

ESA 4DEE Framework

1. Teaching the hierarchy of core ecological concepts (CEC)
2. Engaging in updated ecological field data collection and analysis, interpretation, communication practices (EP)
3. Addressing the human-environmental interactions (HEI)
4. Connecting ecological concepts to cross-cutting biological themes - structure/function, scales, system change (CCT)

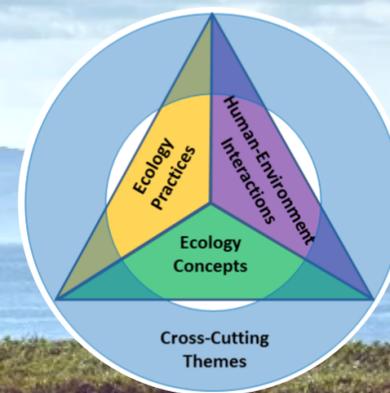
Recommendations

- Increase human dimension integration into every topic discussed in lecture and lab – engage students in doing the historical and current online research to appreciate that dimension
- Divide the class into work groups that address different dimensions and engage them in connecting the dimensions
- Intentionally let students know of the importance of integrating the 4DEE dimensions in understanding of any basic ecological principles
- Make students aware of environmental career skills they are learning (ecology practices) in any lab experience, whether through fieldwork or online resources
- Connect to major biological cross-cutting themes – comparing across habitats or geographic locations, focusing on structure, function, scale, system change



Transforming Ecology Courses to 4D

Four Dimensional Ecology Education Framework



Carmen R. Cid¹, Alan R. Berkowitz², Kimberly A. Bjorgo-Thorne³, Jennifer H. Doherty⁴, Kenneth M. Klemow⁵, George Middendorf⁶, Teresa Mourad⁷, Vikki L. Rodgers⁸ and Amanda E. Sorensen⁹

¹Eastern Connecticut State University, ²Cary Institute of Ecosystem Studies, ³West Virginia Wesleyan College, ⁴University of Washington, ⁵Wilkes University, ⁶Howard University, ⁷Ecological Society of America, ⁸Babson College and ⁹Michigan State University

For more info on the framework please visit the 4DEE website or scan the barcode



<https://www.esa.org/4DEE/>

Transform Your Lesson In Five Easy Steps

1. List core ecological concept to cover in lesson plan
2. Indicate ecological practices featured
3. Outline human dimensions to discuss in lecture and lab on topic
4. Make students aware of biological cross-cutting themes connected to lesson's core ecological concept
5. List your class and exam questions, online research assignment, lab report, oral or poster presentation approach which were used to assess students' abilities to understand the dimensions' interactions you integrated in the learning activity



Course Transformation Pathway

- START: 1)** Assess your current course's lesson coverage of each of the four dimensions
- 2)** Note any existing 2-dimensional (e.g. CEC x EP), 3-dimensional (e.g. CEC x EP x HEI) or 4-dimensional *integration* (e.g. CEC x EP x HEI x CCT) for topics in each of your syllabus learning activities
- 3)** For each learning activity you plan, decide which core topic you will focus on engaging students in *multiple-dimensional thinking*

4DEE Framework

Core Ecological Concepts (CEC)	Ecological Practices (EP)	Human-Environment Interactions (HEI)	Cross-Cutting Themes (CCT)
<ul style="list-style-type: none"> • Organisms • Population • Community • Ecosystems • Landscapes • Biomes • Biosphere 	<ul style="list-style-type: none"> • Natural history • Fieldwork • Quantitative reasoning & computational thinking • Designing & critiquing investigations • Working collaboratively 	<ul style="list-style-type: none"> • Human dependence on the environment • Human accelerated environmental change • How humans shape & manage resources, ecosystems, the environment • Ethical dimensions 	<ul style="list-style-type: none"> • Structure & function • Pathways & transformations of matter & energy • Systems • Spatial & temporal scale

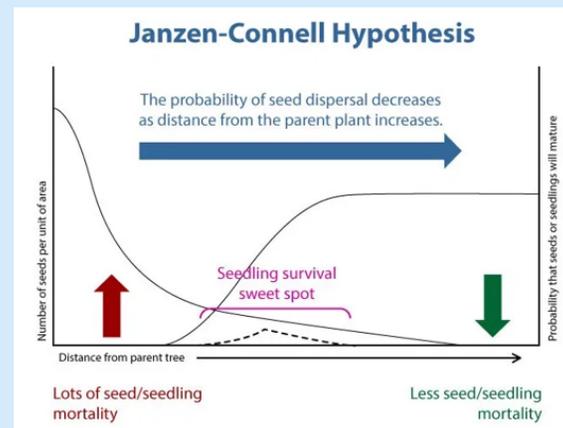
Example 1: Environmental distribution pattern activity

CEC: Gathering data on seedling dispersal and seedling recruitment to plot curves for seedling success in establishment as a function of distance from the maternal plant.

EP: Data analysis and interpretation, figure construction and presentation

HEI: Connection of tropical tree distribution patterns to timber harvesting practices in tropical forests, and impact on greenhouse gas emissions, weather.

CCT: Comparing impact of different timber harvesting practices on the system's energy transformation capabilities of tropical forests



Example 2: Wetland delineation activity

CEC: Individuals, populations, communities, ecosystems, landscapes all pertain to wetlands

EP: Natural history, fieldwork, quantitative reasoning, and collaboration can apply to wetlands. Students learn marketable skills by interpreting maps and identifying wetlands

HEI: Wetlands benefit society; humans have disturbed wetlands

CCT: Wetlands are systems that have scale, structure, function, transform matter and energy and can be disturbed

Integration of dimensions covered in lab or associated lecture involve 2-dimensional, 3-dimensional and 4-dimensional interactions:

Ecological practices involved in wetland delineation provide students with direct opportunity to investigate human impact and dependence on wetlands while exploring cross-cutting themes of scale, disturbance, structure and function and system change