

Connecting to the Biosphere

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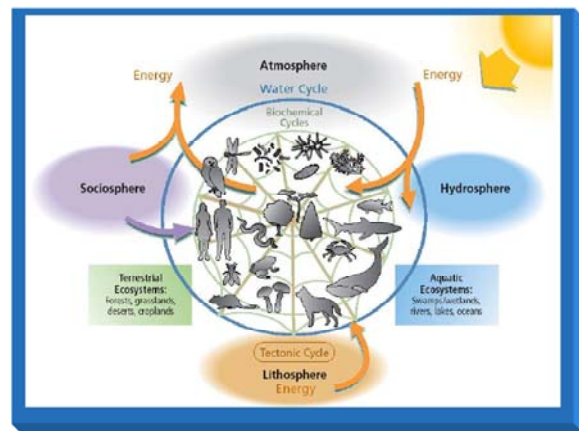
Team teaching Earth system science to a range of undergraduates



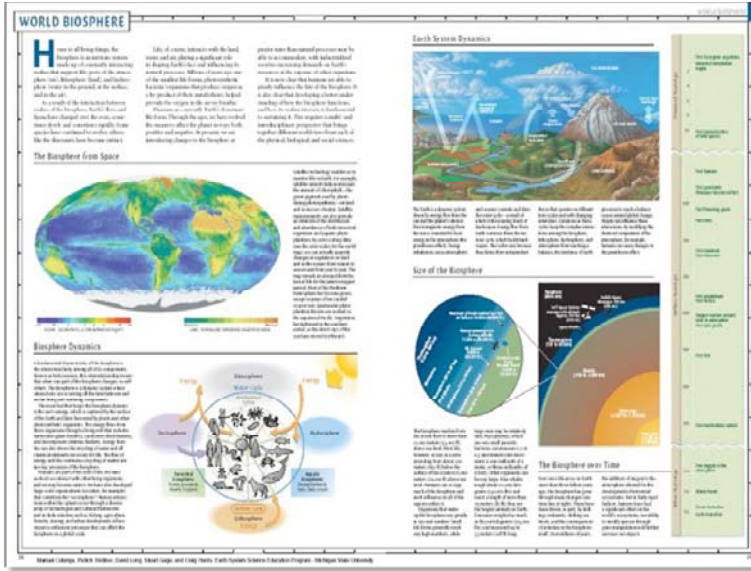
A second tier NASA ESSE grant was awarded to Stuart Gage (Entomology) who proposed, with colleagues David Long (Geosciences) and Patrick Webber (Botany), to develop a multi-disciplinary Earth System Science Education program. Gage and colleagues invited postdoctoral fellow Manuel Colunga, to join the ESSE program as a course facilitator. The faculty met weekly to design the elements of the ***Introduction to Earth System Science***, focusing on teaching students to understand the workings of the Biosphere. Recognizing that humans are an important feature of the Biosphere, the faculty invited Craig Harris (Sociology) to join the team of faculty. They recruited a group of eight graduate students across disciplines to participate and contribute to the first class in fall, 1996. They proceeded to

interactively explore the dimensions of the Biosphere and how it functions. A key to success of the course was the development of diagrams of how the Biosphere works. A synthesis diagram of the Biosphere, developed by Colunga, emerged as the working model. A paper by the MSU ESSE core members that details the principles of the Biosphere was subsequently published (Colunga, *et al.* 2002).

In 2006 the Introduction to Earth System Science at MSU is an interdisciplinary course taught through the Honors College. To sustain Department involvement and credit, a department is provided a quota of about 18 students. Students can enroll through Entomology, Plant Biology, Geosciences, Sociology, or Zoology, representing the Colleges of Natural Science, Agriculture and Natural Resources and Social Sciences, as well as the Honors College. The Provost provides support for a senior graduate student course assistant, with matching funds from the colleges involved.



Over the past five years the limited enrollment course has attracted 80 students annually, from majors ranging from horticulture to geology. The course continues to be coordinated by Gage. Long and Harris are major participants who teach principles of system science, roles of organisms, distribution of biomes, biogeochemical cycles, social systems and human managed systems. Invited faculty cover an array of integrated topics, including Colunga (Urban Systems, Human Health), Skole (Global Change, Land Dynamics), Qi (Sensing Technology), Safir (Botany), Lindell (Biodiversity), Winkler (Climate Dynamics) and Ostrom (Ocean Dynamics).



A key student exercise is to develop a peer reviewed paper in the style of *The National Geographic Magazine* that explores how, through the global cycles, a specific organism connects to the Biosphere. Groups of four students are assigned a biome (arctic, boreal forest, tropical forest, grassland, etc.) and they select an organism that operates in that biome from among primary producers, herbivores, predators and microbes.

Colunga, M., P. Webber, S.H. Gage, D. Long, C. Harris (2002); The Biosphere. National Geographic - Family Reference Atlas of the World 2002. pp 38-39.
 ESS at Michigan State University
<http://www.cevl.msu.edu/pages/courses/courses.htm>