Weather & Ecosystem Monitoring, Assessment, & Prediction for Integration & Training

Topic:	Urban Ecosystems	**Course Level**	1000/2000 and/or GE	**Subjects**	Science/Related
Theme:	Introduction to Earth System Science & Urban Ecosystems (& Sustainability)				
Timeline:	Suggested study period of one to four weeks or special topics offering				

Principle Understanding Desired

(Monitoring of the Environment for Assessment & Prediction)

- Qualitative observation of elements, phenomena, and systems
- Use of instrumentation to remove/limit bias and provide standardization
- Quantification and the use of summary statistics
- Establishing standards for comparison
- Determining 'what' to measure and why
- Planning the observational approach
- Identifying appropriate experimental methods
- Selecting instrumentation
- Justification of measurement approach
- Establishing appropriate metadata
- Considering multiple observations, replications, and repeatability
- Ensuring data are 'representative' of the whole/system
- Consideration of ethical, legal, socio-economic, cultural, and political aspects of observations and their interpretation/use
- Meaning of data collected and applicability
- Observation and assessment in context of the Scientific Method
- Observation and assessment in context of 'real world' applications/uses

Questions to be Considered
(Weather & Ecosystems: Who, What, Where, How, When, Why)
➢ Who are the principle people affected and what are the impacts? ➢ What are the underlying principles and causes? ➢ What systems are involved and what is known about them? ➢ What is the intended outcome or response to the system(s)? ➢ What types of responses are possible? ➢ Where are the key populations located? ➢ Where are the impacts hazardous or beneficial? ➢ How will the populations and communities respond? ➢ How will impact and response be measured and its effectiveness evaluated? ➢ When will impacts be experienced and for how long? ➢ When will updates and further analyses be accomplished? ➢ Why is the system of concern or importance? ➢ Why is the system controllable and to what degree?
Selected Objectives
(Monitoring, Assessment, & Prediction)
Students will know and/or be able to accomplish… ❖ How to determine appropriate observational strategies ❖ How to identify appropriate instrumentation and techniques ❖ How to monitor and collect data and display it for analysis ❖ How to analyze data in space and time and compare to baseline ❖ How to pose hypotheses and propose means to test them ❖ What is needed to predict system behavior ❖ What is needed to evaluate predictions and their effectiveness
Relevant Content & Relationships
(Understanding science and research in the context of 'real world' situations)
Scientific method, quantitative data, qualitative data, classification, prediction, interpretation, inference, urban settings, geosphere, atmosphere, hydrosphere, lithosphere, biosphere, hypothesis, procedures and methods, variables, graphing and plotting, analysis, conclusion and applications, assessment/evaluation, and literature and resource gathering (peer review). Problem identification and solving in a cross-, inter-, and trans-disciplinary manner with competing interests.

Resources/Materials
(Instrumentation, Web-based materials, and other resources)
Science textbooks, online (state, government sites; educational sites); human resources (i.e. as references/sources); observational equipment/instrumentation; datasets; and the development of critical analysis and assessment tools appropriate to the problem studied. Use of faculty/student teams, observation manuals, and teaching/learning methods.

Instructional Strategies/Sequence	
(During the course of a semester, 4-5 weeks, or one week of class activities)	
Prior Knowledge (content)	What is an urban ecosystem? What are its components? What factors determine and affect its behaviors? How? Why? How does it relate to a sustainable system? How does an ecosystem affect people? How serious are these impacts? Can these impacts be avoided, mitigated, or prevented? How?
Motivation (context)	Opportunities provided for students to use local urban ecosystems that they live in or that exist nearby, how these operate, what happens in them, and how these relate to their own and other activities by those in the biosphere. Identify systems and their components and explore the relationships between them. Basic comparison and contrast of systems.
Learning Activities	1. DO NOW – Discussion/Written answers to questions in prior knowledge (or hands-on assignment to review online/other resource to distinguish ecosystem components and variations, particularly in local region) 2. Later 'DO NOW' activities determined by length of timeline and depth of study for unit. 3. Students consider how to quantify/measure system in scientific and urban terms (qualitative) and why both important/essential. 4. Students gather data (field and/or online) using instrumentation. 5. Data analysis for errors, consistency, graphing, plotting, & interpretation. 6. Students define impacts of environmental conditions and hazards. 7. Impact avoidance, mitigation, and prevention weighed and methods to affect each are presented/defended/tested. 8. How to predict urban ecosystem phenomena. 9. How to use that information. 10. Understanding what it means to be "sustainable" in an urban ecosystem. 11. How to incorporate sustainability "thinking" in problem solving.

Closure (synthesis)	Relate studies to personal life/situations and current events in the news.
Assignments (artifacts)	Students collect information about their ecosystems. Students quantify their home/neighborhood urban ecosystems. Students identify sources and resources of data and information on systems. Students graph, plot, and analyze collected data/information from class/lab. Students debate solutions/reactions to environmental conditions & hazards. Students determine variations between and among urban ecosystems. Students develop criteria to establish effectiveness of solutions & cost. Students predict & assess predictions for their accuracy, reliability, usefulness. Students practice sustainable solutions at home and in school and evaluate them.
Assessment (outcomes)	Breadth & depth evaluated for each phase/step covered. Logic and application of science and scientific principles/methods scored on simple rubric. Peer evaluation at various steps to determine justifications and robustness of solutions/answers. Test/Evaluate according to relevant science standards (national and state level).