Sustainability in Ecosystem Ecology: ENST 360 Fall 2014 Semester

Description of the introduction of sustainability concepts, definitions and practices in an Environmental Science and Technology course in Ecosystem Ecology.

In many ways the course I teach is currently tailored to the understanding of the concepts of sustainability. Ecosystem ecology is the study of ecosystems from a larger systems perspective with energy flows and resource inputs and outputs recognized as the driving forces, or energy signature, of each system which will guide and often dictate the behavior, and sustainability, of its populations. What I have done to increase this knowledge is to craft some lectures, labs and site visits to understand natural ecosystems, restored systems, and technoecosystems to augment their thinking and generate an understanding of all things being connected. Potential solutions to the problems of human ecology on the planet may be found in the understanding of the functioning of ecosystems.

The concepts of population dynamics, carrying capacity, resource depletion, energy flows, self-organization and maximum power are all taught through the lens of sustainability, as there are many examples of long standing sustainable populations and ecosystems as well as those that collapse and fail. Nature's pulsing paradigm, the natural pulsing of energy flows is an emerging principle that is thought to be a factor in the maintenance of sustainable ecosystems as those that pulse are more productive, and often sustainable, when pulsing mildly around a set of known resource limits.

Lectures and field visits will be tailored to providing the students the basics in the principles of ecology from a systems perspective. The course text: E.P. Odum's *Fundamentals of Ecology*, 5th Edition (2005) is considered by many professional ecologists to be the standard in understanding ecology from the much larger global perspective as well as the individual population scale.

The study of the text will be augmented with additional papers and readings in ecological concepts, controversies, practices and potential solutions proposed to addressing issues of importance to the global condition. New disciplines such as ecological economics, environmental accounting, political ecology, ecological engineering and new ways of learning and problem solving will be presented in the context of sustainability and what can be done locally and globally.

An example lab: Micrososm Duckweed Population Manipulation

In this assignment, students will be integrating carrying capacity, water quality, ecosphere inputs and systems thinking. Group experiments will be conducted with *Lemna sp*. (duckweed) in microcosms in the lab. Manipulations of light, nutrient loading and water source replacement will be driven by student's self-generated hypotheses in the experiment based on the concepts they have learned. The precautionary principle will be articulated through the inputs and regular tracking of the duckweed population growth or death of individuals. Reflections on what the meaning of exponential growth, death or a relative steady state will be discussed as related to the Ecosphere inputs and what might be done or understood in manipulating the microcosm populations from a systems perspective. Expansion of what is learned to global populations and limiting and regulatory factors will be made with possible outcomes and solutions discussed.