

**Program Level Learning Outcome Assessment
Environmental Science**

PLO: Apply a systems approach to identify and describe components and dynamics of Earth's environment at multiple scales

Learning Outcome	Does Not Meet Expectations	Approaches	Reinforces	Masters
1. Identify a system at different temporal and spatial scales	Does not recognize a system.	Recognizes a simple system	Recognize complex Earth systems that include couplings between different Earth subsystems	Demonstrates a deep understanding of system behavior by analyzing peer reviewed publications and data. Design an execute research that incorporates a systems approach.
2. Describe the components of a system	Does not identify components of a system.	Label components of a system	Construct systems diagrams to describe complex relationships between system components	Analyze and interpret data in a systems context.
3. Describe couplings in a system	Does not explain couplings in a system.	Qualitatively explain how components interact	Utilize equations/models to analyze system behavior.	Demonstrate deep understanding of complex systems with multiple feedbacks and stationary/non-stationary behavior. Create and analyze models that simulate complex systems that include multiple feedbacks.
4. Describe negative and positive feedback loops in a system	Unable to recognize or describe a feedback loop.	Define negative/positive feedback loops	Experiment with negative and positive feedback loops using models	Demonstrate understanding of complex positive and negative feedbacks and how multiple feedbacks reinforce/damp the response of a system to a perturbation. Simulate complex systems.
5. Describe timescales of systems response to perturbations	Does not attach a timescale to couplings in a system.	Recognize timescales of different processes	Investigate the role of response time in the behavior of a system.	Demonstrate qualitative and quantitative understanding of response times, e-folding times, linear and exponential rates of change. Build response times into models of complex systems.