Group Projects	
12-Mar	**17**	**Spring Break**	
14-Mar	**18**	**Spring Break**	
19-Mar	19	Diversification and Porfolio Theory	
21-Mar	20	Diversification and Porfolio Theory	Assignment #3
26-Mar	21	Contract Structure: Puts, Calls, Derivatives	
28-Mar	22	Contract Structure: Puts, Calls, Derivatives	
2-Apr	23	Contract Pricing (Black-Scholes) and Real Options	
4-Apr	24	Contract Pricing (Black-Scholes) and Real Options	Assignment #4
9-Apr	25	Guest Lecture	
11-Apr	26	Integrated Physical and Financial Risk Mgmt Strategies	
16-Apr	27	Integrated Physical and Financial Risk Mgmt Strategies	
18-Apr	28	Integrated Physical and Financial Risk Mgmt Strategies	
23-Apr	29	Final Group Presentations	
25-Apr	30	Final Group Presentations	